SUMMARY OF NATIONAL EVALUATOR INPUT INTO DRAFT #2 OF THE INDIANA ACADEMIC STANDARDS, VERSION DATED MARCH 14, 2014

On February 13-14, 2014, the academic standards Evaluation Panels met during a public meeting to complete a blind evaluation of standards that best aligned with college and career ready learning outcomes. This resulted in a draft set of academic standards, labeled “Draft #1”, which was posted for public comment from February 19 through March 12. Six independent evaluators were also invited to provide feedback on Draft #1, and four agreed to do so. These individuals are:

- Dr. James Milgram, Ph.D., Stanford University
- Dr. Shauna Findlay, Ph.D., Indiana ASCD
- Ms. Janet Rummel, Indiana Network of Independent Schools
- Ms. Kathleen Porter-Magee, Fordham Institute

Following the close of the public comment period on Draft #1, the Standards Leadership Development Team and Indiana Department of Education content specialists incorporated the feedback from independent evaluators and the public comments into a second draft of the standards, labeled “Draft #2” and dated March 14, 2014. Draft #2 was distributed to six national evaluators, who were invited to provide feedback on Draft #2. These evaluators are:

- Dr. Sandra Stotsky – E/LA
- Dr. Terrence Moore, Hillsdale College – E/LA
- Joanne Eresh (Achieve) – E/LA
- Dr. James Milgram (Stanford University) – Math
- Professor Hung-Hsi Wu (UC Berkeley) – Math
- Kaye Forgione (Achieve) – Math

The attached document contains the evaluator reports on Draft #2. Full reports were submitted by April 1, 2014, and were used to inform the work of the Indiana College & Career Ready Panel.

It is important to note that the evaluators provided their feedback on Draft #2, and were not asked to provide input on the final proposed 2014 Indiana Academic Standards released to the public on April 15, 2014. By design, it was the Indiana College & Career Ready Panel that was responsible for assessing all independent evaluator input and determining how this input would be reflected in Indiana’s new standards.

We are grateful to the national evaluators for their time and effort. Their input was invaluable to the development of Indiana’s new academic standards, and their feedback is reflected throughout the version released to the public on April 15, 2014.

April 1, 2014

Governor Michael R. Pence
Office of the Governor
200 W. Washington St., Rm. 206
Indianapolis, IN 46204

Dear Governor Pence,

As you requested, I am pleased to provide you with Achieve's review of the draft proposed Indiana K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts (dated March 14, 2014). We found that overall these standards are strong, however, important changes are necessary to help ensure that all Indiana students have the essential knowledge and skills to be academically prepared for college and careers.

Since the development of the Core 40 diploma in 1994, Indiana has been one of the leading states working to prepare all high school graduates with the academic skills necessary to enter and succeed in postsecondary education. Achieve first reviewed Indiana's English Language Arts and Mathematics standards and assessments in 1999. Since that time, Achieve has worked closely with Indiana policymakers and educators to help make sure that its K-12 reforms are built on a foundation of high expectations – rigorous standards, assessments and performance indicators necessary to prepare all students for college and careers. Indiana, along with four other states, established the American Diploma Project (ADP) Benchmarks in 2004 and launched the 35-state ADP Network in 2005.

Achieve has evaluated the proposed draft standards utilizing criteria and procedures Achieve has developed and refined to evaluate academic standards for more than 25 states over the past 15 years. Achieve has used similar methods for comparing standards in 15 countries.

My colleagues and I at Achieve stand ready to address any questions you and other Indiana leaders may have about this report, and to continue to support your efforts going forward.

Sincerely,

Michael Cohen

CC: Glenda Ritz, Superintendent of Public Instruction
Enclosures

1400 16th Street NW, Suite #510, Washington DC 20036 ◆ Phone (202) 419-1540 ◆ Fax (202) 828-0911
www.achieve.org

Achieve

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A Review of the Draft 2014 Indiana K-12 Content Standards for College and Career Readiness in English Language Arts and Mathematics

Submitted by Achieve at the request of Governor Pence, April 1, 2014.

Table of Contents

Introduction

This report, which provides a review of Indiana's proposed draft 2014 K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts[1], has been prepared at the request of Indiana Governor Mike Pence. It is one step in the process initiated in response to Public Law 286, which mandates that the Indiana State Board of Education develop college and career readiness standards for mathematics and English language arts. This occurs in the wake of the state's decision to reverse the State Board of Education's adoption of the Common Core State Standards in 2010. Indiana has set a high bar for its new mathematics and English language arts standards and has an aggressive timeline for completing their development and adoption.

Achieve's review compares the proposed draft 2014 K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts with the Common Core State Standards, the 2009 Indiana Academic Standards in Mathematics and the 2006 Indiana Academic Standards in English Language Arts, and the American Diploma Project Benchmarks in Mathematics and English Language Arts. We have evaluated the proposed draft 2014 K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts utilizing criteria[2] and procedures Achieve has developed and refined to evaluate academic standards for more than 25 states over the past 15 years. Achieve has used similar methods for comparing standards in 15 countries.

Achieve has a long history of working with Indiana to evaluate and, where necessary, recommend improvements to its standards and assessments. Achieve first reviewed Indiana's English Language Arts and Mathematics standards and assessments in 1999[3] and recommended significant improvements in both, which were largely incorporated in subsequent drafts[4]. In 2003, Achieve conducted an analysis of the newly implemented ISTEP+ to determine the extent to which it was aligned with state standards, as well as whether the proposed scores for passing represented "solid academic performance" and the Pass+ score represented "exemplary performance." This study[5], commissioned by Indiana policymakers, demonstrated an unprecedented commitment to transparency and quality with respect to setting cut scores. In 2004, Achieve used the Indiana mathematics standards as a benchmark – a standard of excellence – in our reviews of standards from other states. The Indiana Mathematics standards were also one of the key reference documents when the Common Core State Standards were developed.

Indiana was one of five states (along with Kentucky, Massachusetts, Nevada and Texas) that joined the initial research phase of American Diploma Project. Project researchers from Achieve and our partners, the Thomas B. Fordham Foundation and Education Trust, worked with college faculty, front-line managers and high school curriculum experts in each state to identify academic skills in mathematics and English language arts that are essential for success in broad access to postsecondary institutions and careers that pay well and have advancement potential. The analysis of employment data and extensive research with two- and four-year faculty illustrated that employers' and colleges' academic demands for

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[1] Achieve conducted the review of Indiana's proposed draft 2014 K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts using the version of the standards provided by Claire Fiddian-Green, Special Assistant to the Governor for Education Innovation, on March 14, 2014.

[2] See Appendix B.

[3] Achieve. (2000). *Measuring Up: A Report on Education Standards and Assessments for Indiana.* http://www.achieve.org/files/Indiana-Benchmarking1-2000.pdf

[4] The lead reviewers for this current review – Kaye Forgione for mathematics and JoAnne Eresh for English language arts – participated in the original 1999 review.

[5] Achieve. (2003). *Setting the Bar: An Evaluation of ISTEP+ Assessments for Indiana.* http://www.achieve.org/files/indiana_ISTEP_0.pdf

high school graduates had converged, yet states' current high-school exit expectations fell well short of those demands. This was the very first effort by states to anchor academic standards in the best available evidence of the essential demands faced by students preparing for college, work and citizenship. The resulting American Diploma Project (ADP) Benchmarks[6] were subsequently used by more than half the states, including Indiana, between 2004 and 2009 to develop their own college- and career-ready standards in mathematics and English language arts. The ADP Benchmarks, published in 2004, are one of the tools used in this review.

At a 2005 National Education Summit on High School Reform, organized by the National Governors Association and Achieve, thirteen states, including Indiana, joined Achieve's American Diploma Project Network. Each of these states, led by their governor, chief state school officer, state higher education officer and business partners, committed to align their standards, high school graduation requirements, high school assessments and accountability indicators with the academic demands of postsecondary education and training. Over time, the network grew to 35 states. By 2008, some 15 of these states had revised their high school standards to align them with the demands of college and career. In Achieve's 2008 report, *Out of Many, One*[7], we found that across those states there was a common core of expectations, aligned with the ADP Benchmarks. This study demonstrated the feasibility of a state-led effort to create common standards, and the ADP Benchmarks, as well as Indiana's mathematics standards, provide much of the foundation for the Common Core State Standards. Thus, in addition to developing its own state standards over the past decade and a half, Indiana played a significant role in the development of the ADP Benchmarks and the Common Core State Standards.

In sum, over the past 15 years, Achieve has worked closely with Indiana to help improve its standards and assessments[8] and other tools and policies in order to prepare Indiana's students for college and careers. Among the products and byproducts of that work are the ADP Benchmark standards used in this report to evaluate Indiana's proposed draft 2014 K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts. In the past, Indiana education leaders have used Achieve's reports to help strengthen and sustain their efforts. We hope this report continues that practice.

[6] Achieve. (2004). *Ready or Not: Creating a High School Diploma That Counts.* http://www.achieve.org/ReadyorNot
[7] Achieve. (2008). *Out of Many, One: Toward Rigorous Common Core Standards From the Ground Up.* http://www.achieve.org/files/OutofManyOne.pdf
[8] See Appendix D for a complete list of Achieve reports regarding Indiana standards, assessments, and related reforms.

Executive Summary

ENGLISH LANGUAGE ARTS/LITERACY

Major Findings
The draft 2014 Indiana English Language Arts Standards reflect the best available evidence of what students need to learn in order to be prepared for college and careers. The resulting draft incorporates standards from the Common Core State Standards, the 2006 Indiana English Language Arts Standards, the American Diploma Project Benchmarks and other sources. Although the draft 2014 English Language Arts Standards mirror the format and progression of the Common Core State Standards and draw the majority of their draft 2014 standards verbatim from that document, the state appears to have clearly examined each statement they have included in this draft, keeping, changing, adding, and revising standards as they try to capture the clearest and highest expectations for the students of Indiana.

With one significant exception, the draft 2014 English Language Arts Standards substantially meet Achieve's criteria. To be well prepared for postsecondary success, high school graduates must be able to apply literacy skills – reading, writing, listening and speaking – across academic disciplines as well as within career and technical courses. The draft 2014 English Language Arts Standards do not attend to developing literacy in the content areas, and as a result reduce the likelihood that Indiana high school graduates will be well prepared.

Key Recommendations

To ensure that the standards are aligned with skill demands of postsecondary education and training, Indiana should address the issue of literacy in all the content areas, not just in English language arts classrooms.

In its present form, the draft 2014 English Language Arts Standards do not address the need for instruction in literacy skills, including primarily reading, writing, and research, in all the content areas. All of these skills are addressed somewhat differently in the various content areas, a research project in history, for example, differing quite a bit from a research project in chemistry, although the most salient characteristics of research remain the same, no matter what the context.

This issue of cross-content literacy instruction is addressed in a multitude of ways in schools, and, as well, in a variety of manners in standards documents. The ADP Benchmarks, for example, provided a footnote on the issue:

> *These skills, although critical to the study of English, are also necessary to the study of many academic subjects. Therefore, the study and reinforcement of these skills should not be confined to the English classroom or coursework.*

The Common Core State Standards also offers entirely separate sets of standards, "Literacy in History/Social Studies, Science, and Technical Subjects," for Grades 6-12. In some manner, the state should set clear expectations that instruction in literacy must extend beyond the English language arts classroom in order for students to become truly competent readers, writers, and thinkers. The ultimate

arbiters of college-ready skills are college faculty and system leaders. Thus, it will be important to make sure postsecondary is fully engaged in determining how to incorporate those skills into the standards.

Indiana should offer clear guidance for what is regarded as appropriate grade-level texts by including in the standards a well-documented reading list as well as judicious use of examples within standards themselves.

In its 2006 report *Reading Between the Lines: What the ACT Reveals About College Readiness in Reading*[9], ACT argues that "the clearest differentiator in reading between students who are college ready and students who are not is the ability to comprehend *complex* texts." The draft 2014 English Language Arts Standards present a stipulation about the level of reading expected at each grade level, as this one from Grade 8:

> *Read and comprehend a variety of literature, including stories, dramas, and poems, within a range of complexity appropriate for grades 6-8 independently and proficiently by the end of the grade 8.*

Without a reading list, example texts, or a rubric of some kind, however, these statements are not as specific as they need to be to guide educators and students in selecting works of appropriate complexity to meet the standards.

Reading standards have grappled with this issue of defining grade-level texts in a variety of ways. The 2006 Indiana Standards offered at least two ways to suggest the appropriate levels of reading, first with a reading list and second by the judicious use of examples within the standards themselves. The ADP Benchmarks indicated the quality and complexity of the expectations by providing examples of the kinds of reading and mathematical problems the ADP Benchmarks are meant to describe, and, as well, suggested that the ADP English Benchmarks were to be used in close coordination with the reading lists developed by two ADP Network partner states, Indiana and Massachusetts. The Common Core State Standards describe a variety of factors that contribute to text complexity and include *Appendix A: Research Supporting Key Elements of the Standards* in which the research on the issue of text complexity is addressed as well as *Appendix B* which includes text exemplars for all grades and most genres.

[9] ACT. (2006). *Reading Between the Lines: What the ACT Reveals About College Readiness in Reading.* http://www.act.org/research/policymakers/pdf/reading_report.pdf

MATHEMATICS

Major Findings

The draft 2014 Mathematics Standards draw on strengths from Indiana's 2009 standards, the ADP Benchmarks, and the Common Core State Standards. Aspects of all of these documents are incorporated in the draft 2014 Mathematics Standards, resulting in standards that are generally rigorous, coherent, focused, specific, clear and accessible, and measurable. The draft 2014 Mathematics Standards provide the coherence and focus that are characteristic of the Common Core State Standards in mathematics, and are generally specific enough to convey the level of performance expected of students at each grade level and in each course. With an important exception noted below, they are generally appropriately rigorous, including content and performance expectations at a level of cognitive demand from kindergarten through high school that will culminate in college and career readiness.

As a hallmark of their rigor, they provide an appropriate balance between conceptual understanding, procedural fluency and application to problem solving. Unlike the Common Core State Standards and the ADP Benchmarks, the draft 2014 Mathematics Standards also include course standards for a number of advanced, and elective, high school courses including Calculus, pre-Calculus, Probability and Statistics, and Trigonometry. These standards are an important addition, and can help guide the preparation of students who complete the state's standards early in high school and want to prepare for a rigorous course of study in college, including STEM and other math-dependent fields in college. However, unlike the ADP Benchmarks and the Common Core State Standards, a number of expectations that appear in the 2009 Indiana standards for all students are now incorporated into these elective courses, raising questions as to whether students who meet, but don't exceed the course taking requirements for a high school diploma will have the preparation they need for postsecondary success.

Achieve also conducted a separate review of the Calculus Standards, compared with calculus standards from Florida and California.[10] The Florida standards are typical of a high school level course, while the California standards are aligned to AP Calculus AB, the equivalent of two semesters of college calculus. The Indiana standards are very well written. However, we found that there are too many standards to be manageable in a one-semester course, and too few for a year-long course.

Key Recommendations

Further strengthen the rigor of the high school mathematics standards to ensure they are fully aligned with the knowledge and skills necessary to enter and succeed in entry-level postsecondary courses.

The draft 2014 Mathematics Standards should be examined to ensure that all students graduating from high school in Indiana have the opportunity to learn all of the mathematical concepts and practices they need to be prepared for college and career. In particular, the draft 2014 Mathematics Standards currently placed in elective high school courses intended to be taken after Algebra II should be reviewed to ensure that they are not among those needed by all students for college and career readiness. The ultimate arbiters of college-ready skills are college faculty and system leaders; it will be important to make sure postsecondary is fully engaged in this examination.

[10] See Appendix A.

Incorporate the expectation that students will be able to use a standard algorithm when students are expected to perform operations fluently.

The draft 2014 Mathematics Standards do a good job of building conceptual understanding along with procedural fluency. The standards are written so as to promote use of strategies based on place value, the properties of operations, and/or relationships between operations, as students learn about mathematical content and processes. However, consideration should be given to building into the draft 2014 Mathematics Standards the same sequenced approach described by Fuson and Beckman[11], with students moving from sense-making as they first learn about a new concept to the use of a standard algorithm fluently with no visual models. The point in the draft 2014 Mathematics Standards at which procedural fluency is expected and articulated would be the logical place for conveying the expectation that students are to be able to use a standard algorithm fluently.

***Several data standards should be moved to later grades – middle school rather than 4th and 5th grade*.**

There are two elementary standards[12] that pertain to data analysis and statistics that should be examined to ensure that their inclusion does not negatively impact the standards' intended focus. These two standards, in particular, are highly redundant and very ambitious for the grade levels where they are placed. They would require significant teaching time and detract from the focus at these grades. Consideration should be given to moving the substance of these standards to one of the middle school grades where data analysis concepts receive more focus and where the data collection, representation, and interpretation expectations would reinforce the teaching and learning of science.

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[11] Fuson, K. and Beckmann, S. (Fall/Winter 2012-2013). "Standard Algorithms in the Common Core State Standards." *National Council of Supervisors of Mathematics Journal.* http://www.mathedleadership.org/docs/resources/journals/NCSMJournal_ST_Algorithms_Fuson_Beckmann.pdf

[12] Fourth grade standard: "Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Recognize the differences in representing categorical and numerical data." Fifth grade standard: "Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Consider how data-collection methods affect the nature of the data set."

Review of Draft 2014 Indiana English Language Arts Standards Using Achieve's Criteria for the Evaluation of College- and Career-Ready Standards

The purpose of the Standards' Review is to assist states in developing high-quality college- and career-Ready Standards in English language arts that prepare high school students for success in credit-bearing college courses and quality, high-growth jobs.

When evaluating standards, Achieve has historically used a set of six criteria: rigor, coherence, focus, specificity, clarity/accessibility, and measurability. For purposes of this analysis, the draft 2014 Indiana English Language Arts Standards were analyzed with respect to these criteria and compared with the 2006 Indiana English Language Arts Standards, the Common Core State Standards (CCSS), and Achieve's American Diploma Project (ADP) Benchmarks.

Rigor

Rigor is the quintessential hallmark of exemplary standards. It is the measure of how closely a set of standards represents the content and cognitive demand necessary for students to succeed in credit-bearing college courses without remediation and in entry-level, quality high-growth jobs. It appears that Indiana has been fairly fastidious in its examination of the level of demand in its draft 2014 English Language Arts Standards, drawing on the best of the state's 2006 English Language Arts Standards and the Common Core State Standards.

The draft 2014 English Language Arts Standards present appropriate challenges for students at appropriate grade levels, and sometimes present higher demands than those included in the Indiana 2006 version within English/Language Arts classrooms.

On the whole, the draft 2014 English Language Arts Standards present a level of challenge equal to, if not higher, than the former state standards. For example, while the 2006 Indiana English Language Arts Standards ask students to merely *identify* genres ["Identify different types (genres) of fiction and describe the major characteristics of each form" (6.R.3.1)], the draft 2014 English Language Arts Standards require students to *apply* that genre knowledge ["Compare and contrast works of literature in different forms or genres (e.g., stories and poems; historical novels and fantasy stories) in terms of their approaches to similar themes and topics" (6.R.L.8)]. In a similar manner, a standard in the 2006 English Language Arts Standards set at grade 4 requires students to, "Draw conclusions or make and confirm predictions about text by using prior knowledge and ideas presented in the text itself, including illustrations, titles, topic sentences, important words, foreshadowing clues (clues that indicate what might happen next), and direct quotations" (4.2.3). Both the draft 2014 English Language Arts Standards and the Common Core State Standards omit the expectation to "make and confirm predictions" as both the draft 2014 English Language Arts Standards and the Common Core State Standards tend to avoid reading strategies as making predictions, focusing instead on performances such as drawing conclusions. What both the Common Core State Standards and the draft 2014 English Language Arts Standards add to the former standard is the requirement for students to back up and justify their conclusions by referring "to details and examples in a text" rather than only "using" various elements listed in the 2006 English Language Arts Standards: CCSS, Grade 4 (CC.4.R.I.1) and draft 2014 English Language Arts Standards, Grade 4 (4.R.N.1) "Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text."

For the most part, the draft 2014 English Language Arts Standards mirror the levels of challenge described in the Common Core State Standards, with a few diversions where Indiana has increased the level of demand, as, for example, in the Writing Strand for Grade 5 from a parallel standard in the Common Core State Standards Language Strand.

Draft 2014 Indiana English Language Arts Standard	Common Core State Standard
Analyze the appropriateness of and use appropriate reference materials, both print and digital, to check and correct spelling, determine or clarify the meanings of words or phrases, and improve word choice. (5.W.2.c)	Consult reference materials, both digital and print, to find the pronunciation and determine or clarify the precise meaning of key words and phrases. (5.L.4.c)

The draft 2014 English language arts standard requires that the student make a determination of the appropriate materials to consult given the kind of information sought, while the Common Core State Standards expectation does not expect the student to evaluate the suitability of a particular reference source for a specific purpose. The purposes for such research are similar yet with some differences, Indiana eschewing the Common Core State Standards' pronunciation information, but adding the goals of spell checking and improving word choice.

Additionally, some standards appear at all levels of Indiana's 2006 English Language Arts Standards but only at lower levels of Common Core State Standards and the draft 2014 English Language Arts Standards. For example, the expectation to use Greek and Latin words roots to determine word meanings is included in grades 9-12 in the 2006 Indiana English Language Arts Standards but only up to grade 8 in the draft 2014 English Language Arts Standards and the Common Core State Standards.

It appears from the draft 2014 English Language Arts Standards that the state has thoroughly reviewed both its past set of English language arts expectations and the more recent Common Core State Standards, and that those reviews have resulted in a set of standards based on the Common Core State Standards, while retaining much of the demand of its 2006 English Language Arts Standards.

To assert that the draft 2014 English Language Arts Standards are sufficient to prepare students for the literacy demands of college and career, however, would be incorrect. Many of the writing tasks faced in the world beyond the classroom, for example, are like those included in the 2006 Indiana English Language Arts Standards at the high school levels: technical documents; career development, job applications, and business letters. The 2006 Indiana English Language Arts Standards paid significant attention to reading and writing tasks that focused on a wide range of literacy skills, while both the draft 2014 English Language Arts Standards and the Common Core State Standards in English Language Arts set expectations that traditionally fall solely within the purview of the English classroom. Recognizing that its English Language Arts standards were insufficient to prepare students for college and career, the Common Core State Standards includes entirely separate sets of expectations entitled Literacy in History/Social Studies, Science, and Technical Subjects. The state will not be fully preparing its students for college or career without attending to the wider aspects of literacy that stretch beyond the English classroom by retaining the cross-content standards present in the Common Core State Standards or to address this issue in other ways. The recommendation section of this review offers a further discussion of this topic.

Coherence

The way in which a state's college- and career-ready standards are categorized and broken out into supporting strands should reflect a coherent structure of the discipline and/or reveal significant relationships among the strands and how the study of one complements the study of another. If college- and career-ready standards suggest a progression, that progression should be meaningful and appropriate across the grades or grade spans.

The draft 2014 English Language Arts Standards reflect a meaningful structure for the discipline.

The draft 2014 English Language Arts Standards present a broad vision of the English language arts curriculum that includes important knowledge and skills, not only in such traditional areas of language, writing, and literature, but also in the areas of informational reading, and media, which are also critical but had been traditionally underrepresented in the English language arts curriculum.

The English language arts discipline historically has been arranged in a variety of ways to serve as the architecture for standards' documents. Achieve had in the past used the Massachusetts 2001 Curriculum Standards[13] and the California 1998 English Language Arts Content Standards[14] as benchmarks for quality standards, and their organizational decisions ranged in number – Massachusetts organized its standards into 27 General Standards and California its standards organized around four strands – and in grain size (Massachusetts General Standards included ones focused on the influence of other languages on English and identifying, analyzing a theme using evidence, while California's strands were quite broad: Reading, Writing, Written and Oral English Language Conventions, and Listening and Speaking). Such structures imply how variously the discipline is envisioned by standards documents, and as well often foreshadow instructional decisions.

The draft 2014 English Language Arts Standards arranges the English language arts strands into seven sets: 1) Reading: Foundations (Grades K-5 only); 2) Reading: Vocabulary; 3) Reading: Nonfiction; 4) Reading: Literature; 5) Writing; 6) Speaking and Listening; and 7) Media Literacy (Grades 3-12). This structure departs from the state's previous six categories (1) Word Recognition, Fluency, and Vocabulary; 2) Comprehension and analysis of nonfiction and informational texts; 3) Comprehension and analysis of Literary Texts; 4) Writing: Processes and Applications; 5) Writing: Applications; and 6) Writing: English Language Conventions), not only by introducing a strand devoted to Media Literacy, but also by folding language conventions into a writing strand and breaking out vocabulary as a strand separate from fluency and word recognition. As suggested earlier, the organization of a set of standards often attempts to reveal significant relationships among the strands, suggesting how the study of one complements the study of another. In its draft 2014 English Language Arts Standards, the state implies that language conventions are tied to their application to writing, that vocabulary is a significant area of study, and that media be given due attention in its own right. The ADP Benchmarks also described a strand focused on media. The ADP Benchmarks and the Common Core State Standards as well devoted separate strands to informational/nonfiction materials and to literary texts, as do both the 2006 and 2014 versions of the Indiana English Language Arts Standards.

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[13] http://www.doe.mass.edu/frameworks/ela/0601.pdf
[14] http://www.cde.ca.gov/be/st/ss/documents/elacontentstnds.pdf

The different strands function as interdependent units which form a coherent whole in all of the standards reviewed, although in their differences they may also suggest different emphases on content, as discussed below in the section on *focus*.

The draft 2014 English Language Arts Standards do an outstanding job of defining meaningful progressions of expectations throughout the grade levels.

Progression is always a fundamental challenge in English language arts standards. Students use many of the same reading and writing skills and strategies across all grade levels (such as identifying main idea and supporting details, identifying theme, writing topic sentences and focused paragraphs, etc.), but educators expect increasing sophistication and flexibility in the use and application of these skills and strategies to read increasingly challenging texts.

One way to show progression in a set of standards is through the use of specific verbs that indicate an increasingly sophisticated performance. Students may progress from identifying main characters, to analyzing characters, to evaluating how authors use techniques to develop characters. An example of this type of progression is evident in the draft 2014 English Language Arts Standards at Grades 4 and 5 in the Reading Literature strand:

Draft 2014 Indiana English Language Arts Standard	Draft 2014 Indiana English Language Arts Standard
Grade 4: Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text (4.R.L.1)	Grade 5: Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text (5.R.L.1)

As well, the material to which the performance is aimed may increase in complexity, as in the following example from the Reading Nonfiction strand:

Draft 2014 Indiana English Language Arts Standard	Draft 2014 Indiana English Language Arts Standard
Grade 4: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably (4.R.N.9)	Grade 5: Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably (5.R.N.9)

These patterns of progressions are mirrored in the Common Core State Standards as well.

Focus

It appears that the draft 2014 English Language Arts Standards draw from both the 2006 Indiana English Language Arts Standards and the Common Core State Standards, indicating that the state has made real attempts to retain the most important foci of the earlier state standards and to build on those presented in the Common Core State Standards.

High quality standards establish priorities about the concepts and skills that students should acquire by graduation from high school. Choices should be based on the knowledge and skills essential for students

to succeed in postsecondary education and the world of work. For example, English standards should reflect an appropriate balance between literature and other important areas such as informational text, oral communication, and research. A sharpened focus also helps ensure that the cumulative knowledge and skills students are expected to learn is manageable.

The draft 2014 English Language Arts Standards have retained the standards on handwriting from the 2006 Indiana version that not included in the Common Core State Standards.

The draft 2014 English Language Arts Standards retain the standards in the state's 2006 version on handwriting from kindergarten through grade 4, requiring students to print from kindergarten to grade 2, and expecting cursive at grades 3 and 4. The Common Core State Standards include such a standard only at kindergarten and grade 1 (Print all uppercase and lowercase letters), and does not address cursive at any grade leaving it up to the states.

The 2006 Indiana English Language Arts standards included a wider range of writing and presentation applications than either the draft 2014 English Language Arts Standards or the Common Core State Standards, while the draft 2014 English Language Arts Standards focus on the more significant writing and speaking forms.

This broader inclusion in the 2006 Indiana standards of writing and speaking applications might be helpful for actual classroom instruction in that they provide helpful criteria for a number of writing and presentational tasks, but most of the expectations are inherent in and matched to broader Common Core State Standards and draft 2014 English Language Arts Standards. Indiana's 2006 English Language Arts Standards , for example, identify fourteen specific writing formats at the secondary levels (narratives, biographies, autobiographies, description/explanation/comparison and contrast/problem and solution essays, responses to literature, reflective essays, persuasive compositions, research reports, technical documents, career development, job applications, and business letters) and twelve oral presentation genres (narrative, informative, persuasive, oral summaries, research, descriptive, interviewing, multimedia, expository, response to literature, reflective, historical investigations). Both the Common Core State Standards and the draft 2014 English Language Arts Standards have three general writing categories (narrative, argumentative, informative) and have three or four general oral presentation standards that apply broadly across multiple genres. This reduction in the number and kinds of writing and speaking applications may provide a stronger focus on the most salient characteristics of the most important writing and speaking applications, while the greater number of types required in the Indiana's 2006 English Language Arts Standards could dilute attention to such commonalities across writing and presentation types. However, many of the 2006 writing and speaking genres include sub points that while phrased somewhat differently are not substantively different than the sub points in the more general Common Core State Standards or the draft 2014 English Language Arts Standards.

The draft 2014 English Language Arts Standards mirror the ADP Benchmarks' and the Common Core State Standards' emphasis on group work and group discussion absent from Indiana's 2006 standards.

The ADP Benchmarks laid a heavy importance on the ability to function within work groups and discussion groups. The draft 2014 English Language Arts Standards include a standard that addresses group discussion at all grade levels, and parallels similar standards in the Common Core State Standards. For example, in the draft 2014 English Language Arts Standards students in grade 3 in the speaking and listening strand are expected to:

“Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with various partners on appropriately complex topics and texts, building on others’ ideas and expressing their own clearly

- Draw on preparation and other information known about the topic to explore ideas under discussion
- Demonstrate knowledge and use of agreed-upon rules for discussions and identify and serve in roles for small group discussions or projects
- Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others
- Explain their own ideas and understanding in light of the discussion
- Retell, paraphrase, and explain the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally
- Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.”

The inclusion of expectations for participation in collaborative discussions highlights the importance of such interactions not only in academic settings, but also in social and political environments, recognizing these abilities as real life skills that can be taught and learned.

Specificity

Quality standards are precise and provide sufficient detail to convey the level of performance expected without being overly prescriptive. Standards that maintain a relatively consistent level of precision (“grain size”) are easier to understand and use. Those that are overly broad or vague leave too much open to interpretation, increasing the likelihood that students will be held to different levels of performance, while atomistic standards encourage a checklist approach to teaching and learning that undermines students’ overall understanding of the discipline.

Although the draft 2014 English Language Arts Standards parallel very closely the expectations of the Common Core State Standards in both their structure and their details, in some situations the draft 2014 English Language Arts Standards have honed the language and therefore improved the specificity from both the 2006 Indiana standards and the Common Core State Standards.

For example, in delineating the reading literature strands, the earlier 2006 Indiana standards separated expectations into three sections: Structural Feature of Literature, Analysis of Grade Level Appropriate Literary Texts, and Literary Criticism. Both the Common Core State Standards and the draft 2014 English Language Arts Standards offer similar categories to the 2006 Indiana standards’ first section – in the Common Core State Standards it is called Craft and Structure and in the draft 2014 English Language Arts Standards it is called “Structural Elements and Organization.” This is a relatively minor change, however, suggesting that the state may want to make clear the interrelationship of key ideas and details, highlighting the idea that details serve a purpose by providing the textual support for the ideas in a text. The Common Core State Standards wording seems to suggest that ideas and details are two discrete categories. This attention to the relationship of details to bigger ideas is evident in how a Common Core State Standards’ reading standard has been tinkered with in the draft 2014 English Language Arts Standards:

Draft 2014 Indiana English Language Arts Standard	Common Core State Standard
Determine how theme or central idea of a text is conveyed through particular details; provide an objective summary of the text. (6.R.L.3)	Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments. (6.R.I.2)

Rather than requiring what appear to be two separate expectations in the first part of the Common Core State Standards standard (determine the theme *and* analyze its development), the Indiana draft 2014 English Language Arts standard presents an integrated expectation – to determine how the theme "is conveyed through particular details," a task that highlights *how* one could analyze the development of a text, arguably a much more specific and clear expectation.

Although such changes seem small, they are indications that the state has considered each element they have drawn from the Common Core State Standards. The state has made a consistent attempt to sharpen the specificity of its standards so as to provide a clear basis for the future translation of the standards to classroom practice.

Clarity/Accessibility

The draft 2014 English Language Arts Standards appear to be free of errors, and written in clear, non-jargon language, thereby communicating in language that can gain widespread acceptance not only by postsecondary faculty but also by employers, teachers, parents, school boards, legislators and others who have a stake in schooling.

The format of the draft 2014 English Language Arts Standards makes it easier to recognize the progression of skills from grade to grade as well as the parallel expectations set for each skill.

The format of the draft 2014 English Language Arts Standards is similar to the Common Core State Standards in that it presents the standards in columns by grade so that the progression of demand and complexity is clearly evident. Indiana's 2006 English Language Arts Standards presented its expectations singly by grade so that it was difficult to discern parallel standards at the various grade levels or to be aware of a progression of skills from grade to grade.

The draft 2014 English Language Arts Standards refine some of the language in standards based on the Common Core State Standards.

Clearly the draft 2014 English Language Arts Standards reflect an attempt to clarify the expectations borrowed from the Common Core State Standards. The majority of the draft 2014 English Language Arts Standards are adopted verbatim from the Common Core State Standards, yet there are several instances where the draft 2014 English Language Arts Standards have attempted to clarify the Common Core State Standards language. For example, at grade 8, the Common Core State Standards expect students to "Analyze how differences in the points of view of the characters and the audience or reader (e.g., created through the use of dramatic irony) create such effects as suspense or humor." The draft 2014 English Language Arts Standards phrasing is much clearer as to how the effects of suspense or humor are created: "Analyze how the author creates such effects as suspense or humor through differences in the points of view of the characters and the reader (e.g., created through the use of dramatic irony)." In

another case, the draft 2014 English Language Arts Standards clarify the language of the parallel Common Core State Standards. At the grades 9-10 band, the Common Core State Standards expect a student to “Analyze a particular point of view or cultural experience reflected in a work of literature from outside the United States, drawing on a wide reading of world literature.” The draft 2014 English Language Arts Standards attempt to clarify how the “wide reading of world literature” could contribute to an analysis: “Analyze a particular point of view or cultural experience in a work of world literature considering how it reflects heritage, traditions, attitudes, and beliefs.” Although the end goals of analyzing literature are the same in both the Common Core State Standards and the draft 2014 English Language Arts Standards, the explanation of how one determines such an analysis seems more straightforward in the state’s current draft 2014 English Language Arts Standards.

Measurability

In general, standards should focus on the results, rather than the processes of teaching and learning. The draft 2014 English Language Arts Standards present clearly measurable student outcomes that focus on the results, rather than the processes, of teaching and learning. The draft 2014 English Language Arts Standards generally make use of performance verbs that call for students to demonstrate knowledge and skills, rather than those that refer to learning activities (such as examine and explore) or cognitive processes (such as know or appreciate). The example cited in the section above on Rigor regarding the reading strategy of making predictions is relevant to measurability as the majority of such reading strategies are techniques and habits that a reader employs in making sense of text, quite often unconsciously as they are integrated into a reader’s approach to a text, making these techniques not easily observed and therefore measured.

Recommendations and Next Steps

The draft 2014 Indiana English Language Arts Standards provide clear evidence of the fact that the state has made a careful and diligent attempt to build from the Common Core State Standards and the 2006 Indiana English Language Arts Standards previously adopted to construct a set of standards that retains strengths of both the Common Core State Standards and the state’s 2006 English Language Arts Standards, while also adding some distinct features. Although the draft 2014 English Language Arts Standards mirror the format and progression of the Common Core State Standards and draw the majority of their new standards verbatim from that document, the state appears to have clearly examined each statement they have included in this draft, keeping, changing, adding, and revising standards as they try to capture the clearest and highest expectations for the students of Indiana.

Indiana has made considerable progress in developing standards in English language arts that are high quality and aligned with what it takes to succeed in college and career, though Achieve will recommend some further considerations as refinements are developed on the present draft. Achieve’s major findings are as follows:

The state should offer as clear guidance as possible for what is regarded as appropriate grade-level texts by including examples within standards, a well-documented reading list, and/or adaptations from or the inclusion of relevant Common Core State Standards materials.

In its 2006 report *Reading Between the Lines: What the ACT Reveals About College Readiness in Reading*[15], ACT argues that "the clearest differentiator in reading between students who are college ready and students who are not is the ability to comprehend *complex* texts." The draft 2014 English Language Arts Standards present a stipulation about the level of reading expected at each grade level, as this one from grade 8:

> *Read and comprehend a variety of literature, including stories, dramas, and poems, within a range of complexity appropriate for grades 6-8 independently and proficiently by the end of the grade 8.*

Without a reading list, example texts or a rubric of some kind, however, these statements are not as specific as they need to be to guide educators and students in selecting works of appropriate complexity to meet the standards.

Reading standards have grappled with this issue of defining grade-level texts in a variety of ways. The ADP Benchmarks indicated the quality and complexity of the expectations by providing examples of the kinds of reading and mathematical problems the benchmarks are meant to describe, and, as well, suggested that the ADP English Benchmarks were to be used in close coordination with the reading lists developed by two ADP Network partner states, Indiana and Massachusetts. The Common Core State Standards describe a variety of factors that contribute to text complexity and include *Appendix A: Research Supporting Key Elements of the Standards* in which the research on the issue of text complexity is addressed as well as *Appendix B* which includes text exemplars for all grades and most genres.

The 2006 Indiana Standards offered at least two ways to suggest the appropriate levels of reading, first with the reading list noted above by the ADP Benchmarks, and by the judicious use of examples within the standards themselves, as seen in the following standards:

2006 Indiana English Language Arts Standards
Grade 1 2.3 Respond to who, what, when, where, why, and how questions and recognize the main idea of what is read. *Example*: After reading or listening to the science book *Gator* or *Croc* by Allan Fowler, students answer questions about the reptiles and discuss the main ideas.
Grade 10 3.1 Analyze the purposes and the characteristics of different forms of dramatic literature (including comedy, tragedy, and dramatic monologue). *Example*: Analyze the features of plays, such as *I Never Sang for My Father* by Robert Anderson or *Arsenic and Old Lace* by Joseph Kesselring or *A Piano Lesson* by August Wilson or *The Buck Private* by Luis Valdez.

At least so far in the draft 2014 English Language Arts Standards, the examples in the 2006 Indiana Standards are not included. The value of having such examples within the standards is that the skill being described in the standard, as responding to questions about a text in the Grade 1 Standard noted above, is contextualized for the standards' audiences, which includes educators as well as the general

[15] ACT. (2006). *Reading Between the Lines: What the ACT Reveals About College Readiness in Reading.* http://www.act.org/research/policymakers/pdf/reading_report.pdf

public, thereby lessening the chance of a standard being misinterpreted and as well as making specific suggestions of how such a skill would be applied to appropriate grade-level texts, whether that is *Croc* or *A Piano Lesson.* In its Appendix B, the Common Core State Standards take this provision of examples and expand upon it by providing exemplars of appropriate texts in a multitude of genres for each grade, even providing in most cases a sample of the text being suggested.

The other vehicle for communicating appropriate reading levels is the reading list. The American Diploma Project in its publication *Ready or Not: Creating a High School Diploma that Counts*[16] described the reading lists for both Massachusetts and Indiana:

> These lists, which directly follow the benchmarks, were developed in thorough and inclusive processes in those states. They not only define the quality and complexity of reading expected of all high school graduates, but also suggest a common level of "cultural literacy" expected of all high school graduates, including representative works of various cultures both within and beyond the United States. (p. 23)

Although the Indiana reading list referenced in the *Ready or Not* report would need some updating to include notable texts published in the last twelve or so years, the state's list would provide a strong basis for a revision that would help to illustrate the state's expectation that all students are given the opportunity to encounter and to interact with quality reading materials.

Of course, it may be the case that Indiana has just not yet decided which of several paths to follow regarding the clarification of range in reading, whether it be modeled on the Common Core State Standards, the former Indiana reading list(s), or the use of intertextual examples in the standards themselves. Any one or a combination of the alternatives will strengthen and make public the level of reading envisioned by the state for its students.

As discussed in the earlier section of this review, the state should consider how to address the issue of literacy in all the content areas, not just in English/Language Arts classrooms.

In its present form, the draft 2014 English Language Arts Standards do not address the need for instruction in literacy skills, including primarily reading, writing, and research, in all the content areas. All of these skills are addressed somewhat differently in the various content areas, a research project in history, for example, differing quite a bit from a research project in chemistry, although the most salient characteristics of research remain the same no matter what the context.

This issue of cross-content literacy instruction is addressed in a multitude of ways in schools, and, as well, in a variety of manners in standards documents. The American Diploma Project, for example, provided a footnote on the issue:

> These skills, although critical to the study of English, are also necessary to the study of many academic subjects. Therefore, the study and reinforcement of these skills should not be confined to the English classroom or coursework. (p. 29)

The Common Core State Standards offers entirely separate sets of standards, "Literacy in History/Social Studies, Science, and Technical Subjects," for grades 6-12. In some clear manner, the state should

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[16] Achieve. (2004). *Ready or Not: Creating a High School Diploma That Counts.* http://www.achieve.org/ReadyorNot

attempt to demand that instruction in literacy must extend beyond the English Language Arts classroom in order for students to become truly competent readers, writers, and thinkers.

Review of Draft 2014 Indiana Mathematics Standards Using Achieve's Criteria for the Evaluation of College- and Career-Ready Standards

The purpose of the Standards' Review is to assist states in developing high-quality college- and career-ready Standards in English language arts that prepare high school students for success in credit-bearing college courses and quality, high-growth jobs.

When evaluating standards, Achieve has historically used a set of six criteria: rigor, coherence, focus, specificity, clarity/accessibility, and measurability. For purposes of this analysis, the draft 2014 Indiana Mathematics Standards were analyzed with respect to these criteria and compared with the 2009 Indiana Mathematics Standards, the Common Core State Standards, and Achieve's American Diploma Project (ADP) Benchmarks. With a few caveats and exceptions that are summarized in this report, the draft 2014 Mathematics Standards generally received favorable evaluations.

Rigor

The draft 2014 Indiana Mathematics Standards are generally appropriately rigorous, including content and performance expectations at a level of cognitive demand, from kindergarten through high school, which will culminate in college and career readiness.

Although there is some minor variation as to exactly when content is presented in the 2009 standards, the Common Core State Standards, and the draft 2014 Mathematics Standards, the draft 2014 Mathematics Standards collectively appear to be appropriately rigorous.

A caveat at the secondary level is that some expectations that appear in the 2009 Mathematics Standards for all students pursuing a Core 40 diploma and in the Common Core State Standards for all students now appear in more advanced high school courses in the draft 2014 Mathematics Standards.

There has been some movement of standards from one grade in the 2009 Indiana Mathematics Standards to another grade in the draft 2014 Mathematics Standards, and this movement generally serves to bring the draft 2014 Mathematics Standards into close alignment with the Common Core State Standards. For example, angle measurement and description of angles in degrees has been moved from grade 5 in the 2009 Mathematics Standards (5.3.1) to grade 4 in the draft 2014 Mathematics Standards (4.M.6 and 4.M.7), which is consistent with the Common Core State Standards (4.MD.5, 4.MD.6, and 4.MD.7). At this grade level, both the Common Core State Standards and the draft 2014 Mathematics Standards also offer a more conceptual treatment of angle measure than is offered in the 2009 Indiana Mathematics Standards. Similarly, treatment of probability concepts, which begins in the 2009 Indiana Mathematics Standards in the primary grades (3.1.9, 4.2.1 and 5.1.9) and extends into middle school (6.4.4 and 6.4.5), is deferred until grade 7 in the draft 2014 Mathematics Standards, consistent with the Common Core State Standards and enhancing focus with respect to this concept – without detracting from the rigor of the standards.

The draft 2014 Mathematics Standards address some topics earlier than they are addressed in the Common Core State Standards, consistent with the state's 2009 Mathematics Standards. For example, Indiana's draft 2014 Mathematics Standards address the inverse relationship between squaring and finding the square root of perfect square integers at grade 7 (7.NS.2), as the state also did in its 2009 Mathematics Standards (7.1.5). This concept is addressed in the Common Core State Standards at grade

8 (8.EE.2). The same is true of identifying, comparing and ordering rational and irrational numbers (7.N.3 in the draft 2014 Mathematics Standards, 7.1.6 in the 2009 Indiana Mathematics Standards, and 8.NS.2 in the Common Core State Standards). Similarly, pyramids are addressed in both the 2009 Indiana Mathematics Standards and draft 2014 Mathematics Standards at Grade 8 (8.3.6 and 8.G.11, respectively) but not addressed in the Common Core State Standards until high school. This is not problematic from a rigor perspective unless it impacts on the focus of a set of grade-level or course-level standards. For example, the addition of standard 4.DA.1 to the draft 2014 Mathematics Standards for grade 4 extends beyond what is expected in both the 2009 Indiana Mathematics Standards and the Common Core State Standards at that grade level. The expectations defined in this standard related to the collection, representation, and interpretation of data are significant and have the potential to use a substantial amount of instructional time – possibly impacting instructional focus at grade 4. Much of the language of this standard is identical to 5.DS.1, so its inclusion, as presently worded in both grades, should be examined. Consideration should be given to moving the substance of these two standards to one of the middle school grades where data analysis concepts receive more focus and where the data collection, representation, and interpretation expectations would reinforce the teaching and learning of science.

The draft 2014 Mathematics Standards include some key concepts that are not explicitly addressed in the Common Core State Standards that many mathematicians and mathematics educators believe are crucial to the development of mathematical understanding. For example, the draft 2014 Mathematics Standards explicitly address prime factorization in grade 7 (7.NS.1), a concept also addressed in Indiana's 2009 Mathematics Standards (7.1.3) but not specifically addressed in the Common Core State Standards. Similarly, both the 2009 Indiana Mathematics Standards and draft 2014 Mathematics Standards for grade 6 address the notion of the interior angles of a triangle summing to 180 degrees and the interior angles of a quadrilateral summing to 360 degrees; this is not addressed in the Common Core State Standards. The criticality of students being able to convert between fraction, decimal, and percent representations is clearly articulated in the draft 2014 Mathematics Standards (6.NS.5), as it was in the 2009 Indiana Mathematics Standards (6.1.4). While this notion is very generally referenced in the Common Core State Standards (7.NS.2d and 8.NS.1), it is more specifically and clearly dealt with in the draft 2014 Mathematics Standards and at an earlier grade level.

The Probability and Statistics standards that are part of the draft 2014 Mathematics Standards for grades 6-8 align reasonably well with the Common Core State Standards but lack some expectations set in the 2009 Indiana Mathematics Standards. For example, the 2009 Indiana Grade 6 standards (6.4.1 and 6.4.2) expect students to be able to construct and analyze circle graphs and stem-and-leaf plots and to choose the appropriate display for a data set from among bar graphs, line graphs, circle graphs, and stem-and-leaf plots. In the draft 2014 Mathematics Standards, students are not responsible for stem-and-leaf plots before the high school Probability and Statistics course (PS.1), a rigorous 4^{th}-year course that not all students will take. And while the draft 2014 Mathematics Standards call for students to interpret data displayed in a circle graph in grade 3, more advanced work with circle graphs/pie charts (such as the construction and analysis called for in the grade 6 2009 Indiana Mathematics Standards) is not required prior to the high school Probability and Statistics course.

The draft 2014 Mathematics Standards for high school submitted for review are organized by course as follows: Algebra I, Algebra II, Geometry, Pre-Calculus, Trigonometry, Finite Mathematics, Probability and Statistics, and Calculus. The existence of standards for this range of courses provides a rigorous array of opportunities for all students to meet and exceed general and Core 40 graduation requirements. An additional course in Quantitative Reasoning is under development as a 4^{th}-year course option for

students who are going on to college but not into a mathematics-intensive major. All of the courses are intended as two-semester, year-long courses, with the caveat that Trigonometry and Pre-Calculus will be combined for a two-semester, year-long course – and Trigonometry will also be offered as a one-semester course.

The focus of this analysis at the high school level is on the traditional three-course sequence of Algebra I, Algebra II and Geometry (since this is a requirement for students pursuing a Core 40 diploma) although reference will be made on occasion to standards in the other courses. In addition to comparing the 2009 Indiana Mathematics Standards and draft 2014 Mathematics Standards, comparisons will also be made to the model high school courses outlined in the appendix to the Common Core State Standards and to the ADP Benchmarks, which define a college and career readiness benchmark. Based on this analysis, several observations can be made:

- As might be expected, the draft 2014 Mathematics Standards tend to align more strongly with the Common Core State Standards than do the 2009 Indiana Mathematics Standards. For example, both the Common Core State Standards and the draft 2014 Mathematics Standards (within Algebra I and Algebra II) include standards that require students to compare and contrast linear and exponential functions. While the 2009 Indiana Mathematics Standards address both types of functions, they tend to do so in isolation, with linearity being a focus for Algebra I and the focus on exponential relationships coming in Algebra II.
- The model high school courses included as an appendix to the Common Core State Standards serve as a basis for comparison to see if the critical areas addressed in those courses are also critical areas in Indiana's draft 2014 courses for Algebra I, Algebra II, and Geometry. Each of the model courses identifies critical areas of focus, and the comparable courses in the draft 2014 Mathematics Standards generally maintain that focus. There are some minor differences, however. For example, the Common Core State Standards model courses expect students in Algebra I to be able to solve systems of equations involving quadratic expressions, while in the draft 2014 Indiana course sequence, solution of a system of equations consisting of a linear equation and a quadratic equation is delayed until Algebra II. There are also instances where the draft 2014 Mathematics Standards include content not addressed in the Common Core State Standards but rather maintained from the 2009 Indiana Mathematics Standards. Examples include non-Euclidean Geometry and congruence and similarity of solids.
- Probability and statistics concepts at the high school level are integrated into the draft 2014 Algebra I, Algebra II, Pre-Calculus, and Finite Mathematics courses, but not the Geometry course. There are also standards for an advanced Probability and Statistics course. The Common Core State Standards model courses parse probability and statistics expectations across all three traditional courses (Algebra I, Algebra II, and Geometry). This differential treatment of probability and statistics is not necessarily a problem, as long as all students get the opportunity to learn the concepts they need to be college and career ready. There are some concepts now contained within the elective draft 2014 Probability and Statistics course (and also the Pre-Calculus course) that the Common Core State Standards and/or the ADP Benchmarks address at the high school level for <u>all</u> students and that the 2009 Indiana Mathematics Standards address in courses required for students pursuing a Core 40 Diploma. The table below shows some examples but is not comprehensive.

Text highlighted in blue below shows identical expectations that have been moved from the 2009 Indiana Algebra II course to the draft 2014 Probability and Statistics course. Text highlighted in green shows identical expectations that are in the Common Core State Standards for all students but in the 2014 Probability and Statistics course. Placement of the ADP Benchmarks in this chart signifies that K-12 educators, post-secondary educators, and business representatives have signified these concepts as important for college and career readiness.

2009 Indiana Mathematics Standards	Draft 2014 Indiana Mathematics Standards	Common Core State Standards	ADP Benchmarks
A1.7.2 Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results.	7.DS.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. PS.27 Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results PS.52 Understand and apply basic ideas related to the design and interpretation of surveys, such as background information, random sampling, and bias PS.55 Understand how sample statistics reflect the values of the population parameters and use sampling distributions as the basis for informal inference	CC.9-12.S.IC.1 Understand and evaluate random processes underlying statistical experiments. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.* CC.9-12.S.IC.3 Make inferences and justify conclusions from sample surveys, experiments, and observational studies. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.*	L3.1. Explain the impact of sampling methods, bias and the phrasing of questions asked during data collection and the conclusions that can rightfully be made. L3.2. Design simple experiments or investigations to collect data to answer questions of interest. L3.3. Explain the differences between randomized experiments and observational studies.
A2.8.1 Use the relative frequency of a	PS.21 Use the relative frequency of a specified	CC.9-12.S.ID.5 Summarize, represent,	L4.2. Explain how the

2009 Indiana Mathematics Standards	Draft 2014 Indiana Mathematics Standards	Common Core State Standards	ADP Benchmarks
specified outcome of an event to estimate the probability of the outcome and apply the law of large numbers in simple examples.	outcome of an event to estimate the probability of the outcome and apply the law of large numbers in simple examples	and interpret data on two categorical and quantitative variables. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.*	relative frequency of a specified outcome of an event can be used to estimate the probability of the outcome. L4.3. Explain how the law of large numbers can be applied in simple examples.
A2.8.2 Determine the probability of simple events involving independent and dependent events and conditional probability. Analyze probabilities to interpret odds and risk of events.	A2.DP.3 Understand the concepts of conditional probability and independent events. PS.13 Determine the probability of simple events involving independent and dependent events and conditional probability. Analyze probabilities to interpret odds and risk of events PS.12 Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B and use Bayes' Theorem and use them to solve problems.	CC.9-12.S.CP.1 Understand independence and conditional probability and use them to interpret data. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").* CC.9-12.S.CP.2 Understand independence and conditional probability and use them to interpret data. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.* CC.9-12.S.CP.3 Understand independence and conditional probability and use them to interpret data. Understand the conditional	L4.4. Apply probability concepts such as conditional probability and independent events to calculate simple probabilities

2009 Indiana Mathematics Standards	Draft 2014 Indiana Mathematics Standards	Common Core State Standards	ADP Benchmarks
		probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.* CC.9-12.S.CP.5 Understand independence and conditional probability and use them to interpret data. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	

Another hallmark of rigorous standards is a good balance between conceptual understanding, procedural fluency, and application to problem solving. As the draft 2014 Mathematics Standards were written and compiled, attention was given to ensuring a good balance between these three components of rigor. While the 2009 Indiana Mathematics Standards were identified in the past by Achieve and others as strong standards, the draft 2014 Mathematics Standards improve upon them by attending more clearly to the development of conceptual understanding and the application of mathematics to solving contextualized problems – thereby increasing the level of rigor. In some instances, Indiana was able to utilize aspects of the Common Core State Standards to achieve this (e.g., in the development of the concept of equivalent fractions in grade 4); in other cases, the writers of the draft 2014 Mathematics Standards inserted additional standards focusing on the application of mathematical procedures to solve contextualized problems (e.g., 4.AT.1, 4.AT.2, 5.AT.2 5.AT.3, and 5.M.2).

Coherence

The draft 2014 Mathematics Standards are, as with the 2009 Indiana Mathematics Standards, organized by grade level at K-8 and by course for high school. They are further categorized within grade level or course by strand, clustering standards related to like conceptual categories. Once the draft 2014 Mathematics Standards are packaged for use by educators and the general public, these strand headings should provide a meaningful organizational structure. Care has been taken in developing the draft 2014 Mathematics Standards to maintain and capitalize on relationships within and across grade levels. For example, as was also true of the 2009 Indiana Mathematics Standards, care is taken to develop the relationships between multiplication, arrays, and area models in grade 3 – followed by more in-depth development and use of area formulas in grade 4.

Focus

The draft 2014 Mathematics Standards are generally focused and establish priorities about what students should know and be able to do at each grade and in each course, in order to be college and career ready.

The expectations at each level are manageable, with a few exceptions. For example, the draft 2014 Mathematics Standards place a somewhat greater emphasis on data analysis than the Common Core State Standards and the 2009 Indiana standards at grades 4 and 5 by expecting students (in standards 4.DA.1 and 5.DS.1[17]) to "formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs." While 4.DA.1 goes on to include categorical and numerical data and 5.DS.1 also addresses how data collection methods affect the data set, the core of these two standards is the same in both grades, resulting in potential redundancy and excessive focus on data analysis concepts. Consideration should be given to moving the substance of these standards to one of the middle school grades where data analysis concepts receive more focus and where the data collection, representation, and interpretation expectations would reinforce the teaching and learning of science.

[17] Fourth grade standard: "Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Recognize the differences in representing categorical and numerical data." Fifth grade standard: "Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Consider how data-collection methods affect the nature of the data set."

An analysis performed by William Schmidt, a Michigan State University Distinguished Professor and co-director of the Education Policy Center confirms the focus of the draft 2014 Mathematics Standards, as shown below. The first column of this table provides a list of major mathematics topics used by Schmidt in his analyses of standards and curricula. The dots identify the grades at which the draft 2014 Mathematics Standards focus on the various topics, with the shading indicating the focus grades for these topics within the Common Core State Standards. As can be seen from the table, there is a high degree of overlap.

Description	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8
Whole Number: Meaning	●	●	●	●	●			
Whole Number: Operations	●	●	●	●	●	●		
Whole Number: Properties of Operations	●	●	●	●	●	●		
Common Fractions	●	●	●	●	●	●		
Measurement: Units	●	●	●	●	●	●	●	●
2-D Geometry: Polygons & Circles	●	●	●	●	●	●	●	●
Data Representation & Analysis	●	●	●	●	●	●	●	●
3-D Geometry	●	●	●			●	●	●
Measurement: Estimation & Errors		●	●					
Number Theory: Primes & Factorization; Even/Odd		●		●	●	●	●	
2-D Geometry: Basics		●	●	●	●	●	●	●
Rounding & Significant Figures			●	●	●			
Relationships of Common & Decimal Fractions			●	●	●	●		
Estimating Computations			●	●	●		●	●
Measurement: Length, Perimeter, Area, & Volume		●	●	●	●	●	●	●
Equations & Formulas			●	●	●	●	●	●
Decimal Fractions				●	●	●		
Patterns, Relations & Functions	●	●		●	●	●	●	●
Geometry: Transformations: includ'g Patterns, Symmetry				●		●	●	●
Properties of Common & Decimal Fractions					●	●		
Orders of Magnitude & Scientific Notation					●			●
1-D & 2-D Geometry: Coordinate Systems					●	●	●	●
Exponents, Roots, & Radicals					●	●	●	●
Percentages					●	●	●	
Negative Numbers, Integers & Their Properties						●	●	
Proportionality Concepts						●	●	
Proportionality Problems						●	●	
Rational Numbers & Their Properties					●	●	●	●
Constructions w/Straightedge & Compass							●	●
Systematic Counting								●
Uncertainty & Probability							●	●
Real Numbers & Their Properties							●	●
Congruence & Similarity								●
Slope & Right Triangle Trigonometry							●	●
Validation & Justification								

The draft 2014 Mathematics Standards for K-8—which include elements of both the 2009 Indiana Mathematics Standards and the Common Core State Standards—appear to do a parsimonious job of combining critical components from both documents. While a simple count of standards is not sufficient to affirm or deny focus, it can be noted that there are more content standard statements in the draft 2014 Mathematics Standards for grades K-8 (279) than there are in the 2009 Indiana Mathematic Standards (172). Focus is still maintained, however, and the additional standards help to ensure more attention to the development of conceptual understanding and the ability to apply mathematics to solving problems. The draft 2014 Mathematics Standards contain fewer standards than the Common Core State Standards (317, if counting all stem standards and sub-standards for K-8).

A comparison of the draft 2014 Mathematics Standards with the 2009 Indiana Mathematics Standards shows that the traditional three-course sequence of Algebra I/Algebra II/Geometry has a slightly greater number of standards (118) in the 2014 draft when compared with the same course sequence in 2009 (105). A comparison to the model courses for Algebra I, Algebra II, and Geometry developed as an appendix to the Common Core State Standards reveals that all or part of 160 standards are addressed across the model three-course sequence.

Specificity

The draft 2014 Mathematics Standards are generally specific enough to convey the level of performance expected of students at each grade level and in each course. They are sufficiently detailed without being overly prescriptive.

The example below highlights variations in the level of specificity for one high school geometry concept in the four documents used for this comparative analysis. It is particularly clear in this example how specificity has been enhanced from 2009 to 2014. The ADP Benchmark, given its intent as a culminating high school benchmark rather than a course standard, is more generally worded. The Common Core State Standards that align to these draft 2014 Indiana course standards are less specific about content yet more specific with respect to strategies and approaches to learning about geometric objects in the coordinate plane.

2009 Indiana Mathematics Standard	Draft 2014 Indiana Mathematics Standard	Common Core State Standards	ADP Benchmark
G.1.6 Represent geometric objects and figures algebraically using coordinates, use algebra to solve geometric problems, and develop simple coordinate proofs involving geometric objects in the coordinate plane.	G.Q.27 Represent triangles and quadrilaterals in the coordinate plane and create proofs related to the figures (e.g. using knowledge of slopes, parallel and perpendicular lines, distance formula and the Pythagorean Theorem to classify the figures as isosceles, right, equilateral, square, rectangle, parallelogram, etc.).	CC.8.G.3 Understand congruence and similarity using physical models, transparencies, or geometry software. Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. CC.9-12.G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and	K10. Represent geometric objects and figures algebraically using coordinates; use algebra to solve geometric problems:

		containing the point (0, 2).	

Clarity/Accessibility

The draft 2014 Mathematics Standards are generally clearly written. This review is not so much an editorial review as it is a review of content, but blatant inaccuracies and errors are not apparent. A thorough review to ensure mathematically precise, yet jargon-free language will still be needed.

A significant change from the 2009 Indiana Mathematics Standards to the draft 2014 Mathematics Standards is the replacement of the 2009 Process Standards – attached to each set of grade-level and course standards – by an adaptation of the Common Core State Standards for Mathematical Practice. The draft 2014 Mathematics Standards include *K-5 Mathematics Process Standards, 6-8 Mathematics Process Standards*, and *Process and Practice Standards for all Courses 9-12*. Although the names of these standards vary somewhat by grade cluster, the standards are identical. They are the Common Core State Standards for Mathematical Practice, with some small edits that appear to be added to enhance specificity and clarity. The most substantive edit is the inclusion of the following language as part of Standard 5 (Use appropriate tools strategically): "Regarding technology, students use it strategically as a tool to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving. Note: Elementary students must learn how to fluently perform the basic arithmetic operations independent of the use of a calculator." This statement appears to have been included to give more clarity to the strategic use of one particular tool (technology) to support learning, with the caveat that it is not to be used by elementary students in lieu of their being able to fluently perform basic computations.

It is not clear where these process or practice standards will reside in the final form of the new Indiana standards; they could be provided once preceding all of the standards and apply to all grade-level and course standards, precede each grade-cluster set of standards (as implied by their current titles), or be inserted into each set of grade-level and course standards. If Indiana decides it is better to precede each set of grade-cluster standards with its own set of process or practice standards, consideration should be given to customizing some of the wording of the standards so they focus on the appropriate grade cluster. For example, Standard 5 includes a statement that targets high school students: "mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator." Such a statement is not applicable for students earlier than high school and might, in fact, create some confusion among elementary school teachers.

Another difference between the 2009 Indiana Mathematics Standards, the draft 2014 Mathematics Standards, and the Common Core State Standards is in the language used to describe the strategies and approaches students are expected to use in solving problems. The 2009 Indiana Mathematics Standards reference students using a "standard algorithmic approach" to fluently solve problems (e.g., in standards 2.16, 3.15, and 5.1.5). The Common Core State Standards reference students being able to use the standard algorithm (e.g., in 5.NBT.5, which calls for students to fluently multiply multi-digit whole numbers) and also the acceptability of a range of algorithms being used (as in 3.NBT.2 and 3.NBT.3 which describe using strategies and algorithms based on such concepts as place value and properties of operations). As explained by Fuson and Beckman[18]:

[18] Fuson, K. and Beckmann, S. (Fall/Winter 2012-2013). "Standard Algorithms in the Common Core State Standards." *National Council of Supervisors of Mathematics Journal.* http://www.mathedleadership.org/docs/resources/journals/NCSMJournal_ST_Algorithms_Fuson_Beckmann.pdf

> For multi-digit computation, the CCSS-M specifies a learning progression in which students develop, discuss, and use efficient, accurate, and generalizable methods based on place value and properties of operations. Students explain the reasoning used in a written method with visual models. Then, in a later grade, students move to using the standard algorithm fluently with no visual models. (p. 14)

They further state that

> General methods that will generalize to and become standard algorithms can and should be developed, discussed, and explained initially using a visual model. Given this emphasis on meaning-making, variations in ways to record the standard algorithm that support and use place value correctly should be emphasized. (p.16)

The draft 2014 Mathematics Standards articulate the expectation that students perform operations fluently (e.g., standards 3.C.1 and 5.C.2) but do not mention use of either "a standard algorithmic approach" or "the standard algorithm." The draft 2014 Mathematics Standards do, however specify in some standards (e.g., 5.C.3) that students use strategies based on place value, the properties of operations, and/or relationships between operations, consistent with some of the language from the Common Core State Standards. More clarity is needed for educators and non-educators as to the thinking behind this approach and its implications for teaching and learning. Consideration should also be given to building into the draft 2014 Mathematics Standards the same sequenced approach described by Fuson and Beckman, with students moving from sense-making as they first learn about a new concept to the use of a standard algorithm fluently with no visual models. The point in the draft 2014 Mathematics Standards at which procedural fluency is expected and articulated would be the logical place for conveying the expectation that students are to be able to use a standard algorithm fluently.

Measurability

The draft 2014 Mathematics Standards are generally measurable, observable, or verifiable in some way. They tend to emphasize what it is that students should know and be able to do rather than the processes of teaching and learning.

As already discussed, the draft 2014 Mathematics Standards refrain from reference to "a standard algorithmic approach" (used in the 2009 Indiana standards) or "the standard algorithm" (used occasionally in the Common Core State Standards). The inclination in the draft 2014 Mathematics Standards is to validate a range of strategies and approaches such as those based on place value, the properties of operations, and/or relationships between operations, consistent with some of the language from the Common Core State Standards.

Also noteworthy, is that the draft 2014 Mathematics Standards sometimes set limits (similar to those in the Common Core State Standards but not as consistently present in the 2009 Indiana Mathematics Standards) that define parameters for not only teaching and learning but also assessment. For example, 4.NS.3 in the draft 2014 Mathematics Standards limits denominators to 2, 3, 4, 5, 6, 8, 10, 25, and 100. This is almost identical to the limits set in the Common Core State Standards; no such limits are defined in standard 4.1.2, the comparable standard from the 2009 Indiana Mathematics Standards.

Recommendations and Next Steps

The draft 2014 Mathematics Standards capitalize on strengths from Indiana's 2009 Mathematics Standards, the ADP Benchmarks, and the Common Core State Standards. Aspects of all of these documents are incorporated in the draft 2014 Mathematics Standards, resulting in standards that are generally rigorous, coherent, focused, specific, clear and accessible, and measurable. This analysis offers some observations and insights into ways the draft 2014 Mathematics Standards can be made stronger, if the state decides to move forward with developing its own set of college- and career-readiness standards.

The draft 2014 Mathematics Standards should be examined to ensure that all students graduating from high school in Indiana have the opportunity to learn all of the mathematical concepts and practices they need to be prepared for college and career. In particular, standards currently placed in courses intended to be taken after Algebra II should be reviewed to ensure that they are not among those needed by all students for college and career readiness.

The draft 2014 Mathematics Standards do a good job of building conceptual understanding along with procedural fluency. The standards are written so as to promote use of strategies based on place value, the properties of operations, and/or relationships between operations, as students learn about mathematical content and processes. However, consideration should be given to building into the draft 2014 Mathematics Standards the same sequenced approach described by Fuson and Beckman, with students moving from sense-making as they first learn about a new concept to the use of a standard algorithm fluently with no visual models. The point in the draft 2014 Mathematics Standards at which procedural fluency is expected and articulated would be the logical place for conveying the expectation that students are to be able to use a standard algorithm fluently.

While the focus of the draft 2014 Mathematics Standards is strong, it could be made more transparent if introductory language was written to precede each set of grade-level and course standards, defining the focus content areas, as is done with the Common Core State Standards and the model courses contained in their appendix. Similarly, it would be helpful to users if fluency expectations for each grade, grade cluster, or course were defined in the introductory narrative (as is done in guidelines that accompany the Tennessee Common Core State Standards); this would also serve as a marker for when students would be expected to transition from sense making to the fluent use of a standard algorithm.

Standards 4.DA.1 and 5.DS.1 should be examined to ensure that their inclusion does not negatively impact the standards' intended focus. These two standards, in particular, are highly redundant and very ambitious for the grades levels where they are placed. They would require significant teaching time and detract from the focus at these grades. Consideration should be given to moving the substance of these standards to one of the middle school grades where data analysis concepts receive more focus and where the data collection, representation, and interpretation expectations would reinforce the teaching and learning of science.

Consideration needs to be given to how to reference and include the Common Core State Standards for Mathematical Practice in the draft 2014 Mathematics Standards. They have been extracted from the Common Core State Standards, with very minor edits made to their wording. It appears, given the various titles given to the standards submitted for grades K-5, 6-8, and 9-12, that the intent may be to use these as grade cluster standards. If this is the case, thought should be given to customizing some of

the language to better target the grades to which they apply. Otherwise, they can be used once, preceding all of the standards, and apply uniformly across all grades and courses.

Appendix A:

Review of Draft 2014 Indiana Calculus Standards Using Achieve's Criteria for the Evaluation of College- and Career-Ready Standards

When evaluating standards, Achieve has historically used a set of six criteria: rigor, coherence, focus, specificity, clarity/accessibility, and measurability. For purposes of this analysis, the Indiana draft 2014 Calculus Standards were analyzed with respect to these criteria and compared with calculus standards from California[19] and Florida[20].

The Indiana draft 2014 Calculus Standards are very well written. They have a few content gaps that can be easily addressed. Compared to California's Calculus Standards, they have large content gaps since those are aligned with AP Calculus BC (two semesters of college calculus). The Indiana draft 2014 Calculus Standards are too few for a yearlong high school course, and likely too many for one semester. It is recommended that a choice be made to either trim some of the content to make it a manageable one-semester course, or expand it to be a two-semester course. In the first case, the standards about differential equations and the Mean Value Theorem could be removed; in the second case, California's standards could be used as a basis for selecting standards about techniques and applications of integration and about numerical and power series to add. In either case some fine-tuning is recommended using the suggestions below. Indiana should not make these standards a requirement for all high school students since they are beyond the majority of students' cognitive reach in the time available to develop the embedded concepts and skills.

- **Guiding Questions Rigor: what is the intellectual demand of the standards?**
    - How well aligned are Indiana's draft 2014 Calculus Standards (as defined in the chart submitted to Achieve by Indiana) with the California and the Florida Calculus Standards? (NOTE: California's consist of all the expected outcomes from a typical two-semester college calculus sequence.)
    - Specific examples and commentary are provided regarding places where a California or Florida calculus standard is not matched by an equivalent Indiana draft 2014 calculus standard.
    - Specific examples and commentary are provided regarding places where the Indiana draft 2014 Calculus Standards include elements not present in the California or Florida Calculus Standards.

- **Coherence: do the standards convey a unified vision of calculus and do they establish connections among the major areas of study?**
    - Do Indiana's draft 2014 Calculus Standards suggest a logical progression of content and skills?
    - Do the categories/strands in Indiana's draft 2014 Calculus Standards reflect a meaningful structure for calculus?
    - Do Indiana's draft 2014 Calculus Standards reveal significant relationships among the strands/categories? Or do the strands seem arbitrarily separate from one another?

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[19] http://www.cde.ca.gov/ci/ma/cf/documents/aug2013calculus.pdf

[20] http://www.fldoe.org/pdf/mathfs.pdf

- **Focus: have choices been made about what is most important for students to learn?**
    - Do Indiana's draft 2014 Calculus Standards establish priorities about the concepts and skills that should be acquired in a high school calculus course?
    - Are these priorities consistent with the California/Florida Calculus Standards?
    - Is the set of Indiana draft 2014 Calculus Standards manageable? Or do they seem to contain too much material for students to learn in a high school 1-year course?

- **Specificity: are the standards specific enough to convey the level of performance expected of students?**
    - Do Indiana's draft 2014 Calculus Standards provide sufficient detail to convey the level of performance expected without being overly prescriptive?
    - Do they maintain a relatively consistent level of precision ("grain size") throughout?

- **Clarity/Accessibility: are the standards clearly written and presented in a logical, easy-to-use format?**
    - Are Indiana's draft 2014 Calculus Standards written in a straightforward, functional format?
    - Are Indiana's draft 2014 Calculus Standards communicated in language that can gain widespread acceptance? Or are they inaccessible due to overreliance on jargon that might be unfamiliar to outside readers?

- **Measurability: is each standard measurable, observable or verifiable in some way?**
    - In general, do Indiana's draft 2014 Calculus Standards focus on the results, rather than the processes of teaching and learning?
    - Where possible, do Indiana's draft 2014 Calculus Standards use performance verbs that call for students to demonstrate knowledge and skills and avoid using those that refer to learning activities, such as examine and explore, or to cognitive processes, such as know, and appreciate?

Rigor

Indiana's draft 2014 Calculus Standards are almost identical to Florida's, with a few exceptions as follows: Indiana's draft 2014 Calculus Standards 13, 16, 17, 41, 43, 49 and 50 are mathematically identical, respectively, to Florida's MA.912.C.2.1, MA.912.C.3.2, MA.912.C.3.1, MA.912.C.4.6, MA.912.C.4.8, MA.912.C.5.7 and MA.912.C.5.8 albeit written with slightly modified language. Indiana's draft 2014 calculus standard 29 does not appear among Florida's standards but it may be considered subsumed Florida's MA.912.C.3.3 and MA.912.C.3.6 (Indiana's 28 and 30).

Florida's MA.912.C.1.8, "Find special limits such as lim (sin x/x) as x→0" (that is also equivalent to California's 1.3), does not appear among Indiana's 2014 draft Calculus Standards. This is an important gap in Indiana's 2014 draft Calculus Standards since they do include derivatives of trigonometric functions (standard 19) that depend on such special limits in an essential way. The only other Florida calculus standard that does not appear in Indiana's is MA.912.C.5.4, "Use slope fields to display a graphic representation of the solution to a differential equation and locate particular solutions to the

equation." This is not an essential standard but it does have deep connections with Indiana's 2014 draft Calculus Standards 44 and 45 and would complement those well if included.

California's Calculus Standards are aligned with the content of AP Calculus BC, that is the typical two-semester sequence of science/engineering college calculus. This is not the scope of Indiana's draft 2014 Calculus Standards and, therefore, important gaps exist between the two. The most important ones are two groups of California Calculus Standards: (i) 18.0 to 22.0, concerned with inverse trigonometric functions, integration of trigonometric and rational functions, Newton's method for finding zeros of a function, Simpson's rule for approximating definite integrals, and improper integrals; (ii) 23.0 to 26.0, focused on convergence of sequences and series, power series and their derivatives and integrals, and Taylor polynomials and series. Just as important gaps in Indiana's 2014 draft Calculus Standards are the part of California's standard 8.0 concerning L'Hôpital's rule, and that of standard 17.0 about integration by parts.

There are some instances of Indiana's 2014 draft Calculus Standards including elements not present in California's: 1, "Find the types of discontinuities of a function;" 8, "Find limits by substitution;" 25, "Find derivatives using logarithmic differentiation;" 41, "Understand and use these properties of definite integrals;" and 48, "Use definite integrals to find the average value of a function over a closed interval." Four of these standards (1, 8, 41 and 48) are quite important and it is good that Indiana chose to include them. Logarithmic differentiation is less important and could be left out to replace it by one or more of core standards that are missing (e.g., special limits).

There are several Indiana 2014 draft Calculus Standards that are less rigorous than the corresponding ones in California. For example, standards 5, 6, 7, and 10 are procedural, while the corresponding California standard 1.0—"Students demonstrate knowledge of both the formal definition and the graphical interpretation of limit of values of functions. This knowledge includes one-sided limits, infinite limits, and limits at infinity. Students know the definition of convergence and divergence of a function as the domain variable approaches either a number or infinity"—is quite conceptual. The same observation applies to Indiana's standards 19-22 when compared to the corresponding California standards 4.4, 5.0, and 6.0. This difference is even more evident in Indiana standard 9, which requires students to *find* limits, while California expects that students not only use theorems about limits of sums, differences, products and quotients, but also *prove* those, as well as the corresponding one for composition of functions that is conceptually more complex. Similarly, in Indiana 2014 draft calculus standard 3, students are expected to understand the concept of limit, while California's standard 1.0 also requires that they demonstrate knowledge of the formal definition of limit. Indiana's standards 38 and 39, albeit conceptual, do not rise to the cognitive level of the corresponding standards from California that require knowledge of the definition of definite integrals as limits of Riemann sums, as well as the proof of the fundamental theorem of calculus.

In some instances Indiana's 2014 draft Calculus Standards are more rigorous than the corresponding ones from California. For example, Indiana's standard 16 explicitly talks of local linear approximations that may or may not be implicit in California's 4.1. Similarly, Indiana standards 34 and 44 talk about velocity and acceleration as derivatives and as definite integrals, while California only has standard 16.0 in correspondence to the latter but nothing explicitly equivalent to the former. Also, Indiana standard 43 contains the Trapezoidal Rule to approximate definite integrals—absent in California's standards.

Three Indiana draft 2014 Calculus Standards need some linguistic correction or restatement: standard 23 should specify "Find derivatives of inverse functions" instead of "Find derivatives as inverse

functions," and standard 50 should read "Apply integration to model and solve problems in physics, biology, economics, etc., using the integral of a rate of change to give accumulated change …" instead of "Apply integration to model and solve problems in physics, biology, economics, etc., using the integral as a rate of change to give accumulated change …" in order that the statements say what is really meant and mathematically correctly. Similarly, Indiana standard 17 should not read "Find the slope of a curve at a point at which there are no tangents," since such points on a curve do not have slopes associated with them.

Coherence

Indiana's 2014 draft Calculus Standards spread over four broad content areas: limits and continuity, derivatives and applications, integrals and applications, separable differential equations and applications. These constitute a meaningful structure for calculus, though the order in which the standards appear do not suggest a logical progression. In particular, standards 1, 2, and 4 should appear after standards 3 and 5-10, since the latter are concerned with limits while the former deal with continuity – a concept that relies on an understanding of limits. Similarly, standards 44, 45, and 46 would be better placed after standards 47-50 since their content area, solution of differential equations, is based on integration – the content area of the latter.

These standards are written to specifically reveal the deep connections across these areas, as exemplified by standard 26, "Understand and use the relationship between differentiability and continuity," and standard 33, "Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration." These standards both stress the intimate relation between the first two areas, just as standard 50, "Apply integration to model and solve problems in physics, biology, economics, etc., using the integral of a rate of change to give accumulated change and using the method of setting up an approximating Riemann Sum and representing its limit as a definite integral," shows the connections between the second and third.

Standard 2 naturally precedes standard 1 since, by definition, the points of discontinuity are found as those where continuity does not exist. Their order should be reversed.

Focus

The Indiana draft 2014 Calculus Standards are too few for a yearlong high school course, and likely too many for one semester.

Indiana's draft 2014 Calculus Standards include those in a traditional first-semester college calculus course, with a few added topics in differential equations that are not frequently found in such college courses. They have little focus on proofs and conceptual understanding but rather seem overly focused on helping students develop procedural skills. The majority of students who acquire these skills upon graduation from high school should be well prepared for a second-semester college calculus course, as well as for demanding jobs with good growth potential. These expectations, however, are not reasonable for every student nor are within the cognitive reach of all students. The majority of high school students will likely not be ready to understand the mathematics in these standards.

The priorities established in these standards are consistent with those in Florida, with one exception mentioned earlier (i.e., not including special limits used in the derivation of the derivatives of the sine and cosine functions). They are also aligned with California's standards 1.0-9.0, 11.0-17.0, and 27.0 but

are not aligned at all with California's standard 10.0, "Students know Newton's method for approximating the zeros of a function," and standards 18.0-26.0 concerned with techniques and applications of integration, and with numerical and power series and their convergence.
It is worth pointing out that some standards could be omitted without detriment to the rest of the standards or their understanding. Specifically standard 27*, "*Understand and apply the Mean Value Theorem," may not be worth including.

Specificity

Indiana's draft 2014 Calculus Standards do mostly convey the expected level of performance expected of students, with a few important exceptions concerning content areas or skills that often make students struggle.

In particular, the broadly stated standards 32, "Solve optimization problems," and 35, "Model rates of change, including related rates problems," can be assessed at many different cognitive levels and the Indiana draft 2014 Calculus Standards make no attempt to set those. Even though it is difficult to balance the level of detail appropriate in the standards lest they become overly prescriptive, for these particular ones it is worth being more specific about the types of applications intended—that should include some requiring higher cognitive skills than the procedural problems that are frequently offered as examples do (e.g., "Find dy/dt given that $x^2 + y^2 = 7$ and dx/dt = 4").

The grain size of the standards is consistent throughout the Indiana draft 2014 Calculus Standards, with a few noteworthy exceptions: standard 46 is completely contained in standard 45; the necessary theory is the solution of separable equations, while the most common modeling applications that standard 46 requires are the growth and decay problems that standard 45 focuses on. Similarly, standard 38, "Interpret a definite integral as a limit of Riemann Sums," is subsumed in standard 43, "Understand and use Riemann Sums, the Trapezoidal Rule, and technology to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values."

Clarity/Accessibility

Indiana's draft 2014 Calculus Standards are mostly clearly written in appropriate language containing the technical terms necessary to describe the relevant concept or skill with precision but without over-reliance on them.

They are presented in a functional format that responds to a common order and division of content. Most exceptions are noted under "Rigor" as the three standards needing corrections for clarity and precision. In particular, standard 17 as stated is not clear with respect to the expectation in the case of no tangent line; the wording should be "Find the slope of a curve at a point, including points at which there are vertical tangent lines, and understand that there is no defined slope at a point at which there is no tangent line." Also, standard 1 could be worded more clearly, for example, as "Find the points at which a given function is discontinuous and the type of discontinuity."

Measurability

Indiana's 2014 draft Calculus Standards are readily measurable because they focus on the results of the teaching-learning process rather than on the process itself.

They are defined by performance verbs that call for students to demonstrate knowledge and skills and all of them avoid using those that refer to learning activities, such as *examine* and *explore*, or to cognitive processes, such as *know*, and *appreciate*.

Appendix B:
The Criteria Used for the Evaluation of
College- and Career-Ready Standards in English Language Arts and Mathematics

Criteria	Description
Rigor—What is the intellectual demand of the standards?	Rigor is the quintessential hallmark of exemplary standards. It is the measure of how closely a set of standards represents the content and cognitive demand necessary for students to succeed in credit-bearing college courses without remediation and in entry-level, quality high-growth jobs. For Achieve's purposes, the Common Core State Standards represent the appropriate threshold of rigor.
Coherence—Do the standards convey a unified vision of the discipline, do they establish connections among the major areas of study, and do they show a meaningful progression of content across the grades?	The way in which a state's College and Career- Ready Standards are categorized and broken out into supporting strands should reflect a coherent structure of the discipline and/or reveal significant relationships among the strands and how the study of one complements the study of another. If College and Career-Ready Standards suggest a progression, that progression should be meaningful and appropriate across the grades or grade spans.
Focus—Have choices been made about what is most important for students to learn, and is the amount of content manageable?	High quality standards establish priorities about the concepts and skills that should be acquired by graduation from high school. Choices should be based on the knowledge and skills essential for students to succeed in postsecondary education and the world of work. For example, in mathematics choices should exhibit an appropriate balance of conceptual understanding, procedural knowledge and problem solving skills, with an emphasis on application, and in English standards should reflect an appropriate balance between literature and other important areas such as informational text, oral communication, logic, and research. A sharpened focus also helps ensure that the cumulative knowledge and skills students are expected to learn is manageable.
Specificity—Are the standards specific enough to convey the level of performance expected of students?	Quality standards are precise and provide sufficient detail to convey the level of performance expected without being overly prescriptive. Standards that maintain a relatively consistent level of precision ("grain size") are easier to understand and use. Those that are overly broad or vague leave too much open to interpretation, increasing the likelihood that students will be held to different levels of performance, while atomistic standards encourage a checklist approach to teaching and learning that undermines students' overall understanding of the discipline. Also, standards that contain multiple expectations may be hard to translate into specific performances.
Clarity/Accessibility—Are the standards clearly written and presented in an error free, legible, easy-to-use format that is accessible to the general public?	Clarity requires more than just plain and jargon-free prose, which is free of errors. The College and Career- Ready Standards also must be communicated in language that can gain widespread acceptance not only by postsecondary faculty but also by employers, teachers, parents, school boards, legislators and others who have a stake in schooling. A straightforward, functional format facilitates user access.
Measurability—Is each standard measurable, observable, or verifiable in some way?	In general, standards should focus on the results, rather than the processes of teaching and learning. The College and Career- Ready Standards should make use of performance verbs that call for students to demonstrate knowledge and skills and should avoid using those that refer to learning activities, such as examine, investigate, and explore, or to cognitive processes, such as appreciate.

Appendix C:
List of Standards Documents Consulted for Review of Indiana's Draft 2014 K-12 Content Standards for Colleges and Career Readiness in Mathematics and English Language Arts

To evaluate the rigor, coherence, focus, specificity, clarity/accessibility, and measurability of the standards, Achieve reviewers considered the following documents:

- Draft Indiana K-12 Content Standards for College and Career Readiness in Mathematics and English Language Arts (revised March 2014)
- Common Core State Standards (2010)
- Indiana Academic Standards in Mathematics (2009)
- Indiana Academic Standards in English Language Arts (2006)
- The American Diploma Project Benchmarks in Mathematics and English Language Arts (2006)
- California's Calculus Standards (1997/2010)
- MAFS: Mathematics Florida Calculus Standards (2014)

Appendix D:
List of Achieve Reports Regarding Indiana Standards, Assessments, and Related Reforms

Aligning High School Graduation Requirements with the Real World: A Road Map for States. (2007). http://www.achieve.org/aligning-high-school-graduation-requirements-real-world-road-map-states

American Diploma Project Algebra II End-Of-Course Exam: 2008 Annual Report. (2008). http://www.achieve.org/2008ADPAnnualReport

American Diploma Project (ADP) End-of-Course Exams: 2009 Annual Report. (2009). http://www.achieve.org/2009ADPAnnualReport

Measuring Up: A Report on Education Standards and Assessments for Indiana. (1999). http://www.achieve.org/measuring-report-education-standards-and-assessments-indiana

Moving Indiana Forward; High Standards and High Graduation Rates. (2006). http://www.achieve.org/files/Indiana-report.pdf

Out of Many, One: Toward Rigorous Common Core Standards From the Ground Up. (2008). http://www.achieve.org/OutofManyOne

Ready or Not: Creating a High School Diploma That Counts. (2004). http://www.achieve.org/ReadyorNot

Setting the Bar: An Evaluation of ISTEP+ Assessments for Indiana. (2003). http://www.achieve.org/setting-bar-evaluation-istep-assessments-indiana

Taking Root: Indiana's Lessons for Sustaining the College- and Career-Ready Agenda. (2009). http://www.achieve.org/Indiana-SustainabilityCaseStudy

Taking Root: Lessons Learned for Sustaining the College- and Career-Ready Agenda. (2009). http://www.achieve.org/TakingRoot-LessonsLearned

Appendix E:
Acknowledgements

This analysis was the result of a collaborative team effort. We are grateful for the contributions and expertise of JoAnne Eresh and Kaye Forgione, who provided the analysis and led teams of content experts in reviewing the English Language Arts and Mathematics Standards, respectively. The content experts in English language arts were Jerome Halpern and Elizabeth Haydel. In mathematics, this included Mary Lynn Raith. We are grateful to Fabio Milner for analyzing the Calculus Standards. Special thanks to William Schmidt for providing an analysis of the major mathematics topics included in the proposed standards. Alissa Peltzman (Vice President of State Policy and Implementation Support) provided overall project management. Additional thanks to Sandy Boyd (Chief Operating Officer and Senior Vice President of Strategic Initiatives), Chad Colby (Director of Strategic Communications and Outreach), Marie O'Hara (Associate Director for State Policy and Implementation Support), and Jenny Taylor (Policy Associate for State Policy and Implementation Support) for their contributions.

Michael Cohen

President

Achieve

SUMMARY OF NATIONAL EVALUATOR INPUT INTO DRAFT #2 OF THE INDIANA ACADEMIC STANDARDS, VERSION DATED MARCH 14, 2014

On February 13-14, 2014, the academic standards Evaluation Panels met during a public meeting to complete a blind evaluation of standards that best aligned with college and career ready learning outcomes. This resulted in a draft set of academic standards, labeled “Draft #1”, which was posted for public comment from February 19 through March 12. Six independent evaluators were also invited to provide feedback on Draft #1, and four agreed to do so. These individuals are:

- Dr. James Milgram, Ph.D., Stanford University
- Dr. Shauna Findlay, Ph.D., Indiana ASCD
- Ms. Janet Rummel, Indiana Network of Independent Schools
- Ms. Kathleen Porter-Magee, Fordham Institute

Following the close of the public comment period on Draft #1, the Standards Leadership Development Team and Indiana Department of Education content specialists incorporated the feedback from independent evaluators and the public comments into a second draft of the standards, labeled “Draft #2” and dated March 14, 2014. Draft #2 was distributed to six national evaluators, who were invited to provide feedback on Draft #2. These evaluators are:

- Dr. Sandra Stotsky – E/LA
- Dr. Terrence Moore, Hillsdale College – E/LA
- Joanne Eresh (Achieve) – E/LA
- Dr. James Milgram (Stanford University) – Math
- Professor Hung-Hsi Wu (UC Berkeley) – Math
- Kaye Forgione (Achieve) – Math

The attached document contains the evaluator reports on Draft #2. Full reports were submitted by April 1, 2014, and were used to inform the work of the Indiana College & Career Ready Panel.

It is important to note that the evaluators provided their feedback on Draft #2, and were not asked to provide input on the final proposed 2014 Indiana Academic Standards released to the public on April 15, 2014. By design, it was the Indiana College & Career Ready Panel that was responsible for assessing all independent evaluator input and determining how this input would be reflected in Indiana’s new standards.

We are grateful to the national evaluators for their time and effort. Their input was invaluable to the development of Indiana’s new academic standards, and their feedback is reflected throughout the version released to the public on April 15, 2014.

SUMMARY OF ANALYSIS ON INDIANA'S DRAFT OF MATHEMATICS STANDARDS, VERSION DATED 3/14/2014

Submitted by James Milgram, Ph.D., Professor of Mathematics, Stanford University

At the invitation of Indiana Governor Mike Pence's Center for Education & Career Innovation and the State Board of Education, I completed an in-depth analysis of a draft set of K-12 mathematics standards developed by a team of Indiana educators. Below is a summary of the analysis I provided to the Center on March 24, 2014.

Summary Assessment

The draft standards that I reviewed represent an improvement over Indiana's current standards, the Common Core State Standards, in that the draft covers most but far from all of the fundamental K-12 mathematics that students have to learn.

The level of Indiana's current standards is far too low to prepare students for success in non-remedial mathematics courses at any of Indiana's public four year colleges and universities. So the fact that the new draft contains standards for the rest of the high school math curriculum, including trigonometry, probability, pre-calculus and calculus, is very welcome indeed.

Overall, I would judge that the new draft has "good bones," but it requires major revisions in every grade to make it first rate (and as a Hoosier, born and raised in Indiana, I would really like to see Indiana have truly international level math standards).

In all grades from K-12, the draft includes too many individual standards that are extremely difficult to parse and understand, including, as they often do, a combination of standards, sub-standards, and often questionable directions for pedagogy all mushed together.

For example, consider the following monstrosity in the draft standards (the first standard from "Computation and Algebraic Thinking" in grade 1, cut and pasted from the current Indiana Core Standards):

> Demonstrate fluency with addition facts and the corresponding subtraction facts within 20. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). Understand the role of 0 in addition and subtraction.

Standards like this -- really an indigestible melange of 8 separate things, some of them even instructions for *non-research based* pedagogy --create a document that is very hard to understand, particularly for ordinary humans without PhD's in mathematics. Such standards occur throughout the draft. Besides being incomprehensible, they hide the actual numbers of standards in each grade. At first glance, there appear to be only 22 first grade standards, but when parsed out the number is much, much greater, well over 50 in first grade alone, and even more in each of grades two - twelve.

The draft needs to be gone over, line by line, by an actual research mathematician or even a team of them, and cut down to the point where the content is much more like the extremely tight and organized standards that we find in the high achieving countries.

Indiana's standards writers should focus their efforts on separating out the key standards from the extraneous standards and pedagogy as they revise the draft (and I've tried to indicate how one could do this in my detailed review). This would enable Indiana's K-12 teachers to focus their classroom instruction on only those few key topics that actually matter – exactly as is done in the high achieving countries where the standards are not "a mile wide and an inch deep."

Perhaps the thing to keep in mind is the main refrain from Tom Lehrer's famous (at least among actual mathematicians) put down of the new math:

> "Hooray for new math,
> New-hoo-hoo-math,
> It won't do you a bit of good to review math.
> It's so simple,
> So very simple,
> That only a child can do it!"

Way too much of the material in the current Indiana standards and still too much in the new draft is the new math in spades. I would imagine that most of you are too old to remember that disastrous experiment, but it began the decline in our math outcomes that has continued for the last 50 years.

The current draft standards gives you the opportunity to start reversing this mess. It represents a real start in that direction, but without extensive revision and, above all, trimming and focusing, it won't get you there.

Respectfully submitted,
R. James Milgram

APPENDIX:

To give you a further idea of the kinds of modifications I am proposing here are some of my comments on the high school level draft standards.

ALGEBRA 1:

Some Missing standards: Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents. Understand the concept of slope of a line, find the x and y intercepts of the graph of $y = ax + b$, and determine the slope. Apply algebraic techniques to solve rate problems, work problems and mixture problems.

GEOMETRY:

Much to my surprise, except for the fact that there are too many standards, the standards here seem entirely reasonable, and a huge and very welcome change from the Core Geometry Standards which are currently a major problem. They have essentially no research underlying them and the one time they were even tried on a large scale (in the old USSR) they were very quickly dropped. As is the case throughout the draft, there should be about half as many standards as there currently are, in the neighborhood of 25.

ALGEBRA 2:

Missing standards: specific examples of factorizations particularly the sum or differences of two cubes and the differences of 2 n^{th} powers $x^n – y^n$. Also, plot complex numbers in the plane. Divide complex numbers where the denominator is non-zero. Evaluate rational expressions for selected values of the variable. Determine how the graph of a quadratic function $ax^2 + bx +c$ changes for changes in the constants, a, b, and c. The same for quadratic functions of two variables: $ax^2 + by^2 + cxy + dx + ey + f$.

For logarithms and exponentials students need to know how to evaluate these functions for different bases, e.g. $\log_a(x +1)$ is related to $\log_b(x + 1)$ in what way? Using properties of logarithms students simplify logarithmic expressions and determine their approximate values. Apply the principles of mathematical induction to prove general statements about whole numbers.

TRIGONOMETRY:

Currently, these are not standards for a strong trig course. To begin, there should be standards recalling and studying the definitions of not only the sine and cosine function, but also tan, cotan, and perhaps even sec, and csc. For example, students should know that if T is the angle a straight line makes with the x-axis, then tan(T) is the slope of this line. There should be a large number of indications of the applications to things like finding distances on the surface of a sphere – for example, using the distance from the observer to the horizon to measure the radius of the sphere. There should be standards concerned with graphing functions of the form sin(Ax + B) and cos(Ax + B), and a discussion of frequency, period and magnitude for functions of the form Rsin(Ax + B) + Scos(Ax + B). There should be at least some discussion of the inverse trig functions, arcsin, arccos, arctan, and students should know how to graph them and why the domain of the inverse function should be restricted. Finally, there should be standards on polar coordinates and translating between rectangular and polar coordinates though this last could also occur in pre-calculus.

PRE-CALCULUS:

All in all, this is a weak set of pre-calculus standards. There seems to be no mention of the fundamental theorem of algebra and how it helps students graph functions. There is no tie in to complex numbers, and no discussion of the crucial subject of conic sections. There is no discussion of the basic proof technique of mathematical induction. There is no discussion of rational functions and the properties of their graphs (roots, poles, asymptotic behavior, etc.) There is no discussion of parametric functions and equations. There is no discussion of limits.

K-5 MATHEMATICS PROCESS STANDARDS

Content Area	Number	Content Area Topic
Mathematics	1	Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” and "Is my answer reasonable?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
Mathematics	2	Reason abstractly and quantitatively. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
Mathematics	3	Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies and use various methods of proof. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematics	4	Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
Mathematics	5	Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Regarding technology, students use it strategically as a tool to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving. Note: Elementary students must learn how to fluently perform the basic arithmetic operations independent of the use of a calculator.
Mathematics	6	Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions including correct mathematical language in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
Mathematics	7	Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x^2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)^2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Mathematics	8	Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x^2 + x + 1), and (x – 1)(x^3 + x^2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

MATHEMATICS: KINDERGARTEN

Content Area	Grade Level/Span	Strand	Number	Content Area Topic	
Mathematics	K	Number Sense	1	Count to 100 by ones and by tens and count on by one from any given number.	
Mathematics	K	Number Sense	2	Write numbers from 0 to 20 and recognize number words from 0 to 10. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).	This is purely a reading standard, having nothing to do with mathematics.
Mathematics	K	Number Sense	3	Find the number that is one more than or one less than any whole number up to 20.	ok, but should have a substandard "recognize that the number one less is smaller and the number one more is bigger."
Mathematics	K	Number Sense	4	When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.	This is purely a vocabulary standard. Nothing wrong with it, just don't try to convince teachers that when they teach this, they are teaching "mathematics."
Mathematics	K	Number Sense	5	Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.	ok, but this is just a "naming" standard – know the names of ..." It is not mathematics
Mathematics	K	Number Sense	6	Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.	Should be paired with the standard on line 6.
Mathematics	K	Number Sense	7	Compare two numbers between 1 and 20 presented as written numerals.	Be more specific about what you mean by compare. If it is greater, less than or equal, the it should be paired with the standard above.
Mathematics	K	Number Sense	8	Use correctly the words for comparison: one and many; none, some and all; more and less; most and least; and equal to, more than and less than.	ok. But it is really an English standard.
Mathematics	K	Number Sense	9	Separate sets of ten or fewer objects into equal groups.	ok. But it may not always be possible. Do you want to e.g. separate 9 elements into two equal groups for example.
Mathematics	K	Number Sense	10	Develop initial understandings of place value and the base 10 number system by showing equivalent forms of whole numbers from 10 to 20 as groups of tens and ones using objects and diagrams.	This is possibly a first grade standard.
Mathematics	K	Computation and Algebraic Thinking	1	Add and subtract within 10, e.g., by using objects or drawings to represent the problem.	Rephrase: Add and subtract within 10. (Memorization is not required, objects or drawing can be used to represent the problem.)
Mathematics	K	Computation and Algebraic Thinking	2	Solve contextual word problems that involve addition and subtraction within 10, e.g., by using objects or drawings to represent the problem.	Substandard of the above rephrased standard.
Mathematics	K	Computation and Algebraic Thinking	3	Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1). *[In Kindergarten, students should see equations and be encouraged to write them, however, writing equations is not required.]*	Substandard of the standard in line 15.
Mathematics	K	Computation and Algebraic Thinking	4	For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.	Substandard of standard in line 15
Mathematics	K	Computation and Algebraic Thinking	5	Compose and decompose numbers from 11 to 19 into a group of ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (such as 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.	The key standard here is "Compose and decompose numbers between 11 and 19 into at ten and an appropriate number of ones." There is a possible substandard: Understand that demonstrate that these numbers are composed of ten ones, and one, two, three, four, five, six, seven, eight, or nine ones. The remainder is pedagogy and almost certainly should be deleted.
Mathematics	K	Computation and Algebraic Thinking	6	Create, extend, and give the rule for simple patterns with numbers and shapes.	Limit this by including examples to show what is expected. As stated it is far to vague to be useful.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic	
Mathematics	K	Geometry	1	Identify the positions of objects and geometric shapes in space and use the terms inside, outside, between, above, below, near, far, under, over, up, down, behind, in front of, next to, to the left of and to the right of.	ok
Mathematics	K	Geometry	2	Compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).	ok
Mathematics	K	Geometry	3	Model shapes in the world by composing shapes from objects (e.g., sticks and clay balls) and drawing shapes.	I don't understand the standard as written. At a minimum give examples.
Mathematics	K	Geometry	4	Compose simple geometric shapes to form larger shapes. For example, create a rectangle composed of two triangles.	There need to be further limits placed on this standard.
Mathematics	K	Measurement	1	Make direct comparisons of the length, capacity, weight, and temperature of objects and recognize which object is shorter, longer, taller, lighter, heavier, warmer, cooler, or holds more.	ok
Mathematics	K	Measurement	2	Understand concepts of time: morning, afternoon, evening, today, yesterday, tomorrow, day, week, month, and year. Understand that clocks and calendars are tools that measure time.	There should be a better idea of what is required here. What kinds of questions would be appropriate to test this standard?
Mathematics	K	Data Analysis	1	Identify, sort, and classify objects by size, number, and other attributes. Identify objects that do not belong to a particular group and explain the reasoning used.	ok, but examples would be very helpful.

MATHEMATICS: FIRST GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	1	Number Sense	1	Count to 120 by ones, fives and tens, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	ok. But the second sentence has nothing to do with mathematics and everything to do with reading.		
Mathematics	1	Number Sense	2	Understand that 10 can be thought of as a group of ten ones — called a "ten"; that the numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones; and that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).	ok but parse as at least 2 standards which should be substandards of the standard above.		
Mathematics	1	Number Sense	3	Show equivalent forms of whole numbers as groups of tens and ones and understand that the individual digits of a two-digit number represent amounts of tens and ones.	two further substandards of the key standard for line 4.		
Mathematics	1	Number Sense	4	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	ok. But this is another substandard of the standard for line 4.		
Mathematics	1	Number Sense	5	Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	This is a new key standard.		
Mathematics	1	Number Sense	6	Match the ordinal numbers first, second, third, etc., with an ordered set up to 10 items.	this is reading, not mathematics, sort of "monkey see, monkey do."		
Mathematics	1	Computation and Algebraic Thinking	1	Demonstrate fluency with addition facts and the corresponding subtraction facts within 20. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). Understand the role of 0 in addition and subtraction.	The first sentence is a key standard. Then it contains five substandards, and list them as such.		
Mathematics	1	Computation and Algebraic Thinking	2	Solve contextual word problems involving addition and subtraction within 20 in situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all parts of the addition or subtraction problem, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	Substandards of the key standard above. But delete the pedagogy as was explicitly done with the virtually identical second grade standard.		
Mathematics	1	Computation and Algebraic Thinking	3	Create a contextual word problem to represent a given equation involving addition and subtraction within 20.	Substandard of the key standard above.		
Mathematics	1	Computation and Algebraic Thinking	4	Solve contextual word problems that call for addition of three whole numbers whose sum is within 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	Substandard of the key standard above.		
Mathematics	1	Computation and Algebraic Thinking	5	Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2	The first phrase is a key standard. Parse the rest into two substandards.	Understand the meaning of the equal sign.	
							determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2
Mathematics	1	Computation and Algebraic Thinking	6	Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; describe the strategy and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	Probably this indicates that one should change the bound of the key standard in line 11 to 100 from 20. Then the rest of this standard becomes 4 substandards.		
Mathematics	1	Computation and Algebraic Thinking	7	Create, extend, and give the rule for number patterns using addition (patterns should not go beyond 100).	See the comment on the virtually identical standard in grade 2.		
Mathematics	1	Geometry	1	Identify objects as two-dimensional or three-dimensional. Identify two-dimensional shapes as the faces of three-dimenstional objects.	As stated this is too much for first grade students. Bound the kinds of shapes to cubes and rectangular prisms. Also resstrict the two dimensional figures to rectangles and triangles.		
Mathematics	1	Geometry	2	Classify and sort two-dimensional and three-dimensional objects by position, shape, size, roundness, and other attributes.	ok		
Mathematics	1	Geometry	3	Distinguish between defining attributes of two- and three-dimensional shapes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); create and draw two-dimensional shapes to possess defining attributes.	Probably too much for first grade. If you think otherwise, then you should indicate the research that supports putting this standard here.		
Mathematics	1	Geometry	4	Use two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. *[Students do not need to learn formal names such as "right rectangular prism."]*	Too many figures, but otherwise a good standard.		
Mathematics	1	Geometry	5	Partition circles and rectangles into two and four equal parts, describe the parts using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the parts. Understand for these examples that decomposing into more equal parts creates smaller parts.	See my comments on the similar standards in grades 2 and three.		
Mathematics	1	Measurement	1	Compare and order objects according to length, area, capacity, weight, and temperature, using direct comparison or a nonstandard unit.	ok		
Mathematics	1	Measurement	2	Tell and write time to the nearest half-hour and relate time to events (before/after, shorter/longer) using analog clocks.	ok		
Mathematics	1	Measurement	3	Identify and give the values of collections of pennies, nickels, and dimes.	See my remarks for the same standard in Grade 2.		
Mathematics	1	Data Analysis	1	Organize and interpret data with up to three choices (What is your favorite fruit? apples, bannanas, oranges); ask and answer questions about the total number of data points, how many in each choice, and how many more or less in one choice compared to another.			

MATHEMATICS: SECOND GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	2	Number Sense	1	Count, read, write, compare and plot whole numbers up to 1,000 on a number line.			
Mathematics	2	Number Sense	2	Count by ones, twos, fives, tens and hundreds up to 1,000.			
Mathematics	2	Number Sense	3	Match the ordinal numbers first, second, third, etc. with an ordered set up to 30 items.	This is not a mathematics standard. Delete		
Mathematics	2	Number Sense	4	Use words, models, standard form and expanded form to represent place value and to show equivalent forms of whole numbers up to 1,000 as groups of hundreds, tens and ones.	The important things here are standard form and expanded form. Words and models have nothing to do with mathematics. Delete.		
Mathematics	2	Number Sense	5	Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by placing that number of objects in two groups of the same size and recognizing that for even numbers no object will be left over and for odd numbers one object will be left over, or by pairing objects or counting them by 2s. Write an equation to express an even number as a sum of two equal addends.	I don't know what the last sentence here is trying to do except confuse. If you think otherwise, include examples of problems that illustrate it.		
Mathematics	2	Number Sense	6	Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand that 100 can be thought of as a group of ten tens — called a "hundred. Understand that the numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).	ok. But unduly complicated. Break into simpler pieces.		
Mathematics	2	Number Sense	7	Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.	ok.		
Mathematics	2	Computation and Algebraic Thinking	1	Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Use mental arithmetic to add or subtract 0, 1, 2, 3, 4, 5, or 10 with numbers less than 100. Use mental arithmetic to add 10 or 100 to a given number 100–900 and subtract 10 or 100 from a given number 100–900.	Break up into three separate standards. Only the first sentence is an important standard. The last three should be substandards of appropriate important standards.	Fluently add and subtract within 1000 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	
							Use mental arithmetic to add or subtract 0, 1, 2, 3, 4, 5, or 10 with numbers less than 100.
							Use mental arithmetic to add 10 or 100 to a given number 100–900.
							Use mental arithmetic to subtract 10 or 100 from a given number 100–900.
Mathematics	2	Computation and Algebraic Thinking	2	Solve contextual word problems involving addition and subtraction within 100 in situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all parts of the addition or subtraction problem, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. Use estimation to decide whether answers are reasonable in addition problems.	Much of this standard is pedagogy, and should not pollute the standards. Decompose as follows:		
							Solve contextual word problems involving addition and subtraction within 100
							Such problems should have unknowns in all parts of the addition or subtraction problem.
							Use drawings and equations with a symbol for the unknown number to represent the problem.
							Use estimation to decide whether answers are reasonable in addition problems.
Mathematics	2	Computation and Algebraic Thinking	3	Solve contextual word problems involving addition and subtraction within 100 in situations involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.	A single substandard as follows. Note that much of this standard is pedagogy:		Solve word prblems involving addition and subtraction within 100 in situations involving lengths that are given in the same units,
Mathematics	2	Computation and Algebraic Thinking	4	Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal groups.	Frankly, I don't see the point of this standard. What IS the object. Please insert one or more examples to justify it.		
Mathematics	2	Computation and Algebraic Thinking	5	Add and subtract within 1000, using models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; describe the strategy and explain the reasoning used. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.	This standard tells me only that the main standard in line 12 should be changed to give bounds up to 1000, not the 100 that is there. So I've done this. The rest are substandards.		Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.
Mathematics	2	Computation and Algebraic Thinking	6	Show that the order in which two numbers are added (commutative property) and how the numbers are grouped in addition (associative property) will not change the sum. These properties can be used to show that numbers can be added in any order.	I complained about the imprecision of a standard virtually identical with this in third or fourth grade. Make the same changes here.		
Mathematics	2	Computation and Algebraic Thinking	7	Create, extend, and give a rule for number patterns using addition and subtraction (patterns should not go beyond 1000).	Pretty vague. Would be much better if a careful list of the kinds of patterns desired were give, as well as sample problems		
Mathematics	2	Geometry	1	Create squares, rectangles, triangles, cubes, and right rectangular prisms using appropriate materials.	Make work. Not a standard, since it gives no idea of the kind of question that would be appropriate to test this.		
Mathematics	2	Geometry	2	Identify, describe, and classify two- and three-dimensional shapes (triangle, square, rectangle, cube, right rectangular prism) according to the number and shape of faces and the number of sides and/or vertices. Draw two-dimensional shapes.	Several separate standards. Break up. Otherwise, ok		
Mathematics	2	Geometry	3	Investigate and predict the result of composing and decomposing two- and three-dimensional shapes.	What is being asked here? I don't know. What I would suggest is either deleting the "standard" or including detailed problems illustrating the kind of questions that would be appropriate to test this.		
Mathematics	2	Geometry	4	Partition a rectangle into rows and columns of same-size (unit) squares and count to find the total number of same-size squares.	I am doubtful that this is more than makework. Same comment as above.		
Mathematics	2	Geometry	5	Partition circles and rectangles into two, three, or four equal parts, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal parts of identical wholes need not have the same shape.	How do you intend that students do this division? You have to be much more explicit.		
Mathematics	2	Measurement	1	Describe the relationship among inch, foot, and yard. Describe the relationship between centimeter and meter.	ok.		
Mathematics	2	Measurement	2	Estimate and measure capacity using cups and pints.	ok.		

Content Area	Grade Level/Span	Strand	Number	Content Area Topic	
Mathematics	2	Measurement	3	Tell and write time to the nearest five minutes from analog clocks , using a.m. and p.m. Solve contextual word problems involving addition and subtraction of time intervals on the hour or half hour.	ok. Decompose into separate problems
Mathematics	2	Measurement	4	Describe relationships of time: seconds in a minute; minutes in an hour; hours in a day; days in a week; and days, weeks, and months in a year.	ok.
Mathematics	2	Measurement	5	Find the value of a collection of pennies, nickels, dimes, quarters and dollars.	ok. But there should be further information on what form the answer should take. Is it dollars and cents or what?
Mathematics	2	Measurement	6	Estimate and measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes to the nearest inch, foot, yard, centimeter and meter.	This is really two standards. Decompose.
Mathematics	2	Measurement	7	Measure the length of an object twice using length units of different lengths for the two measurements; understand that the length of the object does not change regardless of the units used and describe how the two measurements relate to the size of the unit chosen.	ok. But might be pretty sophisticated in second grade. Show research that demonstrates that this is appropriate, or move up to third or even fourth grade.
Mathematics	2	Data Analysis	1	Draw a picture graph (with single-unit scale) and a bar graph (with single-unit scale) to represent a data set with up to four choices (What is your favorite color? red, blue, yellow, green). Solve simple put-together, take-apart, and compare problems using information presented in the graphs.	
Mathematics	2	Data Analysis	2	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them. Make and evaluate predictions and inferences about the data.	

MATHEMATICS: THIRD GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	3	Number Sense	1	Count, read, write, compare and plot whole numbers up to 10,000 on a number line.
Mathematics	3	Number Sense	2	Use words, models, standard form and expanded form to represent place value and to show equivalent forms of whole numbers up to 10,000.
Mathematics	3	Number Sense	3	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b. *[In grade 3, limit denominators of fractions to 2, 3, 4, 6, 8.]*
Mathematics	3	Number Sense	4	Represent a fraction 1/b on a number line by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line.
Mathematics	3	Number Sense	5	Represent a fraction a/b on a number line by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.
Mathematics	3	Number Sense	6	Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.
Mathematics	3	Number Sense	7	Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
Mathematics	3	Number Sense	8	Compare two fractions with the same numerator or the same denominator by reasoning about their size based on the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
Mathematics	3	Number Sense	9	Use place value understanding to round 2 and 3-digit whole numbers to the nearest 10 or 100.
Mathematics	3	Computation	1	Fluently add and subtract whole numbers within 1000.
Mathematics	3	Computation	2	Represent the concept of multiplication of whole numbers with the following models: repeated addition, equal-sized groups, arrays, area models and equal "jumps" on a number line. Understand the properties of 0 and 1 in multiplication.
Mathematics	3	Computation	3	Interpret products of whole numbers, e.g., interpret 5×7 as the total number of objects in 5 groups of 7 objects each.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	3	Computation	4	Represent the concept of division of whole numbers with models as successive subtraction, partitioning, sharing and an inverse of multiplication. Understand the properties of 0 and 1 in division.
Mathematics	3	Computation	5	Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.
Mathematics	3	Computation	6	Multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 x 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations.
Mathematics	3	Computation	7	Fluently multiply two one-digit numbers.
Mathematics	3	Algebraic Thinking	1	Solve contextual word problems involving whole number multiplication and division within 100 in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
Mathematics	3	Algebraic Thinking	2	Determine the unknown whole number in a multiplication or division equation relating three whole numbers
Mathematics	3	Algebraic Thinking	3	Solve contextual word problems involving addition and subtraction of whole numbers within 1000, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
Mathematics	3	Algebraic Thinking	4	Solve two-step contextual word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
Mathematics	3	Algebraic Thinking	5	Create, extend, and give a rule for number patterns by using multiplication (patterns should not go beyond 1000).
Mathematics	3	Geometry	1	Identify, describe, and classify: cube, sphere, prism, pyramid, cone, and cylinder.
Mathematics	3	Geometry	2	Identify, describe and draw points, lines and line segments using appropriate tools (e.g., ruler and technology), and use these terms when describing two-dimensional shapes.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	3	Geometry	3	Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.
Mathematics	3	Geometry	4	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole (1/2, 1/3, 1/4, 1/6, 1/8).
Mathematics	3	Measurement	1	Find the value of any collection of coins and bills. Write amounts less than a dollar using the ¢ symbol and write larger amounts in decimal notation using the $ symbol. Use play or real money to decide whether there is enough money to make a purchase.
Mathematics	3	Measurement	2	Choose and use appropriate units and tools to estimate and measure length, weight, and temperature. Estimate and measure length to a quarter-inch, weight in pounds, and temperature in degrees Celsius and Fahrenheit.
Mathematics	3	Measurement	3	Tell and write time using an analog clock to the nearest minute and measure time intervals in minutes. Solve contextual word problems involving addition and subtraction of time intervals in minutes.
Mathematics	3	Measurement	4	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), quarts (qt), gallons (gal), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.
Mathematics	3	Measurement	5	Find the area of a rectangle with whole-number side lengths by tiling it with unit squares, and show that the area is the same as would be found by multiplying the side lengths.
Mathematics	3	Measurement	6	Multiply side lengths to find areas of rectangles with whole-number side lengths to solve contextual word and math problems, and represent whole-number products as rectangular areas in mathematical reasoning.
Mathematics	3	Measurement	7	Solve contextual word problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.
Mathematics	3	Data Analysis	1	Create scaled picture graphs, scaled bar graphs, and frequency tables to represent a data set (including data collected through observations, surveys, and experiments) with several categories. Solve one- and two-step “how many more” and “how many less” problems regarding the data and make predictions based on the data.
Mathematics	3	Data Analysis	2	Generate measurement data by measuring lengths with rulers to the nearest quarter of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.
Mathematics	3	Data Analysis	3	Interpret data displayed in a circle graph.

MATHEMATICS: FOURTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	4	Number Sense	1	Read and write multi-digit whole numbers up to 1,000,000 using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
Mathematics	4	Number Sense	2	Express whole numbers as fractions and recognize fractions that are equivalent to whole numbers. Name and write mixed numbers, using objects or pictures. Name and write mixed numbers as improper fractions, using objects or pictures.
Mathematics	4	Number Sense	3	Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. *[In grade 4, limit denominators of fractions to 2, 3, 4, 5, 6, 8, 10, 25, 100.]*
Mathematics	4	Number Sense	4	Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model
Mathematics	4	Number Sense	5	Use words, models, standard form and expanded form to represent place value of decimal numbers to hundredths.
Mathematics	4	Number Sense	6	Write tenths and hundredths in decimal and fraction notations. Know the fraction and decimal equivalents for halves and fourths (e.g., 1/2 = 0.5 = 0.50, 7/4 = 1 3/4 = 1.75).
Mathematics	4	Number Sense	7	Compare two decimals to hundredths by reasoning about their size based on the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.
Mathematics	4	Number Sense	8	Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
Mathematics	4	Number Sense	9	Use place value understanding to round multi-digit whole numbers to any given place value.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	4	Computation	1	Show that the order in which two numbers are multiplied (commutative property) and how numbers are grouped in multiplication (associative property) will not change the product. Use these properties to show that numbers can by multiplied in any order. Understand and use the distributive property.
Mathematics	4	Computation	2	Fluently add and subtract multi-digit whole numbers.
Mathematics	4	Computation	3	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Explain the calculation by using a valid mathematical method.
Mathematics	4	Computation	4	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Explain the calculation by using a valid mathematical method.
Mathematics	4	Computation	5	Add and subtract fractions with common denominators. Decompose a fraction into a sum of fractions with common denominators. Understand addition and subtraction of fractions as combining and separating parts referring to the same whole.
Mathematics	4	Computation	6	Add and subtract mixed numbers with common denominators, e.g. by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	4	Algebraic Thinking	1	Solve contextual word problems involving addition and subtraction of multi-digit whole numbers, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
Mathematics	4	Algebraic Thinking	2	Recognize and apply the relationships between addition and multiplication, between subtraction and division, and the inverse relationship between multiplication and division to solve contextual word and math problems.
Mathematics	4	Algebraic Thinking	3	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
Mathematics	4	Algebraic Thinking	4	Solve contextual word problems with whole numbers involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. Division problems do not include quotients with remainders.
Mathematics	4	Algebraic Thinking	5	Solve contextual word problems involving addition and subtraction of fractions referring to the same whole and having common denominators, e.g., by using visual fraction models and equations to represent the problem.
Mathematics	4	Algebraic Thinking	6	Understand that an equation such as y = 3x + 5 is a rule for finding a second number when a first number is given. Generate a number pattern that follows a given rule.
Mathematics	4	Geometry	1	Identify, describe, classify, and draw rays, angles (right, acute, obtuse), and perpendicular and parallel lines using a ruler or straightedge. Identify these in two-dimensional figures.
Mathematics	4	Geometry	2	Identify, describe, classify, and draw parallelograms, rhombuses, and trapezoids using a ruler or straightedge.
Mathematics	4	Geometry	3	Classify triangles and quadrilaterals based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles (right, acute, obtuse). Recognize and identify right triangles.
Mathematics	4	Geometry	4	Recognize and draw lines of symmetry in two-dimensional figures. Identify figures that have lines of symmetry.
Mathematics	4	Measurement	1	Measure length to the nearest quarter-inch, eighth-inch, and millimeter.
Mathematics	4	Measurement	2	Understand volume as a way of measuring the capacity of shapes.
Mathematics	4	Measurement	3	Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	4	Measurement	4	Use the four operations to solve contextual word problems involving distances, intervals of time, liquid volumes, masses of objects, and money. Include problems involving simple fractions and problems that require expressing measurements given in a larger unit in terms of a smaller unit.
Mathematics	4	Measurement	5	Apply the area and perimeter formulas for rectangles to solve contextual word and math problems. Recognize area as additive and find the area of complex shapes composed of rectangles by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts; apply this technique to solve contextual word and math problems.
Mathematics	4	Measurement	6	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint. Understand an angle is measured with reference to a circle with its center at the common endpoint of the rays by considering the fraction of the circular arc between the points where the two rays intersect the circle.
Mathematics	4	Measurement	7	Understand an angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles. An angle that turns through n one-degree angles is said to have an angle measure of n degrees. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
Mathematics	4	Data Analysis	1	Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Recognize the differences in representing categorical and numerical data.
Mathematics	4	Data Analysis	2	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using data displayed in line plots.

MATHEMATICS: FIFTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	5	Number Sense	1	Explain different interpretations of fractions: as parts of a whole, parts of a set, and division of whole numbers by whole numbers.
Mathematics	5	Number Sense	2	Compare and order fractions, mixed numbers, and decimals to thousandths by using >, =, and < symbols. Plot these numbers on a number line.
Mathematics	5	Number Sense	3	Identify and explain prime and composite numbers.
Mathematics	5	Number Sense	4	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
Mathematics	5	Number Sense	5	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
Mathematics	5	Number Sense	6	Use place value understanding to round decimals up to thousandths to any given place value.
Mathematics	5	Number Sense	7	Understand and interpret percents as a part of a hundred.
Mathematics	5	Computation	1	Evaluate expressions with parentheses or brackets involving whole numbers using the commutative, associative, and distributive properties.
Mathematics	5	Computation	2	Fluently multiply multi-digit whole numbers.
Mathematics	5	Computation	3	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Explain the calculation by using a valid mathematical method.
Mathematics	5	Computation	4	Add, subtract, multiply, and divide decimals to hundredths, using models or drawings and strategies based on place value or the properties of operations. Explain the calculation by using a valid mathematical method.
Mathematics	5	Computation	5	Add and subtract fractions with unlike denominators (including mixed numbers).
Mathematics	5	Computation	6	Multiply a fraction by a fraction or whole number. Use a visual fraction model to represent a fraction times a whole number.
Mathematics	5	Computation	7	Compare the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
Mathematics	5	Computation	8	Explain why multiplying a number by a fraction greater than 1 results is a product greater than the given number. Explain why multiplying a number by a fraction less than 1 results in a product smaller than the given number. Relate the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.
Mathematics	5	Computation	9	Divide a unit fraction by a non-zero whole number. Divide a whole number by a unit fraction. Use a visual fraction model to represent these calculations.
Mathematics	5	Algebraic Thinking	1	Write linear algebraic expressions in one or two variables and evaluate them for given values.
Mathematics	5	Algebraic Thinking	2	Solve contextual word problems involving multiplication and division of whole numbers, e.g. by using equations to represent the problem. In division problems that involve remainders, explain how the remainder affects the solution to the problem.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	5	Algebraic Thinking	3	Solve contextual word problems involving addition, subtraction, mutliplication, and division with decimals to hundredths (including problems that involve money in decimal notation), e.g. by using equations to represent the problem.
Mathematics	5	Algebraic Thinking	4	Solve contextual word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
Mathematics	5	Algebraic Thinking	5	Solve contextual word problems involving multiplication of fractions (including mixed numbers), e.g., by using visual fraction models or equations to represent the problem.
Mathematics	5	Algebraic Thinking	6	Solve contextual word problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem.
Mathematics	5	Algebraic Thinking	7	Graph points with whole number coordinates on a coordinate plane. Explain how the coordinates relate the point as the distance from the origin on each axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
Mathematics	5	Algebraic Thinking	8	Represent contextual word and math problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.
Mathematics	5	Algebraic Thinking	9	Generate two numerical patterns using two given rules. Identify relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.
Mathematics	5	Geometry	1	Identify, describe, classify, and draw triangles (right, acute, obtuse) and circles using a ruler or straightedge and compass. Understand the relationship between radius and diameter.
Mathematics	5	Geometry	2	Identify and classify polygons including quadrilaterals, pentagons, hexagons and triangles (i.e., equilateral, isosceles, scalene, right, acute and obtuse triangles) based on angle measures and sides. Classify polygons in a hierarchy based on properties. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.
Mathematics	5	Measurement	1	Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
Mathematics	5	Measurement	2	Develop and use formulas for the area of triangles, parallelograms and trapezoids. Solve contextual word and math problems involving perimeter and area of these shapes using appropriate units for measures.
Mathematics	5	Measurement	3	Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step contextual word problems.
Mathematics	5	Measurement	4	Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Use the associative property of multiplication to represent volumes with whole number products.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	5	Measurement	5	Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for right rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths to solve contextual word and math problems.
Mathematics	5	Measurement	6	Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve contextual word problems.

MATHEMATICS: SIXTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	6	Number Sense	1	Understand that positive and negative numbers are used to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation.
Mathematics	6	Number Sense	2	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.
Mathematics	6	Number Sense	3	Compare and order rational numbers and plot them on a number line. Write, interpret, and explain statements of order for rational numbers in real-world contexts.
Mathematics	6	Number Sense	4	Understand that the absolute value of a number is the distance from zero on a number line. Find the absolute value of real numbers and know that the distance between two numbers on the number line is the absolute value of their difference. Interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
Mathematics	6	Number Sense	5	Recognize commonly used fractions (halves, thirds, fourths, fifths, tenths) and their decimal and percent equivalents. Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator.
Mathematics	6	Number Sense	6	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
Mathematics	6	Number Sense	7	Interpret, model, and use ratios to show the relative sizes of two quantities. Use ratio language to describe a ratio relationship between two quantities. Use the notations: a/b, a to b, a:b.
Mathematics	6	Number Sense	8	Understand the concept of a unit rate and use rate language in the context of a ratio relationship.
Mathematics	6	Computation	1	Evaluate positive rational numbers with whole number exponents.
Mathematics	6	Computation	2	Compute quotients of fractions, and solve real-world problems involving division of fractions by fractions. Use a visual fraction model and/or equation to represent these calculations.
Mathematics	6	Computation	3	Apply the order of operations and the properties of real numbers (i.e., identity, inverse, commutative, associative and distributive properties) to evaluate numerical expressions with nonnegative rational numbers, including those that use grouping symbols like parentheses and involving whole number exponents. Justify each step in the process.
Mathematics	6	Computation	4	Solve one and two-step real-world problems involving addition, subtraction, multiplication and division of positive fractions and decimals.
Mathematics	6	Computation	5	Use ratio and rate reasoning to solve real-world and mathematical problems with nonnegative rational numbers, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. Some examples: unit pricing, constant speed, discounts, tax, gratuities, simple interest, conversions within and across measurement systems, and problems that involve finding the whole given a part and the percent.
Mathematics	6	Computation	6	Fluently divide multi-digit whole numbers.
Mathematics	6	Computation	7	Fluently compute with positive fractions and positive decimals.
Mathematics	6	Algebra and Functions	1	Evaluate expressions at specific values of their variables including expressions with whole-number exponents and those that arise from formulas used in real-world problems.

Mathematics	6	Algebra and Functions	2	Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions and to justify whether two linear expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).
Mathematics	6	Algebra and Functions	3	Define and use variables when writing expressions to represent real-world and mathematical problems.
Mathematics	6	Algebra and Functions	4	Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
Mathematics	6	Algebra and Functions	5	Fluently solve equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. Represent real world problems using equations of these forms and solve such problems.
Mathematics	6	Algebra and Functions	6	Write an inequality of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ to represent a constraint or condition in a real-world or mathematical problem where c is a rational number. Recognize that inequalities of these forms have infinitely many solutions and represent solutions on number line diagrams.
Mathematics	6	Algebra and Functions	7	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. Graph points with rational number coordinates on a coordinate plane.
Mathematics	6	Algebra and Functions	8	Solve real-world and mathematical problems by graphing points with rational number coordinates on a coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
Mathematics	6	Algebra and Functions	9	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane.
Mathematics	6	Algebra and Functions	10	Use variables to represent two quantities in a proportional relationship in a real-world problem; write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.
Mathematics	6	Geometry and Measurement	1	Know that the sum of the interior angles of any triangle is 180º and that the sum of the interior angles of any quadrilateral is 360º. Use this information to solve real-world and mathematical problems.
Mathematics	6	Geometry and Measurement	2	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate; apply these techniques to solve real-world and mathematical problems.
Mathematics	6	Geometry and Measurement	3	Find the area of complex shapes composed of polygons by composing or decomposing into simple shapes; apply this technique to solve real-world and mathematical problems.
Mathematics	6	Geometry and Measurement	4	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths to solve real-world and mathematical problems.
Mathematics	6	Geometry and Measurement	5	Construct right rectangular prisms from nets and use the nets to compute the surface area of prisms; apply this technique to solve real-world and mathematical problems.

Mathematics	6	Data Analysis and Statistics	1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for the variability in the answers. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center (median and/or mean), spread (range, interquartile range and/or mean absolute deviation), and overall shape.
Mathematics	6	Data Analysis and Statistics	2	Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots.
Mathematics	6	Data Analysis and Statistics	3	Formulate statistical questions, and collect, organize, display, and interpret the data using line plots, histograms, and box plots.
Mathematics	6	Data Analysis and Statistics	4	Summarize numerical data sets in relation to their context, such as by: report the number of observations; describe the nature of the attribute under investigation, including how it was measured and its units of measurement; determine quantitative measures of center (median and/or mean) and variability (range, interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

6-8 MATHEMATICS PROCESS STANDARDS

Content Area	Number	Content Area Topic
Mathematics	1	Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” and "Is my answer reasonable?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
Mathematics	2	Reason abstractly and quantitatively. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
Mathematics	3	Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies and use various methods of proof. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematics	4	Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
Mathematics	5	Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Regarding technology, students use it strategically as a tool to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving. Note: Elementary students must learn how to fluently perform the basic arithmetic operations independent of the use of a calculator.
Mathematics	6	Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions including correct mathematical language in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
Mathematics	7	Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression x^2 + 9x + 14, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)^2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Mathematics	8	Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

MATHEMATICS: FIFTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	5	Number Sense	1	Explain different interpretations of fractions: as parts of a whole, parts of a set, and division of whole numbers by whole numbers.	In fifth grade? This is lower level, and pedagogically not helpful.		
Mathematics	5	Number Sense	2	Compare and order fractions, mixed numbers, and decimals to thousandths by using >, =, and < symbols. Plot these numbers on a number line.			
Mathematics	5	Number Sense	3	Identify and explain prime and composite numbers.			
Mathematics	5	Number Sense	4	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.	Probably, learning about the expanded form would be a good idea by fifth grade.		
Mathematics	5	Number Sense	5	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	This is probably more like a fourth grade standard		
Mathematics	5	Number Sense	6	Use place value understanding to round decimals to any given place value.			
Mathematics	5	Number Sense	7	Understand and interpret percents as a part of a hundred.			
Mathematics	5	Computation	1	Evaluate expressions with parentheses or brackets involving whole numbers using the commutative, associative, and distributive properties.			
Mathematics	5	Computation	2	Fluently multiply multi-digit whole numbers.	Do you want to specify anything about the standard algorithm for multiplication.		
Mathematics	5	Computation	3	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Explain the calculation by using a valid mathematical method.	Is there some reason to not mention the standard long division algorithm? The standard as you probably intend it would be better with the last sentence deleted.		
Mathematics	5	Computation	4	Add, subtract, multiply, and divide decimals to hundredths, using models or drawings and strategies based on place value or the properties of operations. Explain the calculation by using a valid mathematical method.	This needs to be clarified particularly for division. What kinds of divisors, what kinds of dividends? For multiplication, how many non-zero places in the multiplier?		
Mathematics	5	Computation	5	Add and subtract fractions with unlike denominators (including mixed numbers).	Need to specify the types of fractions. For example, does this include fractions with denominators 7, 11, and 13?		
Mathematics	5	Computation	6	Multiply a fraction by a fraction or whole number. Use a visual fraction model to represent a fraction times a whole number.	I don't know how, at this level, a "visual fraction model" will be of any help.		
Mathematics	5	Computation	7	Compare the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.	This is confusing. Maybe it should be stated more carefully.		
Mathematics	5	Computation	8	Explain why multiplying a number by a fraction greater than 1 results is a product greater than the given number. Explain why multiplying a number by a fraction less than 1 results in a product smaller than the given number. Relate the principle of fraction equivalence a/b = (n × a)/(n × b) to the effect of multiplying a/b by 1.	ok, but probably should come earlier.		
Mathematics	5	Computation	9	Divide a unit fraction by a non-zero whole number. Divide a whole number by a unit fraction. Use a visual fraction model to represent these calculations.	This is definitely fourth grade level material.		
Mathematics	5	Algebraic Thinking	1	Write linear algebraic expressions in one or two variables and evaluate them for given values.	ok, but probably needs examples to limit the types of expressions and their complexity.		
Mathematics	5	Algebraic Thinking	2	Solve contextual word problems involving multiplication and division of whole numbers, e.g. by using equations to represent the problem. In division problems that involve remainders, explain how the remainder affects the solution to the problem.	This is confusing. What are "contextual word problems?" Would a parent be able to read and understand this standard?		
Mathematics	5	Algebraic Thinking	3	Solve contextual word problems involving addition, subtraction, mutliplication, and division with decimals to hundredths (including problems that involve money in decimal notation), e.g. by using equations to represent the problem.	see above.		
Mathematics	5	Algebraic Thinking	4	Solve contextual word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.	see above.		
Mathematics	5	Algebraic Thinking	5	Solve contextual word problems involving multiplication of fractions (including mixed numbers), e.g., by using visual fraction models or equations to represent the problem.	See above.		
Mathematics	5	Algebraic Thinking	6	Solve contextual word problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem.	See above. For all five of these standards, the terms need to be written in plain English, and they probably should all be substandards of the arithmetic standards in the previous section.		
Mathematics	5	Algebraic Thinking	7	Graph points with whole number coordinates on a coordinate plane. Explain how the coordinates relate the point as the distance from the origin on each axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	Makes little to no sense as written. Needs revision. My best guess is in Column G. I am assuming that in fifth grade only the first quadrant is being used.	Graph points with whole number coordinates in the first quadrant of the coordinate plane. Know that the coordinates give the distance between the point and the corresponding axis, (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	
Mathematics	5	Algebraic Thinking	8	Represent contextual word and math problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	Should be substandards of standard above. Also examples of the kinds of problems desired are needed		Represent word problems by graphing points in the first quadrant of the coordinate plane
							interpret coordinate values of points in the context of the situation.
Mathematics	5	Algebraic Thinking	9	Generate two numerical patterns using two given rules. Identify relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.	This is totally confusing and needs rewriting. If you were to give me some indication of the types of problems you want to see here, I would be glad to attempt to rewrite it.		
Mathematics	5	Geometry	1	Identify, describe, classify, and draw triangles (right, acute, obtuse) and circles using a ruler or straightedge and compass. Understand the relationship between radius and diameter.	Revise as follows	Identify, describe, classify, and draw triangles, polygons, and circles using a ruler or straightedge and compass.	

							Classify triangles as equilateral, isosceles, scalene, right, acute and obtuse, based on angle measures and sides.
							classify polygons including quadrilaterals, pentagons, hexagons based on the number of sides
Mathematics	5	Geometry	2	Identify and classify polygons including quadrilaterals, pentagons, hexagons and triangles (i.e., equilateral, isosceles, scalene, right, acute and obtuse triangles) based on angle measures and sides. Classify polygons in a hierarchy based on properties. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.	These are substandards.		Classify polygons in a hierarchy based on properties. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.
							Know and understand the relationship between radius and diameter.
Mathematics	5	Measurement	1	Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.	Incorrect as stated. Fix.	Find the area of a rectangle with fractional side lengths	
							Know and understand that congruent figures have the same area
							Find the area of a square A with unit fraction side length by tiling the unit squares with copies of A. Verify that if the side length is 1/n, then there are n^2 of these squares tiling the unit square, and conclude that the area of A is 1/n^2.
							Use the above substandard to verify the formula that the area of a rectangle with fractional side lengths is the product of the length and the width.
				Develop and use formulas for the area of triangles, parallelograms and trapezoids. Solve contextual word and math problems involving perimeter and area of these shapes using appropriate units for measures.			Develop and use formulas for the area of triangles, parallelograms and trapezoids.
							Solvel word problems involving perimeter and area of these shapes using appropriate units for measures.
Mathematics	5	Measurement	2	Develop and use formulas for the area of triangles, parallelograms and trapezoids. Solve contextual word and math problems involving perimeter and area of these shapes using appropriate units for measures.	should be substandards of standard above. Also examples of the kinds of problems desired are needed		
Mathematics	5	Measurement	3	Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step contextual word problems.	What is a contextual word problem? Please convert to standard English. Remember that the target should be a reasonably well educated mom, not an academic math educator. Also, sample problems are needed.		
Mathematics	5	Measurement	4	Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Use the associative property of multiplication to represent volumes with whole number products.	Write as a main standard (see column G) and a series of substandards. Remember that the target should be a reasonably well educated mom.	Find the volume of a right rectangular prism with whole-number side lengths	
Mathematics	5	Measurement	5	Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for right rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths to solve contextual word and math problems.	ok as written		
Mathematics	5	Measurement	6	Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve contextual word problems.	needs to be decomposed into a main standard (see column G) and substandards, the rest.	Know and understand that the volume of a region decomposed into two separate regions by a single line segment, is the sum of the volumes of the regions.	
Mathematics	5	Data Analysis and Statistics	1	Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Consider how data-collection methods affect the nature of the data set.	Decompose into main standard and separate substandards.		
Mathematics	5	Data Analysis and Statistics	2	Understand and use measures of center (mean and median) to represent a data set.	Revise as follows	Understand and use measures of center (mean and median) to help describe a data set.	

MATHEMATICS: SIXTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	6	Number Sense	1	Understand that positive and negative numbers are used to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation.	The main standard for the first five standard here is introduction of rational numbers. The rest should be decomposed into substandards.	Know and understand that the rational numbers consist of the positive and negative fractions together with 0 and know how to work with them.	
							Understand that positive and negative numbers are used to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge);
							Use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation.
							Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line;
							Recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.
							Compare and order rational numbers and plot them on a number line.
							Write, interpret, and explain statements of order for rational numbers in real-world contexts.
Mathematics	6	Number Sense	2	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.			
Mathematics	6	Number Sense	3	Compare and order rational numbers and plot them on a number line. Write, interpret, and explain statements of order for rational numbers in real-world contexts.			
							Understand that the absolute value of a number is the distance from zero on a number line.
							Find the absolute value of rational numbers and know that the distance between two numbers on the number line is the absolute value of their difference.
							Interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
Mathematics	6	Number Sense	4	Understand that the absolute value of a number is the distance from zero on a number line. Find the absolute value of real numbers and know that the distance between two numbers on the number line is the absolute value of their difference. Interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.			
Mathematics	6	Number Sense	5	Recognize commonly used fractions (halves, thirds, fourths, fifths, tenths) and their decimal and percent equivalents. Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator.			
							Recognize commonly used fractions (halves, thirds, fourths, fifths, tenths) and their decimal and percent equivalents.
							Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator.
Mathematics	6	Number Sense	6	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.		Know and understand that the greatest common divisor of two non-zero whole numbers is the largest positive integer that divides both numbers. Similarly the least common multiple is the smallest positive integer that is divisible by both	
							Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12.
							Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
Mathematics	6	Number Sense	7	Interpret, model, and use ratios to show the relative sizes of two quantities. Use ratio language to describe a ratio relationship between two quantities. Use the notations: a/b, a to b, a:b.	This needs somewhat extensive clarification		
Mathematics	6	Number Sense	8	Understand the concept of a unit rate and use rate language in the context of a ratio relationship.	fix		
Mathematics	6	Computation	1	Evaluate positive rational numbers with whole number exponents.	fix		
Mathematics	6	Computation	2	Compute quotients of fractions, and solve real-world problems involving division of fractions by fractions. Use a visual fraction model and/or equation to represent these calculations.	fix		
Mathematics	6	Computation	3	Apply the order of operations and the properties of real numbers (i.e., identity, inverse, commutative, associative and distributive properties) to evaluate numerical expressions with nonnegative rational numbers, including those that use grouping symbols like parentheses and involving whole number exponents. Justify each step in the process.	fix. The main standard is know and use order of operations.		
Mathematics	6	Computation	4	Solve one and two-step real-world problems involving addition, subtraction, multiplication and division of positive fractions and decimals.	This goes into the section above as a substandard of the first standard on rational numbers:		
Mathematics	6	Computation	5	Use ratio and rate reasoning to solve real-world and mathematical problems with nonnegative rational numbers, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. Some examples: unit pricing, constant speed, discounts, tax, gratuities, simple interest, conversions within and across measurement systems, and problems that involve finding the whole given a part and the percent.	This goes into the section above as substandards of the standard on line 24		
Mathematics	6	Computation	6	Fluently divide multi-digit whole numbers.	section above also specify the maximum number of digits in the divisor or specify that this number can be arbitrary.		
Mathematics	6	Computation	7	Fluently compute with positive fractions and positive decimals.	section above as a substandard of the standard on rational numbers.		

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	6	Algebra and Functions	1	Evaluate expressions at specific values of their variables including expressions with whole-number exponents and those that arise from formulas used in real-world problems.	Bound the number of variables and the size of the exponents. Give examples	Evaluate expressions at specific values of the variables they contain	
							include expressions with whole-number exponents
							Include expressions that arise from formulas used in real-world problems.
Mathematics	6	Algebra and Functions	2	Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions and to justify whether two linear expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).		Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties)	
							create equivalent linear expressions by using these operations (equivalent linear expressions are linear expressions in one or more variables that give the same value for any choices of the variables)
							justify whether two linear expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).
Mathematics	6	Algebra and Functions	3	Define and use variables when writing expressions to represent real-world and mathematical problems.	substandard of the above.		Define and use variables when writing expressions to represent real-world and mathematical problems.
Mathematics	6	Algebra and Functions	4	Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.		Know and understand that solving an equation or inequality is answering the question: which values from a specified set, if any, make the equation or inequality true?	
							Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
Mathematics	6	Algebra and Functions	5	Fluently solve equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. Represent real world problems using equations of these forms and solve such problems.			Fluently solve equations of the form $x + p = q$ and $px = q$ when p, q and x are all nonnegative rational numbers.
							Represent real world problems using equations of these forms and solve such problems.
Mathematics	6	Algebra and Functions	6	Write an inequality of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ to represent a constraint or condition in a real-world or mathematical problem where c is a rational number. Recognize that inequalities of these forms have infinitely many solutions and represent solutions on number line diagrams.		Solve systems of elementary inequalities in one variable x, each of the form $x < c$, $x \leq c$, or $d < x$, $d \leq x$	
							Know and understand that for each of these inequalities the solution set is either an open or a closed ray on the number line
							Know and understand that if x satisfies two such inequalities, either x does not exist or the solution set is a single point, an open interval, a closed interval or a half open interval
Mathematics	6	Algebra and Functions	7	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. Graph points with rational number coordinates on a coordinate plane.		Plot points in the entire coordinate plane	
							If the coordinates are both positive the point lies in the first quadrant
							if the x-coordinate is negative while the y-coordinate is negative the point lies in the second quadrant
							if both the x-coordinate and the y-coordinate are negative, the point lies in the third quadrant
							if the x-coordinate is positive while the y-coordinate is negative, the point lies in the fourth quadrant.
Mathematics	6	Algebra and Functions	8	Solve real-world and mathematical problems by graphing points with rational number coordinates on a coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.			Solve real-world and mathematical problems by graphing points with rational number coordinates on a coordinate plane
							Use coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
Mathematics	6	Algebra and Functions	9	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane.	This and the next standard belong to a new key standard. Also note that it is below international expectations. Internationally, such standards are in third and/or fourth grade.	Know and understand that ratios are objects given by ordered pairs of real numbers, not both 0, where the ratio corresponding to (a,b) is written a:b, and a:b = na:nb for every non-zero number n.	
							Alternatively any ratio can be identified with a particular line through the origin.
							Make tables of equivalent ratios relating quantities with whole-number measurements,
							Find missing values in a table of pairs for a given ratio.
							Plot the pairs of values in a given ratio on the coordinate plane and verify that they lie on a straight line through the origin.
						Know and understand that two ordered pairs of numbers (a, b) and (c, d) with at least one number in each pair non-zero are proportional if and only if a:b = c:d	
							Use variables to represent two quantities in a proportional relationship in a real-world problem;
							Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable in a proportional relationship.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
							Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation obtained above for a proportional relationship.
Mathematics	6	Algebra and Functions	10	Use variables to represent two quantities in a proportional relationship in a real-world problem; write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.	This gives a number of substandards of the key standard in row 62.		For problems involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = st where s is the speed, d is the distance traveled and t is the total time to represent the relationship between distance and time.
Mathematics	6	Geometry and Measurement	1	Know that the sum of the interior angles of any triangle is 180º and that the sum of the interior angles of any quadrilateral is 360º. Use this information to solve real-world and mathematical problems.	This standard should be expanded. And changed. The main standard should be as given in Col. G	Know, understand, and apply the fact that the sum of the interior angles of a triangle is 180 degrees.	
							Use this to verify that the sum of the interior angles of any quadrilateral is 360º. Use this information to solve real-world and mathematical problems.
							Use this information to solve real-world problems.
Mathematics	6	Geometry and Measurement	2	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate; apply these techniques to solve real-world and mathematical problems.	This should also be decomposed into a main standard and substandards.	Construct polygons in the coordinate plane from the specification of the coordinates for the vertices.	
Mathematics	6	Geometry and Measurement	3	Find the area of complex shapes composed of polygons by composing or decomposing into simple shapes; apply this technique to solve real-world and mathematical problems.	Ok as written, should be a single main standard.		
Mathematics	6	Geometry and Measurement	4	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths to solve real-world and mathematical problems.	Of course cubes with fractional edge edge length ARE NOT UNIT CUBES. The unit cube has edge length 1. So fix the confusion and break into a single main standard and a number of substandards.		
Mathematics	6	Geometry and Measurement	5	Construct right rectangular prisms from nets and use the nets to compute the surface area of prisms; apply this technique to solve real-world and mathematical problems.	There should be a main standard here referring to SURFACE AREA. Then the standard in Col E can be written as two substandards.		
Mathematics	6	Data Analysis and Statistics	1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for the variability in the answers. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center (median and/or mean), spread (range, interquartile range and/or mean absolute deviation), and overall shape.			
Mathematics	6	Data Analysis and Statistics	2	Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots.			
Mathematics	6	Data Analysis and Statistics	3	Formulate statistical questions, and collect, organize, display, and interpret the data using line plots, histograms, and box plots.			
Mathematics	6	Data Analysis and Statistics	4	Summarize numerical data sets in relation to their context, such as by: report the number of observations; describe the nature of the attribute under investigation, including how it was measured and its units of measurement; determine quantitative measures of center (median and/or mean) and variability (range, interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.			

MATHEMATICS: SEVENTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	7	Number Sense	1	Find the prime factorization of whole numbers. Write the results using exponents.	This comes out of the blue. NEED A KEY STANDARD	Know and understand the fundamental theorem of arithmetic.	
							Find the prime factorization of whole numbers.
							Write whole numbers as products of primes using exponents.
Mathematics	7	Number Sense	2	Understand the inverse relationship between squaring and finding the square root of a perfect square integer. Find square roots of perfect square integers.	As far as I can see you have not discussed inverse functions previously so this needs a new key standard.	Know and understand what square roots of positive numbers are and evaluate them in specific cases.	
							Identify, compare, and order rational and common irrational numbers ($\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, ∏) and plot them on a number line.
							Find square roots of perfect square integers.
							Understand the inverse relationship between squaring and finding the square root of a perfect square integer
Mathematics	7	Number Sense	3	Identify, compare, and order rational and common irrational numbers ($\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, ∏) and plot them on a number line.			
Mathematics	7	Number Sense	4	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.	ok as written. This is a key standard. But it should go with the standards currently on lines 18 and 19!		
					From here on I will not go through the construction of the actual standards but will just indicate what needs to be done		
Mathematics	7	Computation	1	Understand $p + q$ as the number located a distance $\lvert q \rvert$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	see the comment for the standard in row 20		
Mathematics	7	Computation	2	Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	These are all substandards of the key standard indicated above.		
Mathematics	7	Computation	3	Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(–1)(–1) = 1$ and the rules for multiplying signed numbers.	Be consistent. You need a definition of "rational number" I presume you are referring to "fractions" here as non-negative fractions, but it is generally customary these days to call all rational numbers fractions.		
Mathematics	7	Computation	4	Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $–(p/q) = (–p)/q = p/(–q)$.	see the comment for row 20		
Mathematics	7	Computation	5	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.	Should be combined with the standard on line 12 and the standard on line 19.		
Mathematics	7	Computation	6	Use proportional relationships to solve multistep ratio and percent problems. Some examples: simple interest, tax, markups, markdowns, gratuities, commissions, fees, conversions within and across measurement systems, percent increase and decrease, and percent error.	See the comment above.		
Mathematics	7	Computation	7	Fluently compute with rational numbers.	This should be the key standard for the standards on lines 14, 15, 17 and 21, all of which should be substandards of it.		
Mathematics	7	Computation	8	Solve one and two-step real-world problems involving addition, subtraction, multiplication, and division with rational numbers.			
Mathematics	7	Algebra and Functions	1	Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to add, subtract, factor, and expand linear expressions. Justify each step in the process	Key standard		
Mathematics	7	Algebra and Functions	2	Define slope as vertical change for each unit of horizontal change and recognize that a constant rate of change or constant slope describes a linear function. Identify and describe situations with constant or varying rates of change.	Rephrase and write as one key standard and at least two substandards.		
Mathematics	7	Algebra and Functions	3	Graph a line given its slope and a point on the line. Find the slope of a line given its graph.	there are two substandards of the key standard above here.		
Mathematics	7	Algebra and Functions	4	Identify the unit rate or constant of proportionality in tables, graphs, equations, and verbal descriptions of proportional relationships.	How can one put "unit rate" and "constant of proportionality" in the same standard? This needs to be decomposed into at least two standards.		
Mathematics	7	Algebra and Functions	5	Explain what the coordinates of a point on the graph of a proportional relationship mean in terms of the situation, with special attention to the points (0, 0) and (1,r) where r is the unit rate.	Far too vague. I might suggest that two ordered pairs of numbers, (a, b) and (c, d), are proportional if and only if the straight line through these points also contains the origin. Show that (a,b) and (c,d) are proportional only if $ad – bc = 0$.		
Mathematics	7	Algebra and Functions	6	Identify real world and mathematical situations that involve proportional relationships. Write equations and draw graphs to represent proportional relationships and recognize that these situations are described by a linear function in the form $y = mx$, where the unit rate m is the slope of the line.	This should be a substandard of the suggested standard above. Also, this standard and the one above should be moved up to go with the standards on rows 18 and 19.		
Mathematics	7	Algebra and Functions	7	Fluently solve equations of the form $px + q= r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Represent real world problems using equations of these forms and solve such problems.	I am not sure I see the point of this standard. In any case it should go with the standard on line 21.		
Mathematics	7	Algebra and Functions	8	Solve inequalities of the form $px +q$ (> or ≥) r or $px + q$ (< or ≤) r, where p, q, and r are specific rational numbers. Represent real world problems using inequalities of these forms and solve such problems. Graph the solution set of the inequality and interpret it in the context of the problem.	three separate standards where the first sentence is the key standard and the second and third are substandards.		
Mathematics	7	Geometry and Measurement	1	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	You need to specify the types of shapes immediately. Thus, the key standard here is the third. But as stated is it almost certainly too difficult for seventh grade.		
Mathematics	7	Geometry and Measurement	2	Identify, describe and construct similarity relationships and solve problems involving similarity (including similar triangles).	What do you mean by "similarity relationships?" I would suggest using a more standard terminology "corresponding sides and or angles" instead. Also, the kinds of problems need to be specified.		
Mathematics	7	Geometry and Measurement	3	Solve real-world and mathematical problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing. Create a scale drawing by using proportional reasoning.	This is a substandard of the standard on line 33.		

Content Area	Grade Level/Span	Strand	Number	Content Area Topic	
Mathematics	7	Geometry and Measurement	4	Solve real-world and mathematical problems that involve vertical, adjacent, complementary, and supplementary angles.	This needs to be more specific. Examples of the kinds of problems need to be supplied.
Mathematics	7	Geometry and Measurement	5	Understand the formulas for area and circumference of a circle and use them to solve real-world and mathematical problems; give an informal derivation of the relationship between circumference and area of a circle.	I am not sure I see the point of the last sentence. I would suggest the best you might ask is that students have seen and understood an informal derivation of this relationship
Mathematics	7	Geometry and Measurement	6	Solve real-world and mathematical problems involving volume of three-dimensional objects composed of right rectangular prisms. Solve real-world and mathematical problems involving volume of cylinders.	Two separate standards. You need examples illustrating both.
Mathematics	7	Geometry and Measurement	7	Construct nets for right rectangular prisms and cylinders. Solve real world and mathematical problems involving surface area of right rectangular prisms and cylinders.	Same comment as above.
Mathematics	7	Data Analysis, Statistics, and Probability	1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	As stated, "representative" is tautologically defined. You need to be more explicit. For example a sample of a population is representative for that population with respect to a probability measure a, if the value of a for the subpopulation is always close to the value for the entire population, where close also needs to be specified. Similarly, you need to be more specific about when a subset of a population is random. Since this is extremely difficult, I would suggest that what you should do is to list the kinds of "random samples" that students should assume qualify.
Mathematics	7	Data Analysis, Statistics, and Probability	2	Use data from a random sample to draw inferences about a population. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.	If you handle the standard above as suggested, then this simply becomes a substandard.
Mathematics	7	Data Analysis, Statistics, and Probability	3	Make observations about the degree of visual overlap of two numerical data distributions represented in line plots or box plots. Describe how additional data, particularly outliers, added to a data set may affect the mean and/or median.	pretty vague. Is there a way to be more specific?
Mathematics	7	Data Analysis, Statistics, and Probability	4	Find, use, and interpret measures of center (mean and median) and measures of variability (range, interquartile range, and mean absolute deviation) for numerical data from random samples to draw comparative inferences about two populations.	ok
Mathematics	7	Data Analysis, Statistics, and Probability	5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. A probability of 1 indicates an event certain to occur and a probability of 0 indicates an event impossible to occur.	ok
Mathematics	7	Data Analysis, Statistics, and Probability	6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its relative frequency from a large sample. Predict the approximate relative frequency of an event given the probability.	ok
Mathematics	7	Data Analysis, Statistics, and Probability	7	Develop and use probability models (both uniform and not) to determine probabilities of simple events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.	ok

MATHEMATICS: EIGHTH GRADE

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	8	Number Sense	1	Know that there are numbers that are rational and irrational and explain the difference between them. Give examples of rational and irrational numbers. Understand that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats into a rational number.
Mathematics	8	Number Sense	2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions involving irrational numbers.
Mathematics	8	Number Sense	3	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 × 3^–5 = 3^–3 = 1/3^3 = 1/27.
Mathematics	8	Number Sense	4	Use square root and cube root symbols to represent solutions to equations of the form x^2 = p and x^3 = p, where p is a positive rational number. Evaluate square roots of perfect squares and cube roots of perfect cubes.
Mathematics	8	Computation	1	Solve multi-step real-world problems involving addition, subtraction, multiplication, and division with rational numbers.
Mathematics	8	Computation	2	Solve real-world and mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as, a scientific calculator, graphing calculator, and excel spreadsheet.
Mathematics	8	Algebra and Functions	1	Fluently solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and solve such problems.
Mathematics	8	Algebra and Functions	2	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by transforming a given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
Mathematics	8	Algebra and Functions	3	Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph and describe the meaning of each in the context of a problem.
Mathematics	8	Algebra and Functions	4	Compare two different linear relationships given in different forms (table of values, equation, verbal description, and graph). For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
Mathematics	8	Algebra and Functions	5	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
Mathematics	8	Algebra and Functions	6	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations.
Mathematics	8	Algebra and Functions	7	Write a system of two linear equations that represents a real-world problem and solve the problem.
Mathematics	8	Algebra and Functions	8	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
Mathematics	8	Algebra and Functions	9	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	8	Algebra and Functions	10	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations.
Mathematics	8	Geometry and Measurement	1	Perform constructions with or without technology: angle and segment bisectors, copies of segments and angles, and perpendicular segments. Describe and justify the constructions.
Mathematics	8	Geometry and Measurement	2	Identify, define and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids) and describe the two-dimensional figure that results from slicing these objects.
Mathematics	8	Geometry and Measurement	3	Verify experimentally the properties of rotations, reflections, and translations; lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.
Mathematics	8	Geometry and Measurement	4	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
Mathematics	8	Geometry and Measurement	5	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar figures, describe a sequence that exhibits the similarity between them.
Mathematics	8	Geometry and Measurement	6	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
Mathematics	8	Geometry and Measurement	7	Know facts about the angle sum and exterior angles of triangles, angles created when parallel lines are cut by a transversal (corresponding, alternate interior, alternate exterior, consecutive interior, consecutive exterior, vertical), and angle-angle criterion for similarity of triangles. Use this information to solve real-world and mathematical problems.
Mathematics	8	Geometry and Measurement	8	Explain the reasoning of a given proof of the Pythagorean Theorem and its converse.
Mathematics	8	Geometry and Measurement	9	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two dimensions.
Mathematics	8	Geometry and Measurement	10	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
Mathematics	8	Geometry and Measurement	11	Solve real-world and mathematical problems involving volume and surface area of cones, spheres, and pyramids.
Mathematics	8	Data Analysis, Statistics, and Probability	1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
Mathematics	8	Data Analysis, Statistics, and Probability	2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line.
Mathematics	8	Data Analysis, Statistics, and Probability	3	Write and use an equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept.
Mathematics	8	Data Analysis, Statistics, and Probability	4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic
Mathematics	8	Data Analysis, Statistics, and Probability	5	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.
Mathematics	8	Data Analysis, Statistics, and Probability	6	Represent sample spaces and find probabilities of compound events (independent and dependent) using methods such as organized lists, tables, and tree diagrams.
Mathematics	8	Data Analysis, Statistics, and Probability	7	For events with a large number of outcomes, understand the use of the Multiplication Counting Principle. Develop the Multiplication Counting Principle and apply it to situations with a large number of outcomes.

Algebra 1

Content Area	Course	Strand	Number	Content Area Topic
Mathematics	Algebra 1	Number Sense	1	Understand the heirarchy and relationships of numbers and sets of numbers within the Real Number System.
Mathematics	Algebra 1	Number Sense	2	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. *
Mathematics	Algebra 1	Number Sense	3	Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents.
Mathematics	Algebra 1	Linear equations and inequalities	1	Fluently solve linear equations and inequalities in one variable. Explain and justify each step in solving an equation starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
Mathematics	Algebra 1	Linear equations and inequalities	2	Understand that the logic of equation solving begins with the assumption that the variable is a number that satisfies the equation and that the steps taken when solving equations create new equations that have, in most cases, the same solution as the original. Understand that similar logic applies to solving systems of equations simultaneously.
Mathematics	Algebra 1	Linear equations and inequalities	3	Represent real-world problems using linear equations and inequalities and solve such problems. Interpret the solution(s) and determine if the solution(s) is reasonable.
Mathematics	Algebra 1	Linear equations and inequalities	4	Solve equations and formulas for a specified variable including equations with coefficients represented by letters
Mathematics	Algebra 1	Linear equations and inequalities	5	Solve compound linear inequalities using properties of order.
Mathematics	Algebra 1	Functions	6	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
Mathematics	Algebra 1	Functions	7	Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.
Mathematics	Algebra 1	Functions	8	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Represent linear functions as graphs from equations.
Mathematics	Algebra 1	Functions	9	Represent linear functions in real-world problems using tables, graphs, verbal descriptions, and equations. Translate fluently among tables, graphs, verbal descriptions, and equations. Determine and interpret the slope and intercepts of linear functions. Use graphing technology in situations that involve more complex numbers.
Mathematics	Algebra 1	Functions	10	Translate among equivalent forms of equations for linear functions (i.e., slope-intercept, point-slope and standard). Recognize that different forms reveal more or less information about a given situation
Mathematics	Algebra 1	Functions	11	Graph a linear inequality in two variables to determine the solution set of the inequality.
Mathematics	Algebra 1	Systems	12	Graph a pair of linear inequalities in two variables with and without technology to determine the solution set of the inequality.
Mathematics	Algebra 1	Systems	13	Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions using tables, graphs and equations.
Mathematics	Algebra 1	Systems	14	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
Mathematics	Algebra 1	Systems	15	Understand the relationship between a solution of a pair of linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing (exact or approximate) , substitution or elimination.
Mathematics	Algebra 1	Systems	16	Write a system of two linear equations that represents a real-world problem and solve the problem. Interpret the solution and determine if the solution is reasonable. Use graphing technology in situations that involve more complex numbers.
Mathematics	Algebra 1	Quadratics and Polynomials	17	Understand that polynomials are closed under the operations of addition, subtraction, and multiplication with integers; Add, subtract and multiply polynomials and divide polynomials by monomials.
Mathematics	Algebra 1	Quadratics and Polynomials	18	Factor common terms from polynomials and factor polynomials completely.
Mathematics	Algebra 1	Quadratics and Polynomials	19	Factor the difference of two squares, perfect square trinomials and other quadratic expression.
Mathematics	Algebra 1	Quadratics and Polynomials	20	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation.
Mathematics	Algebra 1	Quadratics and Polynomials	21	Graph and describe quadratic functions with and without technology. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Mathematics	Algebra 1	Quadratics and Polynomials	22	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	
Mathematics	Algebra 1	Quadratics and Polynomials	23	Recognize and describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph and the factors of a polynomial expression.	
Mathematics	Algebra 1	Quadratics and Polynomials	24	Represent real-world problems using quadratic equations and solve such problems. Interpret the solution(s) and determine if the solution(s) is reasonable. Use graphing technology in situations that involve more complex numbers.	
Mathematics	Algebra 1	Functions	25	Rewrite square roots of non-perfect square integers and algebraic monomials	
Mathematics	Algebra 1	Functions	26	Use graphing technology to find approximate solutions of exponential and power functions.	
Mathematics	Algebra 1	Functions	27	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. Identify independent and dependent variables and make predictions about the relationship.	
Mathematics	Algebra 1	Algebraic Rational Expressions	28	Rewrite algebraic rational expressions in equivalent forms (i.e. numerators and denominators are monomial expressions with integer exponents).	* limit
Mathematics	Algebra 1	Algebraic Rational Expressions	29	Write and solve algebraic proportions that lead to a linear equation including real-world problems.	
Mathematics	Algebra 1	Data Analysis & Probability	1	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	
Mathematics	Algebra 1	Data Analysis & Probability	2	Use technology to write a linear function that represents data in a scatter plot representing a linear association. Interpret the slope and y-intercept in the context of the data. Compute (using technology) and interpret the correlation coefficient.	
Mathematics	Algebra 1	Data Analysis & Probability	3	Distinguish between correlation and causation. Evaluate reports based on data by considering the source of the data, the design of the study, the way the data are analyzed and displayed and whether the report confuses correlation with causation.	
Mathematics	Algebra 1	Data Analysis & Probability	4	Summarize categorical data for two categories, that has been collected or provided, in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations, trends in the data and answer questions about the data.	
Mathematics	Algebra 1	Data Analysis & Probability	5	Organize, display and analyze univariate and bivariate data (e.g. using tables, line plots, histograms and box plots). Summarize the data using measures of center (e.g. mean, median) and spread (e.g, range, inter-quartile range, percentiles, variance). Understand the effects of outliers on the data.	

Process and Practice Standards for all Courses 9 - 12

Content Area	Number	Content Area Topic
Mathematics	1	Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” and "Is my answer reasonable?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
Mathematics	2	Reason abstractly and quantitatively. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
Mathematics	3	Construct viable arguments and critique the reasoning of others. Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies and use various methods of proof. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
Mathematics	4	Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Mathematics	5	Use appropriate tools strategically. Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Regarding technology, students use it strategically as a tool to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving. Note: Elementary students must learn how to fluently perform the basic arithmetic operations independent of the use of a calculator.
Mathematics	6	Attend to precision. Mathematically proficient students try to communicate precisely to others. They try to use clear definitions including correct mathematical language in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.
Mathematics	7	Look for and make use of structure. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x^2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)^2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
Mathematics	8	Look for and express regularity in repeated reasoning. Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x^2 + x + 1), and (x – 1)(x^3 + x^2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

MATHEMATICS: EIGHTH GRADE

Comment: I've expanded the standards listed in Col E into main standards and substandards in columns G and H. Once this is done, it becomes evident that there are far too many standards hidden in many "standards" in Col. E. Moreover, as written most of the Col. E standards are very, very difficult to parse, and some of them are too vague. Hopefully, these issues have also been fixed in columns G and H. In the data section I parsed and fixed some of the standards, but, in the end, I left it up to the standards writers to fix this material. You should understand that one of the ways Core Standards got "fewer" standards than most states was to glom many individual standards together. So what I've mostly done here is to "unglom" the worst offenders.

Content Area	Grade Level/Span	Strand	Number	Content Area Topic			
Mathematics	8	Number Sense	1	Know that there are numbers that are rational and irrational and explain the difference between them. Give examples of rational and irrational numbers. Understand that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats into a rational number.	Should read as follows:	Know that there are numbers that are rational and irrational and explain the difference between them.	
							Understand that every real number has a decimal expansion
							For rational numbers understand that the decimal expansion eventually repeats
							Convert between ultimately repeating decimals and fractions
							Convert between fractions and ultimately repeating decimals
							Give examples of irrational numbers via the decimal expansion
Mathematics	8	Number Sense	2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions involving irrational numbers.	Should read as follows:	Determine which of two infinite decimals is larger and which is smaller	
							Approximate a an irrational number by a point on the number line
							Estimate the value of an expression involving irrational numbers
Mathematics	8	Number Sense	3	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.	Should read as follows:	Know and apply the properties of integer exponents	
							$a^m \times a^n = a^{(m+n)}$.
							$(a^m)^n = A^{(mn)}$
Mathematics	8	Number Sense	4	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of perfect squares and cube roots of perfect cubes.	Should read as follows:	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number.	
							Determine all real square roots of a rational perfect square
Mathematics	8	Computation	1	Solve multi-step real-world problems involving addition, subtraction, multiplication, and division with rational numbers.	Should read as follows:		Show that there is one and only one cube root of a rational perfect cube
Mathematics	8	Computation	2	Solve real-world and mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as, a scientific calculator, graphing calculator, and excel spreadsheet.	Should read as follows:		
Mathematics	8	Algebra and Functions	1	Fluently solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and solve such problems.	Should use a series of substandards tied to the standard that I've put into Column G.	Fluently solve linear equations with rational number coefficients,	
Mathematics	8	Algebra and Functions	2	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by transforming a given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).	This should be a substandard of the standard in 23 G.		Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions by transforming a given equation into one of the three elementary forms forms, x = a, a=a, or a=b where a and b are different numbers
Mathematics	8	Algebra and Functions	3	Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in $y = mx + b$ that m is the slope (rate of change) and b is the y-intercept of the graph and describe the meaning of each in the context of a problem.	Should read as follows:	Construct a function to model a linear relationship between two quantities	
							In $y = mx + b$ identify m with the slope (rate of change) and b with the y-intercept of the graph and describe the meaning of each in the context of a problem.
				NEED A NEW STANDARD HERE (GRAPHS)	New standard	Understand that the graph of a expression in two variables is the set of number pairs (a, b) so that substituting a for the first variable and b for the second makes the relation true	
Mathematics	8	Algebra and Functions	4	Compare two different linear relationships given in different forms (table of values, equation, verbal description, and graph). For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	NOT A STANDARD. Should be a substandard		Compare two different linear relationships given in different forms and identify them if they have the same graph

Mathematics	8	Algebra and Functions	5	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.		Know that the graph of a relation in two variables is a straight line.	
Mathematics	8	Algebra and Functions	6	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations.			Apply this to a system of two linear equations in two unknowns by identifying the solution as the point of intersection of the two graphs.
Mathematics	8	Algebra and Functions	7	Write a system of two linear equations that represents a real-world problem and solve the problem.	NOT A STANDARD. Should be a substandard		Write a system of two linear equations that represents a real-world problem and solve the problem.
Mathematics	8	Algebra and Functions	8	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.		Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	
Mathematics	8	Algebra and Functions	9	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	NOT A STANDARD. Should be a substandard		
Mathematics	8	Algebra and Functions	10	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations.	NOT A STANDARD. Should be substandards		Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations
Mathematics	8	Geometry and Measurement	1	Perform constructions with or without technology: angle and segment bisectors, copies of segments and angles, and perpendicular segments. Describe and justify the constructions.		Perform constructions with or without technology: Describe and justify the constructions.	
							angle and segment bisectors,
							copies of segments and angles,
							perpendicular segments.
Mathematics	8	Geometry and Measurement	2	Identify, define and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids) and describe the two-dimensional figure that results from slicing these objects.	As stated the second part is too difficult		
Mathematics	8	Geometry and Measurement	3	Verify experimentally the properties of rotations, reflections, and translations; lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.	Again, this should contain 3 substandards	Verify experimentally the properties of rotations, reflections, and translations	
							lines are mapped to lines,
							line segments to line segments of the same length; .
							angles are mapped to angles of the same measure;
							parallel lines are mapped to parallel lines.
							Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures in simple situation by using coordinates.
Mathematics	8	Geometry and Measurement	4	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.		Know that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations;	
							given two congruent figures, describe a sequence that exhibits the congruence between them.
Mathematics	8	Geometry and Measurement	5	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar figures, describe a sequence that exhibits the similarity between them.		Know that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations;	
							given two similar figures, describe a sequence that exhibits the similarity between them.
Mathematics	8	Geometry and Measurement	6	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	This is really a substandard of the third geometry standard		
Mathematics	8	Geometry and Measurement	7	Know facts about the angle sum and exterior angles of triangles, angles created when parallel lines are cut by a transversal (corresponding, alternate interior, alternate exterior, consecutive interior, consecutive exterior, vertical), and angle-angle criterion for similarity of triangles. Use this information to solve real-world and mathematical problems.		Know and understand basic facts about angle measure.	
							sum and exterior angles of triangles
							angles created when parallel lines are cut by a transversal (corresponding, alternate interior, alternate exterior, consecutive interior, consecutive exterior, vertical),
							angle-angle criterion for similarity of triangles
							Use this information to solve real-world and mathematical problems.

Mathematics	8	Geometry and Measurement	8	Explain the reasoning of a given proof of the Pythagorean Theorem and its converse.	Terrible standard. Much better would be the following:	Prove the Pythagorean Theorem and its converse.	
							Give examples justifying the steps in the proof
Mathematics	8	Geometry and Measurement	9	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two dimensions.	This is really a substandard and is not well phrased		Apply the Pythagorean Theorem to determine unknown side lengths in right triangle mathematical problems that are derived from real-world situations.
Mathematics	8	Geometry and Measurement	10	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	Not well phrased and is a substandard.		Apply the Pythagorean Theorem to verify the formula for the distance between two points in a coordinate system.
Mathematics	8	Geometry and Measurement	11	Solve real-world and mathematical problems involving volume and surface area of cones, spheres, and pyramids.	This comes out of the blue. It needs considerable preparation before students will be ready for it.		
Mathematics	8	Data Analysis, Statistics, and Probability	1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	Write in plain english	Bivariate measurement data are ordered pairs of numbers associated to each data point	
							Give examples of bivariate measurement data
							Construct and interpret scatter plots for bivariate measurement data
							Describe the resulting patterns in terms of clustering, outliers, positive or negative association, linear association, and nonlinear association.
Mathematics	8	Data Analysis, Statistics, and Probability	2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line.	Write in plain english as modeled in the standard and sub-standards above. I would suggest the following:		For scatter plots that suggest a linear association, informally fit a straight line.
							describe the model fit by judging the closeness of the data points to the line.
Mathematics	8	Data Analysis, Statistics, and Probability	3	Write and use an equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept.	Write in plain english as modeled in the standard and sub-standards above.		
Mathematics	8	Data Analysis, Statistics, and Probability	4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	Write in plain english as modeled in the standard and sub-standards above.		
Mathematics	8	Data Analysis, Statistics, and Probability	5	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.	This is the first probability standard. Write in plain english.		
Mathematics	8	Data Analysis, Statistics, and Probability	6	Represent sample spaces and find probabilities of compound events (independent and dependent) using methods such as organized lists, tables, and tree diagrams.	Write this in plain english as well		
Mathematics	8	Data Analysis, Statistics, and Probability	7	For events with a large number of outcomes, understand the use of the Multiplication Counting Principle. Develop the Multiplication Counting Principle and apply it to situations with a large number of outcomes.	Thils is a new and difficult standard. I would suggest modifications.	Know that the multiplication counting principle is given as follows: if there are n outcomes for the first event and m outcomes for the second event, then there are n times m possible outcomes for both events.	
							Know that if the two events are not independent, then there may well be fewer than n times m outcomes that actually occur.
							Apply the multiplication counting principle in the case where the events are independent.
							Give examples that illustrate the failure of the multiplication counting principle when the events are not independent.

Algebra 1

Missing standards: Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents. Understand the concept of slope of a line, find the x and y intercepts of the graph of y = ax + b and determine the slope. Apply algebraic techniques to solve rate problems, work problems and mixture problems.

Content Area	Course	Strand	Number	Content Area Topic			
Mathematics	Algebra 1	Number Sense	1	Understand the heirarchy and relationships of numbers and sets of numbers within the Real Number System.	Badly phrased	Know the relationships between important subsets of the real numbers	
							The rational numbers are the signed fractions. Know that the rationals are closed under both addition and multiplication
							Explain why the sum of a rational number and an irrational number is always irrational
							Explain why the product of a nonzero rational number and an irrational number is always irrational.
Mathematics	Algebra 1	Number Sense	2	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	Should be substandards of standard above.		
Mathematics	Algebra 1	Number Sense	3	Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents.	This is ok as a separate standard.	Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents.	
Mathematics	Algebra 1	Linear equations and inequalities	1	Fluently solve linear equations and inequalities in one variable. Explain and justify each step in solving an equation starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	Should be standards and substandards.	Fluently solve linear equations and inequalities in one variable.	
							Explain and justify each step in solving an equation starting from the assumption that the original equation has a solution.
							Construct a viable argument to justify a solution method.
							Represent real-world problems using linear equations and inequalities and solve such problems
							Interpret the solutions of the linear equations and inequalities associated to a real world problem, and determine if the solutions are reasonable in the context of the original problem.
Mathematics	Algebra 1	Linear equations and inequalities	2	Understand that the logic of equation solving begins with the assumption that the variable is a number that satisfies the equation and that the steps taken when solving equations create new equations that have, in most cases, the same solution as the original. Understand that similar logic applies to solving systems of equations simultaneously.	Should be standards and substandards.	Understand that the logic of equation solving begins with the assumption that the variable is a number that satisfies the equation.	
							Understand that the steps taken when solving equations create new equations that usually have the same solution or solutions as the original.
							Understand that an equation may not have any number solutions and construct examples.
						Understand that similar logic applies to solving systems of equations simultaneously.	
Mathematics	Algebra 1	Linear equations and inequalities	3	Represent real-world problems using linear equations and inequalities and solve such problems. Interpret the solution(s) and determine if the solution(s) is reasonable.	This becomes two substandards of the standard in 10G		
Mathematics	Algebra 1	Linear equations and inequalities	4	Solve equations and formulas for a specified variable including equations with coefficients represented by letters	More or less ok as written	Solve equations and formulas for a specified variable including the case where the coefficients are represented by letters	
Mathematics	Algebra 1	Linear equations and inequalities	5	Solve compound linear inequalities using properties of order.	Frankly, I'm not sure what is meant here. I do think that you should probably have standards for systems of inequalities either here or in Algebra 2		

Mathematics	Algebra 1	Functions	6	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	I don't know what "in terms of a context" is supposed to mean. But as best I can understand, I would revise this standard as follows:	Understand what functions and function notation are.	
							Use function notation,
							evaluate functions for inputs in their domains,
							interpret statements that use function notation in the context of real world problems.
Mathematics	Algebra 1	Functions	7	Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.	Should be clarified and made into standards and substandards.	Identify the domains and ranges for relations. (A relation is simply a subset of the Cartesian product of the domain and the range).	
							If the relation is represented by a table
							If the relation is represented by a graph
							if the relation is described in words
							If the relation is represented by equations
Mathematics	Algebra 1	Functions	8	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). Represent linear functions as graphs from equations.			
Mathematics	Algebra 1	Functions	9	Represent linear functions in real-world problems using tables, graphs, verbal descriptions, and equations. Translate fluently among tables, graphs, verbal descriptions, and equations. Determine and interpret the slope and intercepts of linear functions. Use graphing technology in situations that involve more complex numbers.	As written this is not correct. In order to translate among tables, graphs, etc. one must first explicitly make the ASSUMPTION that these data describe linear functions. As an example, it is virtually impossible to visibly distinguish a straight line graphed between say (x,y)= (-1, -1) and (1, 1), and the short arc of the circle (x - 500)^2 + (y + 500)^2 = 500000 with endpoints (-1, -1) and (1,1 with a graphing calculator. And if we are given a table with the three rows (-1, -1) (0, 0) (1,1) we have absolutely no information on what the y coordinate might be when x = .5	Represent linear functions in real-world problems using tables, graphs, verbal descriptions, and equations.	
							Assuming that we are dealing with linear equations translate fluently among tables, graphs, verbal descriptions, and equations
							Determine and interpret the slope and intercepts of linear functions
							Use graphing technology to approximate the slope and intercepts of linear equations in situations that involve more complex fractions or irrational numbers.
Mathematics	Algebra 1	Functions	10	Translate among equivalent forms of equations for linear functions (i.e., slope-intercept, point-slope and standard). Recognize that different forms reveal more or less information about a given situation	Should be substandard.		Translate among equivalent forms of equations for linear functions (i.e., slope-intercept, point-slope and standard)
							Recognize that different forms reveal more or less information about a given situation
Mathematics	Algebra 1	Functions	11	Graph a linear inequality in two variables to determine the solution set of the inequality.	OK		
Mathematics	Algebra 1	Systems	12	Graph a pair of linear inequalities in two variables with and without technology to determine the solution set of the inequality.	The statement "with and without technology" is a tautology.	Graph a pair of linear inequalities in two variables.	
Mathematics	Algebra 1	Systems	13	Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions using tables, graphs and equations.	What does the term "equal differences" mean? Should say the difference in y values is a constant times the difference of the x values.		

Mathematics	Algebra 1	Systems	14	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	ok		
Mathematics	Algebra 1	Systems	15	Understand the relationship between a solution of a pair of linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing (exact or approximate) , substitution or elimination.	Awkward.	Know that the point of intersection of the graphs of two linear equations, ax + by = e, and cx + dy = f, is the pair (x,y) so that both equations are true	
							solve pairs of linear equations by substitution
							solve pairs of linear equations by eliminating a variable
							approximate the solution to a pair of linear equations using graphs
Mathematics	Algebra 1	Systems	16	Write a system of two linear equations that represents a real-world problem and solve the problem. Interpret the solution and determine if the solution is reasonable. Use graphing technology in situations that involve more complex numbers.	This should be be three substandards		Write a system of two linear equations that represents a real-world problem and solve the problem.
							Interpret the solution and determine if the solution is reasonable in terms of the original real-world problem
							Use graphing technology in situations that involve more complex numbers.
Mathematics	Algebra 1	Quadratics and Polynomials	17	Understand that polynomials are closed under the operations of addition, subtraction, and multiplication with integers; Add, subtract and multiply polynomials and divide polynomials by monomials.	Should be parsed more carefully	Know what polynomials are and how to work with them.	
							Know how to add, subtract and multiply polynomials
							Know how to divide polynomials by monomials
					Not sure what you want with "multiplication with integers"		Understand that polynomials are closed under the operations of addition, subtraction, and multiplication.
Mathematics	Algebra 1	Quadratics and Polynomials	18	Factor common terms from polynomials and factor polynomials completely.	substandards		Factor common terms from polynomials.
							factor quadratics completely.
Mathematics	Algebra 1	Quadratics and Polynomials	19	Factor the difference of two squares, perfect square trinomials and other quadratic expression.	substandards		Factor the difference of two squares.
							Factor perfect square trinomials
Mathematics	Algebra 1	Quadratics and Polynomials	20	Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation.		Solve quadratic equations.	
							Solve quadratic equations by inspection (e.g., for x^2 = 49, taking square roots)
							Solve quadratic equations by completing the square
							Solve quadratic equations by factoring.
							Solve quadratic equations by using the quadratic formula
Mathematics	Algebra 1	Quadratics and Polynomials	21	Graph and describe quadratic functions with and without technology. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	this and next standard need to be decomposed and combined as standards and sub standards.	Graph and describe quadratic functions with and without technology.	
							Use factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph.
							For real-world problems interpret zeros, extreme values and symmetry in the context of the problem.
							Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
						Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	
							Recognize and describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph and the factors of a polynomial expression.
Mathematics	Algebra 1	Quadratics and Polynomials	22	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	see above.		
Mathematics	Algebra 1	Quadratics and Polynomials	23	Recognize and describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph and the factors of a polynomial expression.	This is a substandard for the fundamental theorem		
Mathematics	Algebra 1	Quadratics and Polynomials	24	Represent real-world problems using quadratic equations and solve such problems. Interpret the solution(s) and determine if the solution(s) is reasonable. Use graphing technology in situations that involve more complex numbers.	This has already been subsumed in the previous standards for quadratic functions		
Mathematics	Algebra 1	Functions	25	Rewrite square roots of non-perfect square integers and algebraic monomials	need examples otherwise ok.		
Mathematics	Algebra 1	Functions	26	Use graphing technology to find approximate solutions of exponential and power functions.			

Mathematics	Algebra 1	Functions	27	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. Identify independent and dependent variables and make predictions about the relationship.	
Mathematics	Algebra 1	Algebraic Rational Expressions	28	Rewrite algebraic rational expressions in equivalent forms (i.e. numerators and denominators are monomial expressions with integer exponents).	* limit
Mathematics	Algebra 1	Algebraic Rational Expressions	29	Write and solve algebraic proportions that lead to a linear equation including real-world problems.	Need examples.
Mathematics	Algebra 1	Data Analysis & Probability	1	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	
Mathematics	Algebra 1	Data Analysis & Probability	2	Use technology to write a linear function that represents data in a scatter plot representing a linear association. Interpret the slope and y-intercept in the context of the data. Compute (using technology) and interpret the correlation coefficient.	
Mathematics	Algebra 1	Data Analysis & Probability	3	Distinguish between correlation and causation. Evaluate reports based on data by considering the source of the data, the design of the study, the way the data are analyzed and displayed and whether the report confuses correlation with causation.	
Mathematics	Algebra 1	Data Analysis & Probability	4	Summarize categorical data for two categories, that has been collected or provided, in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations, trends in the data and answer questions about the data.	
Mathematics	Algebra 1	Data Analysis & Probability	5	Organize, display and analyze univariate and bivariate data (e.g. using tables, line plots, histograms and box plots). Summarize the data using measures of center (e.g. mean, median) and spread (e.g, range, inter-quartile range, percentiles, variance). Understand the effects of outliers on the data.	mostly should have been done in earlier grades.

Geometry

Much to my surprise, except for the fact that there are too many standards, the standards here seem entirely reasonable, and a huge and very welcome change from the Core Standards Geometry standards. There should be about half as many standards, in the neighborhood of 25, and they should be the more important of the standards listed here.

Content Area	Course	Strand	Number	Content Area Topic	
Mathematics	Geometry	Proofs	1	Identify and give examples of undefined terms, axioms and postulates), and theorems, and inductive and deductive proofs. Describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems).	*
Mathematics	Geometry	Proofs	2	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	
Mathematics	Geometry	Proofs	3	State, use, and examine the validity of the converse, inverse, and contrapositive of “if – then” and “if and only if” statements.	
Mathematics	Geometry	Proofs	4	Understand the differences among supporting evidence, counterexamples and actual proofs.	C 1&3
Mathematics	Geometry	Proofs	5	Develop geometric proofs (i.e., direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry) using two-column, paragraphs and flow charts formats.	
Mathematics	Geometry	Segments, Lines and Planes	6	Identify, justify and apply properties of planes. Describe the intersection of two or more geometric figures in the plane.	
Mathematics	Geometry	Construction Segments, Lines and	7	Define, identify, and construct with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, parallel and perpendicular lines, and congruent triangles. Explain and justify the process used.	
Mathematics	Geometry	Segments, Lines and Planes	8	Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints.	
Mathematics	Geometry	Segments, Lines and Planes	9	Develop the distance formula using the Pythagorem Theorem. Find the lengths and midpoints of line segments in one- or two-dimensional coordinate systems. Find measures of the sides of polygons in the coordinate plane; apply this technique to compute the perimeters and areas of polygons in real-world and mathematical problems.	
Mathematics	Geometry	Segments, Lines and Planes	10	Find the point on a directed line segment between two given points that partitions the segment in a given ratio. Prove and apply theorems involving segments divided proportionally.	
Mathematics	Geometry	Segments, Lines and Planes	11	Identify and apply properties of and theorems about parallel and perpendiculars, write equations of parallel and perpendicular lines, and develop geometric proofs involving the relationships between special pairs of angles formed by parallel lines and transversals and perpendicular lines.	
Mathematics	Algebra 2	Segments, Lines and Planes	12	Prove the slope criteria for parallel and perpendicular lines and use them to solve real-world and mathematical problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	

Mathematics	Geometry	Triangles	13	Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point, a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity, isosceles triangle theorem and its converse.	
Mathematics	Geometry	Triangles	14	Explain how the criteria for triangle congruence (ASA, SAS, ASA and SSS) follow from the definition of congruence in terms of rigid motions.	C 15&13?
Mathematics	Geometry	Triangles	15	Use properties of congruent and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.	
Mathematics	Geometry	Triangles	16	Given two figures, use the definition of similarity in terms of similarity transformations such as the AA criterion to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	
Mathematics	Geometry	Triangles	17	Construct the inscribed and circumscribed circles of a triangle (with or without technology), and prove properties of angles for a quadrilateral inscribed in a circle.	
Mathematics	Geometry	Triangles	18	Prove, understand, and apply the inequality theorems: triangle inequality, inequality in one triangle, and the hinge theorem.	
Mathematics	Geometry	Triangles	19	State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle.	
Mathematics	Geometry	Triangles	20	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	
Mathematics	Geometry	Triangles	21	Use trigonometric ratios and the Pythagorean Theorem to solve real-world and mathematical problems in two- and three-dimensions.	
Mathematics	Geometry	Triangles	22	Use special right triangles (30° - 60° and 45° - 45°) to solve real-world and mathematical problems.	
Mathematics	Geometry	Quadrilaterals	23	Describe, classify, and understand relationships among the quadrilaterals convex, concave, and regular polygons, square, rectangle, rhombus, parallelogram, trapezoid, and kite.	
Mathematics	Geometry	Quadrilaterals	24	Use properties of congruent and similar quadrilaterals to solve problems involving lengths and areas.	
Mathematics	Geometry	Quadrilaterals	25	Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.	*27
Mathematics	Geometry	Quadrilaterals	26	Prove and apply theorems about parallelograms and trapezoids (including isosceles trapezoids) involving their angles, sides and diagonals. Prove that the given quadrilaterals are parallelograms, rhombuses, rectangles, squares or trapezoids (as appropriate).	*26
Mathematics	Geometry	Quadrilaterals	27	Represent triangles and quadrilaterals in the coordinate plane and create proofs related to the figures (e.g. using knowledge of slopes, parallel and perpendicular lines, distance formula and the Pythagorean Theorem to classify the figures as isosceles, right, equilateral, square, rectangle, parallelogram, etc.).	
Mathematics	Geometry	Transformations	28	Use geometric descriptions of rigid motions to transform figures and predict and describe the results of translations, reflections and rotations on polygons. Describe a motion or series of motions that will show that two shapes are congruent.	
Mathematics	Geometry	Transformations	29	A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	
Mathematics	Geometry	Polygons	30	Identify types of symmetry (i.e., line, point, rotational, self-congruencies) of polygons.	
Mathematics	Geometry	Polygons	31	Deduce formulas relating lengths and sides, perimeters, and areas of regular polygons. Understand how limiting cases of such formulas lead to expressions for the circumference and the area of a circle.	

Mathematics	Geometry	Construction Circles	32	Construct the circle that passes through three given points not on a line, construct tangents to circles, tangent line from a point outside a given circle to the circle. Justify the process used.
Mathematics	Geometry	Circles	33	Define , identify and use relationships among: radius, diameter, arc, measure of an arc, chord, secant, tangent, and congruent concentric circles.
Mathematics	Geometry	Circles	34	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
Mathematics	Geometry	Circles	35	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.
Mathematics	Geometry	Polyhera	36	Describe relationships between the faces, edges, and vertices of polyhedra. Create a net for a given polyhedron. Describe the polyhedron that can be made from a given net (or pattern).
Mathematics	Geometry	Polyhera	37	Identify, justify and apply properties of prisms, regular pyramids, cylinders, right circular cones and spheres. Solve problems involving congruent and similar solids.
Mathematics	Geometry	Polyhera	38	Describe sets of points on spheres: chords, tangents, and great circles.
Mathematics	Geometry	Polyhera	39	Describe symmetries of geometric solids.
Mathematics	Geometry	Geometry	40	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
Mathematics	Geometry	Polyhedra	41	Solve real-world and mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids including problems that involve algebraic expressions, e.g., determine the area of the base of a regular pyramid given the volume and the fact that the height is 5 more than 3 times the area of the base.
Mathematics	Geometry	Polyhedra	42	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
Mathematics	Geometry	Geometry	43	Recognize that there are geometries, other than Euclidean geometry, in which the parallel postulate is not true. Illustrate its counterparts in other geometries.

Mathematics	Geometry	Measurement	1	Find measures of interior and exterior angles of polygons, explain and justifying the method used.
Mathematics	Geometry	Measurement	2	Define, find, and use measures of circumference, arc length, and areas of circles and sectors, and arcs and related angles (central, inscribed, and intersections of secants and tangents). Use these measures to solve problems.
Mathematics	Geometry	Measurement	3	Find and use measures of sides, volumes and surface areas of prisms, regular pyramids, cylinders, right circular cones and spheres. Relate these measures to each other using formulas. Identify and know properties of congruent and similar solids.

Algebra 2

The standards on lines 73, 74, 75 are not part of data analysis and should be moved up

Missing standards: specific examples of factorizations -- suggested, sums or differences of two cubes, differences of 2 nth powers. Plot complex numbers in the plane. Divide complex numbers where the denominator is non-zero. Evaluate rational expressions for selected values of the variable. Students evaluate how the graph of a quadratic function $ax^2 + bx + c$ changes for changes in the constants, a, b, and c. The same for quadratic functions of two variables: $ax^2 + by^2 + cxy + dx + ey + f$.

For logarithms and exponentials students need to know how to evaluate these functions for different bases, e.g. $\log_a(x+1)$ is related to $\log_b(x+1)$ in what way? Using properties of logarithms students simplify logarithmic expressions and determine their approximate values. Apply the principles of mathematical induction to prove general statements about whole numbers.

Content Area	Course	Strand	Number	Content Area Topic			
Mathematics	Algebra 2	Functions	1	Determine whether a relation represented by a table, graph, verbal description, or equation is a function. Add, subtract, multiply, and divide pairs of functions.		Determine whether a relation represented by a table, graph, verbal description, or equation is a function.	
							Add, subtract, multiply, and divide pairs of functions.
Mathematics	Algebra 2	Functions	2	Understand and interpret statements that use function notation in terms of a context. Relate the domain of a function to its graph and to the quantitative relationship it describes.			Understand and interpret statements that use function notation in terms of a context.
							Relate the domain of a function to its graph and to the quantitative relationship it describes.
						Know and understand the structure of the complex numbers.	
					This is where I've moved the standard on the complex numbers.		Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.
							Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
							Know and understand that every complex number a + ib can be written in the form r(cos(t) + I sin(t)) where r is the square root of $a^2 + b^2$, cos(t) = a/r, sin(t) = b/r, and that when one multiplies r(cost(t) + I sin(t)) by s(cos(v) + I sin(v)) the product is rs*(cos(t+v) + I sin(t + v)) so that multiplying complex numbers in the form, the product has length the product of the two multiplicands, and angle the sum of the angles.
Mathematics	Algebra 2	Absolute Value	3	Graph and solve absolute value linear equations and inequalities.		Graph and solve absolute value linear equations and inequalities.	
Mathematics	Algebra 2	Systems	4	Solve systems of two or three linear equations in two or three variables algebraically. Use graphing technology in situations that involve more complex numbers.		Solve systems of two or three linear equations in two or three variables	
							Solve systems of two or three linear equations in two or three variables algebraically. (Give exact solutions)
							Write a system of linear equations in three variables that represents a real-world problem and solve the problem.
							Interpret the solution and determine if the solution is reasonable.
Mathematics	Algebra 2	Systems	5	Write a system of linear equations in three variables that represents a real-world problem and solve the problem. Interpret the solution and determine if the solution is reasonable. Use graphing technology in situations that involve more complex numbers.			
							Solve a system of equations consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.
Mathematics	Algebra 2	Systems	6	Solve a system of equations consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. Use graphing technology in situations that involve more complex numbers.			Use graphing technology in situations that involve more complex numbers. (Give good approximations to the actual solutions when the coefficients are more complicated.)
Mathematics	Algebra 2	Quadratics	7	Graph quadratic functions. Identify intercepts, zeros, domain and range, and lines of symmetry. Use graphing technology in situations that involve more complex numbers.		Graph quadratic functions.	
Mathematics	Algebra 2	Quadratics	8	Derive the equation of a parabola given a focus and directrix.			Identify intercepts, zeros, domain and range, and lines of symmetry.
							Represent real-world problems using quadratic equations and solve such problems.
							Interpret the solution(s) and determine if the solution(s) is reasonable in the desired application.
Mathematics	Algebra 2	Quadratics	9	Represent real-world problems using quadratic equations and solve such problems. Interpret the solution(s) and determine if the solution(s) is reasonable. Use graphing technology in situations that involve more complex numbers.			Use graphing technology in situations that involve more complex numbers.

Mathematics	Algebra 2	Quadratics	10	Know there is a complex number i such that i^2 = -1, and every complex number has the form a + bi with a and b real. Use the relation i^2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	Should appear sooner. See rows 8-11 for details.		
Mathematics	Algebra 2	Quadratics	11	Recognize when the quadratic formula gives complex solutions. Solve quadratic equations with real coefficients that have complex solutions and write them as a ± bi for real numbers a and b.		Solve and factor quadratic equations with complex roots	
							Recognize when the quadratic formula gives complex solutions.
							Solve quadratic equations with real coefficients that have complex solutions and write them as a ± bi for real numbers a and b.
				Distinguish between situations that can be modeled with linear functions and with exponential functions		Know and understand exponential functions and logarithmic functions.	
							Distinguish between situations that can be modeled with linear functions and with exponential functions
				Compare properties of linear and exponential functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	substandards of the standard above.		Compare properties of linear and exponential functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
Mathematics	Algebra 2	Exponential and Linear	12				Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
Mathematics	Algebra 2	Exponential and Linear	13				
Mathematics	Algebra 2	Exponential	14	Graph exponential functions. Identify and describe features such as, intercepts, zeros, domain and range, and asymptotic and end behavior. Interpret the parameters in an exponential function in terms of a context. Use graphing technology in situations that involve more complex numbers.	Substandards of the standard above.		
							Graph exponential functions.
							Identify and describe features such as, intercepts, zeros, domain and range, and asymptotic and end behavior.
							Interpret the parameters in an exponential function in terms of a context.
							Use graphing technology in situations that involve more complex numbers.
Mathematics	Algebra 2	Exponential	15	Use the properties of exponents to transform and interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)^t, y = (0.97)^t, y = (1.01)12^t, y = (1.2)^t/10, and classify them as representing exponential growth or decay.	Substandards of the standard above.		Use the properties of exponents to transform and interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)^t, y = (0.97)^t, y = (1.01)12^t, y = (1.2)^t/10
							Classify and identify exponential functions that represent exponential growth or decay.
Mathematics	Algebra 2	Exponential and Logarithmic	16	Compare exponential and logarithmic functions using graphing technology.	Substandards of the standard above.		Compare exponential and logarithmic functions using graphing technology.
Mathematics	Algebra 2	Exponential and Logarithmic	17	Know that the inverse of an exponential function is a logarithm. Use laws of exponents to derive laws of logarithms. Use the inverse relationship between exponential functions and logarithms and the laws of logarithms to solve mathmatical problems.	Substandards of the standard above.		Know that the inverse of an exponential function is a logarithm.
							Use laws of exponents to derive laws of logarithms.
							Use the inverse relationship between exponential functions and logarithms and the laws of logarithms to solve mathematical problems.
Mathematics	Algebra 2	Exponential and Logarithmic	18	Solve real-world word problems that can be modeled using exponential and logarithmic equations, interpret the solutions, and determine whether the solutions are reasonable.	Substandards of the standard above.		Solve real-world word problems that can be modeled using exponential and logarithmic equations
							Interpret the solutions, and determine whether the solutions are reasonable with regard to the real-world problem they are supposed to model..
Mathematics	Algebra 2	Polynomials	19	Find a polynomial function of lowest degree with real coefficients when given its roots. Solve problems by using the relationships among solutions of an equation, zeros of a function, x-intercepts of a graph and factors of a polynomial expression.	Substandards of the key standard in Col. G	Know, underestand, and apply polynomial functions	
							Find a polynomial function of lowest degree with real coefficients when given its roots.
							Solve problems by using the relationships among solutions of an equation, zeros of a function, x-intercepts of a graph and factors of a polynomial expression.
Mathematics	Algebra 2	Polynomials	20	Solve real-world word problems that can be represented using polynomial equations. Interpret the solutions and determine whether the solutions are reasonable.	Substandards of the key standard above		Solve real-world word problems that can be represented using polynomial equations.
							Interpret the solutions of polynomial functions and determine whether the solutions are reasonable in terms of a real-world problem the polynomials are supposed to model.
Mathematics	Algebra 2	Polynomials	21	Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle	Substandard of the key standard above		Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle
Mathematics	Algebra 2	Rational and Radical	22	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.		Know and understand rational functions.	

							Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression;
							Add, subtract, multiply, and divide rational expressions.
Mathematics	Algebra 2	Rational and Radical	23	Rewrite rational expressions in equivalent forms, e.g., using properties of exponents and factoring techniques.	Substandard of key standard above		Rewrite rational expressions in equivalent forms, e.g., using properties of exponents and factoring techniques.
Mathematics	Algebra 2	Rational and Radical	24	Rewrite rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using long division.	Substandard of key standard above		Rewrite rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using long division.
Mathematics	Algebra 2	Rational and Radical	25	Relate expressions containing rational exponents to the corresponding radical expressions	This is a new key standard.	Know and understand radical expressions	
Mathematics	Algebra 2	Functions	26	Graph rational functions using technology. Identify and describe features such as, intercepts, domain and range, and asymptotic and end behavior.			
Mathematics	Algebra 2	Rational and Radical	27	Solve real-world and mathematical problems involving rational and radical equations, inculding direct, inverse, and joint variation. Give examples showing how extraneous solutions may arise.	Substandards of the two key standards above		Solve real-world and mathematical problems involving rational and radical equations, inculding direct, inverse, and joint variation.
							Give examples showing how extraneous solutions may arise in using the substandard above to solve real-world and mathematical problems..
Mathematics	Algebra 2	Functions	28	Graph relations and functions including polynomial, square root, cube root, and piecewise-defined functions (including step functions and absolute value functions). Identify and describe features such as, intercepts, zeros, domain and range, end behavior, and lines of symmetry. Use graphing technology in situations that involve more complex numbers and to approximate solutions of the equations.	Substandards of the two key standards above		Graph relations and functions including polynomial, square root, cube root, and piecewise-defined functions (including step functions and absolute value functions).
							Identify and describe features of the graphs above such as, intercepts, zeros, domain and range, end behavior, and lines of symmetry and give explicit examples.
							Use graphing technology in situations that involve more complex numbers and to approximate solutions of the equations.
Mathematics	Algebra 2	Data Analysis & Probability	1	Analyze data to determine if it suggests a linear, quadratic, or exponential relationship. Use technology to write a function to represent the data and solve problems using the function.			
Mathematics	Algebra 2	Data Analysis & Probability	2	Use simulations to construct empirical probability distributions.			
Mathematics	Algebra 2	Data Analysis & Probability	3	Understand the concepts of conditional probability and independent events.			
Mathematics	Algebra 2	Data Analysis & Probability	4	Understand the counting principle, permutations, and combinations and use them to solve contextual word problems			
Mathematics	Algebra 2	Data Analysis & Probability	5	Define arithmetic and geometric sequences and series, find specified terms of arithmetic and geometric sequences			
Mathematics	Algebra 2	Data Analysis & Probability	6	Find partial sums of arithmetic and geometric series			
Mathematics	Algebra 2	Data Analysis & Probability	7	Solve contextual word problems involving applications of sequences and series, write the formula for the general term for arithmetic and geometric sequences and make connections to linear and exponential functions			

Pre-Calculus

All in all, this is a very weak set of pre-calculus standards. There seems to be no mention of the fundamental theorem of algebra and how it helps students graph functions. There is no tie in to complex numbers, and no discussion of the crucial subject of conic sections. There is no discussion of the basic proof technique of mathematical induction. There is no discussion of rational functions and the properties of their graphs (roots, poles, asymptotic behavior, etc.) There is no discussion of parametric functions and equations. There is no discussion of limits.

Content Area	Course	Strand	Number	Content Area Topic			
Mathematics	Pre-Calculus	Polynomials	1	Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).			
Mathematics	Pre-Calculus	Quadratic	2	Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2 = q that has the same solutions. Derive the quadratic formula from this form.			
Mathematics	Pre-Calculus	Functions	3	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity	Has extraneous terms. Revise as follows:	Interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity	
Mathematics	Pre-Calculus	Functions	4	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers	Awkward. Revise	Recognize that sequences are functions, whose domain is a subset of the integers	
							Understand the meaning of defining the terms of a sequence by a closed formula and determine examples
							Understand the meaning of defining the terms of a sequence recursively and determine examples.
Mathematics	Pre-Calculus	Functions	5	Understand composition of functions and combine functions by composition.	Awkward. Revise	Know that the composition of functions f(x) and g(y) is the function f(g(y)), i.e, set x = g(y) and then take f(x) and combine functions by composition.	
							determine the compositions of specified functions. For example if f(x) = sin(x) and g(y) = y^2, then the composition f(g(y)) is sin(y^2), but the composition g(f(x)) is (sin(x))^2
							Know that the inverse of a function f(x), is that function g(y), if it exists, so that g(f(x)) = x. For example, if f(x) = x^2, then for the domain y greater than or equal to 0, f(x) has g(y) as its inverse function where g(y) is the positive square root of y.
Mathematics	Pre-Calculus	Functions	6	Find and verify by composition that one function is the inverse of another.	substandard		Produce an invertible function from a non-invertible function by restricting the domain
Mathematics	Pre-Calculus	Functions	7	Produce an invertible function from a non-invertible function by restricting the domain	substandard		
Mathematics	Pre-Calculus	Functions	8	Find a quadratic, exponential, logarithmic, power, or sinusoidal function to model a data set and explain the parameters of the model.	too vague.		
Mathematics	Pre-Calculus	Functions	9	Determine if a graph or table has and inverse and if it has an inverse is the inverse a function or relation. Identify the values of an inverse function/relation from a graph or a table, given that the function has an inverse. Justify the values are on the inverse function/relation. Derive the inverse equation from the values of the inverse.	???		
Mathematics	Pre-Calculus	Exponential	10	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another	???		
Mathematics	Pre-Calculus	Logarithms	11	Use the definition of logarithms to convert logarithms from one base to another, prove simple laws of logarithms.			
Mathematics	Pre-Calculus	Logarithms	12	Use the properties of logarithms to simplify logarithmic expressions and to find their approximate values.			
Mathematics	Pre-Calculus	Exponential and Logarithmic	13	For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.			
Mathematics	Pre-Calculus	Exponential and Logarithmic	14	Solve logarithmic and exponential equations and inequalities.			
Mathematics	Pre-Calculus	Functions	15	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x),f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them			
Mathematics	Pre-Calculus	Conics	16	Determine how the graph of a parabola changes if a, b and c changes in the equation y = a(x – b)2 + c. Find an equation for a parabola when given sufficient information			
Mathematics	Pre-Calculus	Conics	17	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation			
Mathematics	Pre-Calculus	Conics	18	Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant			
Mathematics	Pre-Calculus	Conics	19	Graph conic sections. Identify and describe features like center, vertex or vertices, focus, directrix, axis of symmetry, major axis, minor axis, and eccentricity.			
Mathematics	Pre-Calculus	Complex Numbers	20	Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.			

Mathematics	Pre-Calculus	Complex Numbers	21	Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
Mathematics	Pre-Calculus	Complex Numbers	22	Represent addition, subtraction, multiplication, and conjugation of complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
Mathematics	Pre-Calculus	Algebra & Functions	23	State, prove, and use De Moivre's Theorem
Mathematics	Pre-Calculus	Geometry	1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments
Mathematics	Pre-Calculus	Geometry	2	Prove the Pythagorean Theorem and its converse and use them to solve problems, including problems involving the length of a segment in the coordinate plane
Mathematics	Pre-Calculus	Geometry	3	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. Visualize solids and surfaces in three-dimensional space when given two-dimensional representations, and create two-dimensional representations for the surfaces of three-dimensional objects
Mathematics	Pre-Calculus	Data Analysis & Probability	1	Describe the concept of the limit of a sequence and a limit of a function. Decide whether simple sequences converge or diverge. Recognize an infinite series as the limit of a sequence of partial sums
Mathematics	Pre-Calculus	Calculus	1	Decide if a function is continuous at a point, understand continuity in terms of limits
Mathematics	Pre-Calculus	Calculus	2	Find the types of discontinuities of a function and relate them to fininding limits of a function.
Mathematics	Pre-Calculus	Calculus	3	Understand the concept of limit and estimate limits from graphs and tables of values
Mathematics	Pre-Calculus	Calculus	4	Find limits at infinity

Trigonometry

This is not a strong trig course. To begin, there should be standards recalling and studying the definitions of not only the sine and cosine function, but also tan, cotan, sec, and csc. For example, students should know that if T is the angle a straight line makes with the x-axis, then tan(T) is the slope of this line. There should be a large number of indications of the applications to things like finding distances on the surface of a sphere – for example, using the distance from the observer to the horizon to measure the radius of the sphere, as well as others involved in surveying and related areas. There should be standards concerned with graphing functions of the form sin(Ax + B) and cos(Ax + B), and a discussion of frequency, period and magnitude for functions of the form Rsin(Ax + B) + Scos(Ax + B). There should be at least some discussion of the inverse trig functions, arcsin, arccos, arctan, and students should know how to graph them and why the domain of the inverse function should be restricted. There should be standards on polar coordinates and translating between rectangular and polar coordinates.

Content Area	Course	Strand	Number	Content Area Topic	
Mathematics	Trigonometry	Unit Circle	1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle	Not entirely sure about this. Need to assume that one goes around the circle in a clockwise direction, and one has to note that 2pi radians must equal 0 radians. It is almost certainly better to begin by measuring angles in terms, directly, of the intersection of the unit circle with the rays defining the angle.
Mathematics	Trigonometry	Unit Circle	2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle	This should probably appear after the next standard. Then a key extension of the standard would be to show that the basic trig functions are periodic. Another key extension is to note that one can define periodic functions with DIFFERENT periods via e.g. cos(ct), sin(ct). Finally, one can define the amplitude, and frequency for such functions.
Mathematics	Trigonometry	Unit Circle	3	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions	This is ok, but needs expansion. First, having fixed a Cartesian coordinate system, one notes that every vector on the unit circle has the form (a, b) with a^2 + b^2 = 1. Then one DEFINES cos(t) = a, sin(t) = b where t is the radian measure of the angle subtended between (1,0) and (a, b) with vertex at (0,0). Then one notes that reflection about the x-axis takes (a, b) to (a, -b), while the angle measured by t goes to the angle measured by -t. Thus, cos(t) is automatically even and sin(t) is automatically odd.
Mathematics	Trigonometry	Functions	4	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline	This could use some detail showing examples of the kinds of situation that you expect..
Mathematics	Trigonometry	Functions	5	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed	ok as stated
Mathematics	Trigonometry	Functions	6	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context	could use more detail showing examples of the kinds of problems that you expect to occur here.

Mathematics	Trigonometry	Identities	7	Prove the Pythagorean identity sin2(?) + cos2(?) = 1 and use it to find sin(?), cos(?), or tan(?) given sin(?), cos(?), or tan(?) and the quadrant of the angle	I'm not sure that the quadrant of an angle has anything to do with sin^2(t) + cos^2(t) = 1, since the relevant angles in all four quadrants have exactly the same squares of their sines and cosines.
Mathematics	Trigonometry	Algebra & Functions	8	Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems	ok as stated
Mathematics	Trigonometry	Algebra & Functions	9	Prove the double- and half-angle formulas for sine, cosine, and tangent and use them to solve problems	ok as stated
Mathematics	Trigonometry	Geometry	1	Define and use the trigonometric functions (sine, cosine, tangent, cotangent, secant, cosecant) in terms of angles of right triangles	I wonder if this shouldn't come more in the beginning of the course – initial definitions of sine and cosine, and using them to define the remaining four basic trig functions.
Mathematics	Trigonometry	Geometry	2	Solve contextual problems that can be modeled using right triangles, including problems that can be modeled using trigonometric functions. Interpret the solutions and determine whether the solutions are reasonable. Use technology as appropriate	Same comment. Should be preliminary material. Also, there should be examples of the kinds of problems to be covered.
Mathematics	Trigonometry	Geometry	3	Explain and use the relationship between the sine and cosine of complementary angles	ok as stated
Mathematics	Trigonometry	Geometry	4	Use special triangles to determine geometrically the values of sine, cosine, tangent for p/3, p/4 and p/6, and use the unit circle to express the values of sine, cosine, and tangent for x, p + x, and 2p – x in terms of their values for x, where x is any real number	ok as stated
Mathematics	Trigonometry	Geometry	5	Prove the Laws of Sines and Cosines and use them to solve problem	This is usually covered in a geometry course, but the suggested applications, in the next standard, are more advanced, and should be the point of emphasis in a trig course.
Mathematics	Trigonometry	Geometry	6	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces)	ok as stated
Mathematics	Trigonometry	Geometry	7	Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side	I don't think it is necessary to describe the method of proof. There are other methods that can be used.

Finite Math

Content Area	Course	Number	Content Area Topic	
Mathematics	Finite Math	1	Explain and illustrate the role of definitions, conjectures, theorems, proofs and counterexamples in mathematical reasoning. Construct logical arguments, assess the validity of logical arguments and give counterexamples to disprove statements	
Mathematics	Finite Math	2	Use mathematical induction to prove simple propositions	This standard is out of place here. It should appear after what is currently the fifth standard.
Mathematics	Finite Math	3	Recognize syllogisms, tautologies, flawed reasoning and circular reasoning	
Mathematics	Finite Math	4	Know and use the concepts of sets, elements and subsets	
Mathematics	Finite Math	5	Perform operations on sets (union, intersection, complement, cross product)	
Mathematics	Finite Math	6	Explore function iteration and, in the process, informally introduce function composition	
Mathematics	Finite Math	7	Use networks, traceable paths, tree diagrams, Venn diagrams, and other pictorial representations to find the number of outcomes in a problem situation	
Mathematics	Finite Math	8	Optimize networks in different ways and in different contexts by finding minimal spanning trees, shortest paths, and Hamiltonian paths	
Mathematics	Finite Math	9	Use critical-path analysis to solve scheduling problems	Much more difficult than previous standards. Perhaps it should come later.
Mathematics	Finite Math	10	Construct and interpret directed and undirected graphs, decision trees, networks and flow charts	This should be expanded with a number of examples given to illustrate what parts of this gigantic subject should be covered.
Mathematics	Finite Math	11	Understand matrices as systems that have some of the properties of the real-number system.	I don't know what this means. Be much more specific. What properties?
Mathematics	Finite Math	12	Multiply matrices by scalars to produce new matrices.	
Mathematics	Finite Math	13	Add, subtract, and multiply matrices of appropriate dimensions (i.e. up to 3x3 matrices).	
Mathematics	Finite Math	14	Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.	The determinant should appear later, probably as a separate standard.
Mathematics	Finite Math	15	Use the properties of matrix multiplication, including identity and inverse matrices, to solve problems.	Needs examples to illustrate which areas should be covered.
Mathematics	Finite Math	16	Use matrices to solve real-world problems that can be modeled by a system of equations (i.e. up to 3 linear equations) in two or three variables using technology.	
Mathematics	Finite Math	17	Use an adjacency matrix to describe a vertex-edge graph	
Mathematics	Finite Math	18	Perform row and column sums for matrix equations	I don't know what you want here. Clarify, and if you have specific kinds of problems in mind for this standard, give a few..
Mathematics	Finite Math	19	Build and use matrix representations to model polygons, transformations, and computer animations	This is almost certainly too advanced as stated. This is another standard that must be illustrated by specific problems.
Mathematics	Finite Math	20	Understand vectors as systems that have some of the properties of the real-number system	As with matrices, I don't know what you want here. Which properties? How do they help you?
Mathematics	Finite Math	21	Solve problems involving velocity and other quantities that can be represented by vectors	Finite math?
Mathematics	Finite Math	22	Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(vx, vy) = (cvx, cvy)	I don't know what kinds of problems are appropriate for this and the next standard. They must be illustrated by examples.
Mathematics	Finite Math	23	Compute the magnitude of a scalar multiple cv using $\lVert cv \rVert = \lvert c \rvert v$. Compute the direction of cv knowing that when $\lvert c \rvert v$? 0, the direction of cv is either along v (for c > 0) or against v (for c < 0)	See above.
Mathematics	Finite Math	24	Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors	Expand out. This is more than a single standard.
Mathematics	Finite Math	25	Use graph-coloring techniques to solve problems	Same issue. This is a huge area. Specify the limits of what is desired.
Mathematics	Finite Math	26	Use bin-packing techniques to solve problems of optimizing resource usage	See above.

Mathematics	Finite Math	27	Convert between a pair of parametric equations and an equation in x and y	This and the next two standards are probably not appropriate in a finite math course. But if you want to include them, I feel you need to limit what is desired and give sample problems.
Mathematics	Finite Math	28	Analyze planar curves, including those given in parametric form	
Mathematics	Finite Math	29	Model and solve problems using parametric equations	
Mathematics	Finite Math	30	Use row-reduction techniques to solve problems	This goes in the section on matrices which is above.
Mathematics	Finite Math	31	Use Markov chains to solve problems	This is an example of the use of matrices in applications and should be included in the standards on matrices that are above.
Mathematics	Finite Math	32	Use finite differences to solve problems	These last five standards are entirely appropriate, but again, it would be a good idea to give sample problems to indicate the limits of the expected instruction.
Mathematics	Finite Math	33	Use graphs consisting of vertices and edges to model a problem situation	
Mathematics	Finite Math	34	Use minimal spanning trees to solve problems	
Mathematics	Finite Math	35	Use geometric techniques to solve optimization problems	
Mathematics	Finite Math	36	Use the Simplex method to solve optimization problems with and without technology	

Probability & Statistics

Content Area	Course	Number	Content Area Topic
Mathematics	Probability & Statistics	1	Create, compare, and evaluate different graphic displays of the same data, using histograms, frequency polygons, cumulative frequency distribution functions, pie charts, scatterplots, stem-and-leaf plots, and box-and-whisker plots. Draw these by hand or use a computer spreadsheet program
Mathematics	Probability & Statistics	2	Compute and use mean, median, mode, weighted mean, geometric mean, harmonic mean, range, quartiles, variance, and standard deviation
Mathematics	Probability & Statistics	3	Define and use the mathematical induction method of proof
Mathematics	Probability & Statistics	4	Understand the central limit theorem and use it to solve problems
Mathematics	Probability & Statistics	5	Compute and use confidence intervals to make estimates
Mathematics	Probability & Statistics	6	Construct and interpret margin of error and confidence intervals for population proportions
Mathematics	Probability & Statistics	7	Compute and interpret the expected value of random variables in simple cases
Mathematics	Probability & Statistics	8	Understand and use the addition rule to calculate probabilities for mutually exclusive and nonmutually exclusive events
Mathematics	Probability & Statistics	9	Understand and use the multiplication rule to calculate probabilities for independent and dependent events
Mathematics	Probability & Statistics	10	Use counting techniques to solve probability problems
Mathematics	Probability & Statistics	11	Calculate the probabilities of complementary events
Mathematics	Probability & Statistics	12	Understand the conditional probability of A given B as P(A andB)/P(B), and interpret independence of A and B as saying that the conditional probability of A givenB is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B and use Bayes' Theorem and use them to solve problems
Mathematics	Probability & Statistics	13	Determine the probability of simple events involving independent and dependent events and conditional probability. Analyze probabilities to interpret odds and risk of events
Mathematics	Probability & Statistics	14	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent
Mathematics	Probability & Statistics	15	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution
Mathematics	Probability & Statistics	16	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game)
Mathematics	Probability & Statistics	17	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions
Mathematics	Probability & Statistics	18	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values
Mathematics	Probability & Statistics	19	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value
Mathematics	Probability & Statistics	20	Use simulations to solve counting and probability problems
Mathematics	Probability & Statistics	21	Use the relative frequency of a specified outcome of an event to estimate the probability of the outcome and apply the law of large numbers in simple examples
Mathematics	Probability & Statistics	22	Recognize how linear transformations of univariate data affect shape, center, and spread
Mathematics	Probability & Statistics	23	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities
Mathematics	Probability & Statistics	24	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation
Mathematics	Probability & Statistics	25	Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable
Mathematics	Probability & Statistics	26	Identify, display, and discuss trends in bivariate data and find functions that model the data or transform the data so that they can be modeled
Mathematics	Probability & Statistics	27	Distinguish between random and non-random sampling methods, identify possible sources of bias in sampling, describe how such bias can be controlled and reduced, evaluate the characteristics of a good survey and well-designed experiment, design simple experiments or investigations to collect data to answer questions of interest, and make inferences from sample results
Mathematics	Probability & Statistics	28	Evaluate information based on data by considering the source of the data, the design of the study, the way the data are analyzed and displayed, and whether the report confuses correlation with causation
Mathematics	Probability & Statistics	29	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
Mathematics	Probability & Statistics	30	Select and use appropriate statistical methods to analyze data
Mathematics	Probability & Statistics	31	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling
Mathematics	Probability & Statistics	32	Use election theory techniques to analyze election data
Mathematics	Probability & Statistics	33	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve
Mathematics	Probability & Statistics	34	Analyze and apply algorithms for searching (sequential, binary), for sorting (bubble sort, quick sort, bin sort) and for solving optimization problems
Mathematics	Probability & Statistics	35	Analyze and interpret relationships defined iteratively and recursively. Use recursive thinking to solve problems
Mathematics	Probability & Statistics	36	Define arithmetic and geometric sequences recursively. Use a variety of recursion equations to describe a function.
Mathematics	Probability & Statistics	37	Construct simulated sampling distributions of sample proportions and use sampling distributions to identify which proportions are likely to be found in a sample of a given size
Mathematics	Probability & Statistics	38	Construct vertex-edge graph models involving relationships among a finite number of elements
Mathematics	Probability & Statistics	39	Derive the binomial theorem by combinatorics
Mathematics	Probability & Statistics	40	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not")
Mathematics	Probability & Statistics	41	Determine the number of ways events can occur using permutations, combinations and the Fundamental Counting Principle
Mathematics	Probability & Statistics	42	Determine whether two propositions are logically equivalent
Mathematics	Probability & Statistics	43	Develop the skill of algorithmic problem solving: designing, using, and analyzing systematic procedures for problem solving
Mathematics	Probability & Statistics	44	Distinguish between inductive and deductive reasoning. Identify inductive reasoning as central to the scientific method and deductive reasoning as characteristic of mathematics

Mathematics	Probability & Statistics	45	Experience in mathematical modeling by building and using vertex-edge graph models to solve problems in a variety of real-world settings
Mathematics	Probability & Statistics	46	Explore the geometric, or waiting-time, distribution
Mathematics	Probability & Statistics	47	Find linear models by using median fit and least squares regression methods. Decide which among several linear models gives a better fit. Interpret the slope in terms of the original context
Mathematics	Probability & Statistics	48	Informally assess the fit of a function by plotting and analyzing residuals
Mathematics	Probability & Statistics	49	Make predictions from the least squares regression line or its equation
Mathematics	Probability & Statistics	50	Model and solve problems involving patterns using recursion and iteration, growth and decay, and compound interest
Mathematics	Probability & Statistics	51	Model and solve word problems involving applications of sequences and series, interpret the solutions and determine whether the solutions are reasonable
Mathematics	Probability & Statistics	52	Understand and apply basic ideas related to the design and interpretation of surveys, such as background information, random sampling, and bias
Mathematics	Probability & Statistics	53	Understand and apply recursion equations, particularly combined recursion equations of the form An = rAn-1 + b.
Mathematics	Probability & Statistics	54	Understand how basic statistical techniques are used to monitor process characteristics in the workplace
Mathematics	Probability & Statistics	55	Understand how sample statistics reflect the values of the population parameters and use sampling distributions as the basis for informal inference
Mathematics	Probability & Statistics	56	Understand statistics as a process for making inferences about population parameters based on a random sample from that population
Mathematics	Probability & Statistics	57	Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each
Mathematics	Probability & Statistics	58	Use a recursion function to describe a fractal
Mathematics	Probability & Statistics	59	Use and interpret relational conjunctions (and, or, not), terms of causation (if… then) and equivalence (if and only if). Distinguish between the common uses of such terms in everyday language and their use in mathematics
Mathematics	Probability & Statistics	60	Use combinatorial reasoning to solve problems
Mathematics	Probability & Statistics	61	Use fair division techniques to solve apportionment problems and to divide continuous objects
Mathematics	Probability & Statistics	62	Use game theory to solve strictly and non strictly determined games
Mathematics	Probability & Statistics	63	Use iteration and recursion as tools to represent, analyze, and solve problems involving sequential change
Mathematics	Probability & Statistics	64	Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions
Mathematics	Probability & Statistics	65	Use truth tables to determine the truth values of propositional statements
Mathematics	Probability & Statistics	66	Use weighted voting techniques to decide voting power within a group

Calculus

There are too many standards here, and some key material is missing. What follows are my detailed comments.

The first standard is far too broad. Limit it by specifying the kinds of functions desired.

The second standard, as stated, is clearly too difficult for high school students. Limit it by specifying the kinds of functions desired.

The third standard is out of place. After all, continuity is defined in terms of limits. So I would suggest that this is a key standard, and the second standard should be a substandard. For that matter, so should the first standard.

The fourth standard is also a substandard of the third, as are the fifth, sixth and seventh, 9th and 10th.

I do not understand what you mean by the eighth standard. Examples are needed to clarify it.

The 11th standard is fine.

The 12th standard is ok as well, but, since the proof involves connectedness, and this is too advanced for high school, it should be specified that the extreme value theorem should not be proved.

The thirteenth standard should be decomposed into a number of substandards for the 18th standard.

The fourteenth standard should be a substandard of the 12th.

The fifteenth standard should be something along these lines. Key standard: Relate the inflection points of an at least two times differentiable function to the vanishing of the second derivative. Then each sentence of the fifteenth standard should be a substandard of this key standard.

The 16th standard should be a substandard of the 18th, as should the 17th, 19th and 20th.

The 21st standard should consist of the key standard "Know and understand the chain rule." With "Find the derivatives of composite functions" as a substandard.

22 should also be a Key standard

23 is poorly phrased and I don't really understand it. Clarify.

24 should be a substandard of 18.

25 should be attached to the new key standard "Know and understand the definition of the logarithmic derivative" which has 25 as a substandard.

26 I don't understand this standard as written. What do you mean? Give examples.

27 ok. But probably should appear earlier. It is a key standard.

28 should probably be a substandard of the key standard associated to the 15th.

For 29, analyze HOW? What kinds of things do you want students to say, and what kinds of graphs should they apply them to?

30 should be two substandards of the 15th.

31 Actually, what you do with inverse functions is to use the relation, f(f^{-1}) = identity and the chain rule to find the derivative of an inverse function. The standard on line 31 should appear as a substandard of the chain-rule key standard, and it should appear in the form I just gave.

32 Needs examples to limit it

33 could be a substandard of the differentation standard, but could be a key standard on its own due to the importance of these kinds of applications.

34 is a substandard of 33.

35 is unclear to me. Give examples to show what you have in mind.

36 Should be prefaced with some kind of standard relating to the definition of the (Riemann) integral, and it probably should be a substandard, as should be the case with 37, 38.

39 is fouled up. It is f'(x) (DELTA(x) = b-a) = f(b) - f(a) for an appropriate x in the interval [a, b].

40 key standard. But limit it, specifying the kinds of functions to integrate. Also break up into key standard and substandards.

39 is fouled up. It is f'(x) (DELTA(x) = b-a) = f(b) - f(a) for an appropriate x in the interval [a,b] 40 is a key standard. But limit it, specifying the kins of functions to integrate. Also break up into key standards and substandards. 41 is unclear “what properties?” Clarify and probably make it a substandard of the key standard in 40. All the remaining standards needto be clarified and limited, and a number of them should be substandards of previous standards.

Content Area	Course	Number	integrate. Also break up into key standard and substandards.
Mathematics	Calculus	1	41 is unclear "what properties?" Clarify and probably make it a substandard
Mathematics	Calculus	2	of the key standard in 40.
Mathematics	Calculus	3	All the remaining standards need to be clarified and limited, and a number
Mathematics	Calculus	4	ofthem should be substandards of previous standards.
Mathematics	Calculus	5	the (Riemann) integral, and it probably should be a substandard, as should be
Mathematics	Calculus	6	the case with 37, 38.
Mathematics	Calculus	7	39 is fouled up. It is f'(x) (DELTA(x) = b-a) = f(b) - f(a) for an
Mathematics	Calculus	8	appropriate x in the interval [a, b].
Mathematics	Calculus	9	40 key standard. But limit it, specifying the kinds of functions to
Mathematics	Calculus	10	integrate. Also break up into key standard and substandards.
Mathematics	Calculus	11	41 is unclear "what properties?" Clarify and probably make it a substandard
Mathematics	Calculus	12	of the key standard in 40.
Mathematics	Calculus	13	All the remaining standards need to be clarified and limited, and a number
Mathematics	Calculus	14	ofthem should be substandards of previous standards.
Mathematics	Calculus	15	
Mathematics	Calculus	16	The 11th standard is fine.
Mathematics	Calculus	17	The 12th standard is ok as well, but, since the proof involves connectedness,
Mathematics	Calculus	18	
Mathematics	Calculus	19	extreme value theorem should not be proved.
Mathematics	Calculus	20	Find the derivatives of sums, products, and quotients

Mathematics	Calculus	21	The thirteenth standard should be decomposed into a number of substandards for
Mathematics	Calculus	22	the 18th standard.
Mathematics	Calculus	23	Find derivatives as inverse functions
Mathematics	Calculus	24	The fourteenth standard should be a substandard of the 12th.
Mathematics	Calculus	25	Find derivatives using logarithmic differentiation
Mathematics	Calculus	26	The fifteenth standard should be something along these lines. Key standard:
Mathematics	Calculus	27	Relate the inflection points of an at least two times differentiable function
Mathematics	Calculus	28	to the vanishing of the second derivative. Then each sentence of the
Mathematics	Calculus	29	fifteenth standard should be a substandard of this key standard.
Mathematics	Calculus	30	Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of f, f', and f"
Mathematics	Calculus	31	The 16th standard should be a substandard of the 18th, as should the 17th,
Mathematics	Calculus	32	19th and 20th.
Mathematics	Calculus	33	Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration
Mathematics	Calculus	34	The 21st standard should consist of the key standard "Know and understand the
Mathematics	Calculus	35	chain rule." With "Find the derivatives of composite functions" as a
Mathematics	Calculus	36	substandard.
Mathematics	Calculus	37	Calculate the values of Riemann Sums over equal subdivisions using left, right, and midpoint evaluation points
Mathematics	Calculus	38	22 should also be a Key standard
Mathematics	Calculus	39	Understand the Fundamental Theorem of Calculus: Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval, that is f'(x)dx = f(b) - f(a).
			23 is poorly phrased and I don't really understand it. Clarify.
Mathematics	Calculus	40	Use the Fundamental Theorem of Calculus to evaluate definite and indefinite integrals and to represent particular antiderivatives. Perform analytical and graphical analysis of functions so defined
Mathematics	Calculus	41	24 should be a substandard of 18.
Mathematics	Calculus	42	Understand and use integration by substitution (or change of variable) to find values of integrals
Mathematics	Calculus	43	25 should be attached to the new key standard
Mathematics	Calculus	44	Know and understand the definition of the logarithmic derivative which has 25 as a substandard.
Mathematics	Calculus	45	Solve separable differential equations and use them in modeling
Mathematics	Calculus	46	26 I don't understand this standard as written. What do you mean? Give
Mathematics	Calculus	47	examples.
Mathematics	Calculus	48	Use definite integrals to find the average value of a function over a closed interval
Mathematics	Calculus	49	27 ok. But probably should appear earlier. It is a key standard.
Mathematics	Calculus	50	Apply integration to model and solve problems in physics, biology, economics, etc., using the integral as a rate of change to give accumulated change and using the method of setting up an approximating Riemann Sum and representing its limit as a definite integral

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For 29, analyze HOW? What kinds of things do you want students to say, and what kinds of graphs should they apply them to?

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41 is unclear "what properties?" Clarify and probably make it a substandard of the key standard in 40.

All the remaining standards need to be clarified and limited, and a number ofthem should be substandards of previous standards.

I've attached the third file. And below is my commentary.

Yours,
Jim Milgram

Summary report.

The first file MathematicsK-5-Standards_draft031414-commented.xls does not contain any comments on grades 5 and 6 because these grades are also contained in the second file, Mathematics 6-8 Standards with Algebra 1_draft031414-commented.xls, where they are analyzed and commented on. Likewise, this second file does not contain any comments on grade 8 and Algebra as they are contained in the third file, Mathematics 9-12 Standards_draft031414-commented.xls
where they are analyzed and commented on.

In the third file I also preface each course with comments including a list of topics that should be present but are not. Here they are for easy
reference:
GRADE 8:
Comment: I've expanded the standards listed in Col E into main standards and substandards in columns G and H. Once this is done, it becomes evident that there are far too many standards hidden in many "standards" in Col. E.
Moreover, as written most of the Col. E standards are very, very difficult to parse, and some of them are too vague. Hopefully, these issues have also been fixed in columns G and H. In the data section I parsed and fixed some of the standards, but, in the end, I left it up to the standards writers to fix this material. You should understand that one of the ways Core Standards got "fewer" standards than most states was to glom many individual standards together. So what I've mostly done here is to "unglom" the worst offenders.

ALGEBRA 1:
Missing standards: Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents. Understand the concept of slope of a line, find the x and y intercepts of the graph of $y = ax + b$ and determine the slope. Apply algebraic techniques to solve rate
problems, work problems and mixture problems.

GEOMETRY:
Much to my surprise, except for the fact that there are too many standards, the standards here seem entirely reasonable, and a huge and very welcome change from the Core Standards Geometry standards. There should be about half as many standards, in the neighborhood of 25, and they should be the more important of the standards listed here.

ALGEBRA 2:
The standards on lines 73, 74, 75 are not part of data analysis and should be moved up Missing standards: specific examples of factorizations -- suggested, sums or differences of two cubes, differences of 2 nth powers. Plot complex numbers in the plane. Divide complex numbers where the denominator is non-zero.

Evaluate rational expressions for selected values of the variable. Students evaluate how the graph of a quadratic function ax^2 + bx +c changes for changes in the constants, a, b, and c. The same for quadratic functions of two variables: ax^2 + by^2 + cxy + dx + ey + f.
For logarithms and exponentials students need to know how to evaluate these functions for different bases, e.g. log_a(x +1) is related to log_b(x + 1) in what way? Using properties of logarithms students simplify logarithmic expressions and determine their approximate values. Apply the principles of mathematical induction to prove general statements about whole numbers.

PRE-CALCULUS:
All in all, this is a very weak set of pre-calculus standards. There seems to be no mention of the fundamental theorem of algebra and how it helps students graph functions. There is no tie in to complex numbers, and no discussion of the crucial subject of conic sections. There is no discussion of the basic proof technique of mathematical induction. There is no discussion of rational functions and the properties of their graphs (roots, poles, asymptotic behavior, etc.) There is no discussion of parametric functions and equations.
There is no discussion of limits.

TRIGONOMETRY:
This is not a strong trig course. To begin, there should be standards recalling and studying the definitions of not only the sine and cosine function, but also tan, cotan, sec, and csc. For example, students should know that if T is the angle a straight line makes with the x-axis, then tan(T) is the slope of this line. There should be a large number of indications of the applications to things like finding distances on the surface of a sphere – for example, using the distance from the observer to the horizon to measure the radius of the sphere, as well as others involved in surveying and related areas. There should be standards concerned with graphing functions of the form sin(Ax + B) and cos(Ax + B), and a discussion of frequency, period and magnitude for functions of the form Rsin(Ax + B) + Scos(Ax + B). There should be at least some discussion of the inverse trig functions, arcsin, arccos, arctan, and students should know how to graph them and why the domain of the inverse function should be restricted. There should be standards on polar coordinates and translating between rectangular and polar coordinates.

FINITE-MATH:
I commented on the individual standards, but didn't show how I would suggest revising them. (By this point I would expect the writing team to know and understand what these kinds of concerns are.)

PROBABILITY AND STATISTICS:
This is not an area where I consider myself to be an expert. However, if it is felt that you would want my input here, even though it would be an effort, I would be willing to oblige.

CALCULUS:
There are too many standards here, and some key material is missing. What follows are my detailed comments.
The first standard is far too broad. Limit it by specifying the kinds of functions desired.
The second standard, as stated, is clearly too difficult for high school students. Limit it by specifying the kinds of functions desired.
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41 is unclear "what properties?" Clarify and probably make it a substandard of the key standard in 40.
All the remaining standards need to be clarified and limited, and a number ofthem should be substandards of previous standards.

Yours,
Jim Milgram

SUMMARY OF NATIONAL EVALUATOR INPUT INTO DRAFT #2 OF THE INDIANA ACADEMIC STANDARDS, VERSION DATED MARCH 14, 2014

On February 13-14, 2014, the academic standards Evaluation Panels met during a public meeting to complete a blind evaluation of standards that best aligned with college and career ready learning outcomes. This resulted in a draft set of academic standards, labeled "Draft #1", which was posted for public comment from February 19 through March 12. Six independent evaluators were also invited to provide feedback on Draft #1, and four agreed to do so. These individuals are:

- Dr. James Milgram, Ph.D., Stanford University
- Dr. Shauna Findlay, Ph.D., Indiana ASCD
- Ms. Janet Rummel, Indiana Network of Independent Schools
- Ms. Kathleen Porter-Magee, Fordham Institute

Following the close of the public comment period on Draft #1, the Standards Leadership Development Team and Indiana Department of Education content specialists incorporated the feedback from independent evaluators and the public comments into a second draft of the standards, labeled "Draft #2" and dated March 14, 2014. Draft #2 was distributed to six national evaluators, who were invited to provide feedback on Draft #2. These evaluators are:

- Dr. Sandra Stotsky – E/LA
- Dr. Terrence Moore, Hillsdale College – E/LA
- Joanne Eresh (Achieve) – E/LA
- Dr. James Milgram (Stanford University) – Math
- Professor Hung-Hsi Wu (UC Berkeley) – Math
- Kaye Forgione (Achieve) – Math

The attached document contains the evaluator reports on Draft #2. Full reports were submitted by April 1, 2014, and were used to inform the work of the Indiana College & Career Ready Panel.

It is important to note that the evaluators provided their feedback on Draft #2, and were not asked to provide input on the final proposed 2014 Indiana Academic Standards released to the public on April 15, 2014. By design, it was the Indiana College & Career Ready Panel that was responsible for assessing all independent evaluator input and determining how this input would be reflected in Indiana's new standards.

We are grateful to the national evaluators for their time and effort. Their input was invaluable to the development of Indiana's new academic standards, and their feedback is reflected throughout the version released to the public on April 15, 2014.

Review of Indiana Draft English Standards
Overview of K-5 Standards

Terrence O. Moore, Ph.D.
Hillsdale College
Resident of Angola, Indiana

Attached you will find my review of the K-5 English Standards. That review is aimed at each standard and does not make for the most engaging reading. Therefore I offer this overview of the standards in order to make clear my general findings.

The Indiana Draft Standards are an utter disappointment. They were clearly "written" in a rush, and that rush is being passed on to the reviewers who were initially given a whole ten days to review the standards. Nonetheless, it is not clear that the committee brought together to rewrite the standards could have done much better had months been given to what has become known as "the process." The reasons are contained in the fatal flaws of these standards as they now stand.

First, the new draft standards are simply the Common Core: in many cases simply cut-and-pasted, in others slightly rewritten. To this end, I have noted in my review where the Indiana committee simply followed the Common Core. This derivative quality must be known since the whole country right now imagines that Indiana educators are writing "Hoosier standards for Hoosier students." That will plainly not be the case if the present version of these standards remains *in any shape or form*, and any testimony that such an echo of the Common Core differs significantly with the Common Core must be an effort to deceive. Of course, what the next draft may amount to remains to be seen.

Second, the problem with the Common Core and all other state standards in the country is that they are written in an impenetrable edu-speak that parents and citizens cannot understand. For that matter, virtually every elected official would not be able to explain these standards; and it is a charade to call these or any others written in this way "good standards." Could the governor or the state superintendent of education or anyone on the state school board or any legislator or any superintendent of any district in the state explain how to teach "at least the initial sounds or many of the most frequent sounds for each consonant"? (See my analysis of this absurdity in the review.) I for one believe that genuine academic standards should be fairly straightforward and easy to understand for any tolerably educated person. Yet when I go all over the state and ask people whether they have tried to read the standards, they shake their heads and throw up their hands as though in an act of surrender. This "complexity" is not because the standards contain any high truths or sophisticated insights. It is rather that the authors of standards are trying to disguise really mediocre and sometimes silly advice in terms that seem exceedingly hard and sublime. The standards-writers make raising your hand to speak in class seem like an epic event. In trying to convince the public of such sophistication, the standards-writers often say things that are simply not true and often absurd. I think that a large part of any standards review should consist in translating these "standards" into plain English. To that end, I have provided several such translations, at times with humor.

Third, the K-5 standards, whose purpose in the early grades should be to teach the fundamentals of reading and spelling, are clearly written with either an anti-phonics bias or a lack of understanding of how an explicit phonics program actually works. I have spent the bulk of my time painstakingly going through the Kindergarten and first-grade reading standards because those are what determine whether students learn how to read and spell properly. To some it may seem like nit-picking. Yet what I have found is that these standards use certain phonics terms very loosely while really encouraging a partly faux-phonics, partly whole language approach. The standards do not require teachers to do the most obvious thing: to teach the phonograms in isolation and then to spell words for the students by breaking down each word, phonogram by phonogram. That constant exercise then leads to students being able to read by "sounding out" each word, yet with the real tools of how the different parts of words work. There is no indication in these standards that the present authors have any concept of how real phonics is to be taught.

Fourth, another mischief to be found in these standards is the questionable dictating of teaching practices in the name of standards. For example, in the speaking and listening standards, there is a constant call for students to work one-on-one and in groups. Why? Obviously, this is a leading tenet of progressive education. Classical schools do not use those techniques to teach their classes, particularly not in English. Either the direction to put students in groups would be a piece of unwanted advice or it would be an egregious interference with proven teaching practices, one the state has no business to impose. In fact, such an overreach should be considered a blow to school choice.

Fifth, all of the above deficiencies probably flow from a lack of clarity concerning what an academic standard should be. Should having students do homework and raise their hands in class when they want to speak be academic standards? Meanwhile, we are given no indication what books students ought to be reading; we are simply offered the opaque phrase "age-appropriate texts." Most of what is written in the draft standards should probably not be considered standards at all. If so, then what should standards be? That is a much larger discussion, but one I am happy to have if anyone is interested.

Indiana English Draft Standards
Evaluation for K-5

Terrence O. Moore, Ph.D.
Hillsdale College
Resident of Angola, IN

Foundational Skills Expectation (Tab One):

"Understand and apply knowledge of print concepts, phonics and phonemic awareness and demonstrate fluency and comprehension as a foundation for developing reading skills."

The master or anchor standard governing this section is unclear and confusing. It is a blend of several Common Core Standards and a prime example of edu-speak. Why not just say, "Learning to read, spell, and write" and then explain phonemic awareness later? Would not teachers and parents understand that a lot better? As we shall see, the actual standards written below do not reveal that the authors themselves understand phonics or "reading skills" particularly well.

<u>Print Concepts</u>

Standard 1:

K: **Demonstrate understanding of the organization and basic features of print, and understand that printed materials provide information.**

1st Grade: **Apply understanding of the organization and basic features of print.**

Cut-and-paste from CC: RF.K.1 and RF.1.1 (p. 15 in ELA Standards). The term *print concept* is taken straight out of Common Core.

What is a print concept? When did learning *print concepts* become a fundamental aim of education? Benjamin Franklin was a printer by trade, and he also founded a school in Philadelphia (that became the University of Pennsylvania), and yet he never once wrote about print concepts.

Thus, this is a completely empty standard. Most children will have grown up with books in the home and be familiar with print. What is the teacher supposed to say, "This is a *printed* book, children"? Then what? This is not a true standard, and telling students that books are printed could not take more than twenty seconds. Most parents will have read hundreds of books to their children without bothering to say, "This is print, child."

The only addition the Indiana Standards make to the Common Core is "understanding that printed materials provide information." Notice the bias for "information": an echo of the Common Core's emphasis on "informational texts." Reducing books to information is misguided, particularly at the early elementary level. Nursery rhymes do not "provide

information." Fairy tales do not "provide information." Poetry does not "provide information." These kinds of literature amuse and instruct, and at times move the soul towards beauty and virtue. Confining books to "information" simply diminishes their importance and reveals a lack of interest in the human imagination.

Standard 2:

K: **Demonstrate understanding that English language moves from left to right across the page and from top to bottom.**

Reworded slightly from CC: RF.K.1a (p. 15)

Low-level standard. Any child who has ever been read to will already know this. How much time will be spent on this? How many times will a student need to "demonstrate" this understanding? Standards 3 and 4 are in much the same vein.

Standard 5:

K: **Recognize and name all uppercase (capital) and lowercase letters of the alphabet**.

Cut-and-paste from CC: RF.K.1d (p. 15)

This is a lower-level standard than it should be and does not belong in this contrived category called "print concepts," unless by *print* you really mean *writing*. Most children will already know the alphabet coming into kindergarten. Therefore, their learning the alphabet at this stage should be combined with writing. They should learn to *print* all the upper- and lower-case letters and also begin writing words, dictated by the teacher, which the students will in turn learn to read. This is the pattern of a genuine phonics program. Furthermore, bona fide phonics programs prefer that students be introduced to the letters (that they usually already know) with all the sounds that the letters make. (See below on explicit phonics instruction.)

Even if the students still need to learn the alphabet, it makes no sense to put it in such a manufactured category as "print concepts."

Standard 6:

K: **Learn and apply knowledge of alphabetic order (by the first letter).**

Is this a new Indiana standard?

"By the first letter" implies that students will be alphabetizing words. Yet up to this point in these standards students have not been taught to read words. (I am assuming that the standards should follow the logical order of students learning to read). Will children, then, be alphabetizing words they cannot read? This is another consequence of creating such an unnecessary category as "print concepts" and making it the first standard. What

will happen in the classroom, I would wager, is that this exercise would be done with pictures (such as with **c**ats, **d**ogs, **e**lephants, etc.) If so, that makes the exercise pointless. Students should spend their time learning to read at this point, not alphabetizing, which would simply confuse children, and not using pictures, which is no more than a game. How much time would be spent on this alphabetizing exercise, anyway? Alphabetizing should come later.

Phonological Awareness

This is the second category taken from the Common Core foundational skills section, this one found on p. 15 of the ELA Standards.

Standard 1: **Demonstrate understanding of spoken words, syllables, and sounds (phonemes).**

Cut-and-paste from CC: RF.K.2 (still p. 15 of Common Core ELA Standards)

This introductory or overarching standard for this category actually makes little sense as written. For example, what could "demonstrate understanding of spoken words possibly mean"? The children are already five or six. They can communicate in English. What are the spoken words the children are supposed to demonstrate an understanding of? The words of common English? How are they supposed to demonstrate their understanding? Does this mean vocabulary?

What does "demonstrate understanding of . . . syllables" mean? Does it mean knowing what a syllable is or recognizing a given syllable in a word?

Further, what does "demonstrate understanding of . . . sounds" mean? Which sounds? How would a child demonstrate an understanding of a sound, which is what the standard calls for?

This is our first clue that these standards do not reveal an understanding of the structure of English nor how children should be taught the reading and writing of English. The authors of the standards are spreading around certain terms used in phonics, hoping they will stick, yet without describing how these terms work together. The standard as it now stands does not make sense and offers no meaningful direction to teachers. Please see my alternative standards for phonics instruction.

Standard 2: **Identify and produce rhyming words.**

Cut-and-paste from CC: RF.K.2a (p. 15)

Why? What is to be gained from the exercise? This is an empty, pointless standard until someone bothers to explain it. If it is an oral drill that goes hand-in-hand with listening to poetry, then perhaps it is not harmful, though the purpose and value is far from clear. If by "recognize," though, the authors mean recognize *in print* (and in the Common Core, it

appears as a *reading* standard), then this is an exercise in whole language that breaks down in practice. For example, notice that the standard says "produce rhyming words." Presumably that means students calling out words that rhyme. Yet consider the words *fate*, *bait*, *great*, *weight*, and *straight*, which all rhyme but have different spellings of the /ay/ sound. Since the students are not said to learn the phonograms explicitly in these standards, the different spellings would only confuse them. Hence, this rhyming exercise is either a game or becomes an attempt at memorizing "sight words," i.e. whole language.

Standard 3: **Orally count, pronounce, blend, and segment syllables in spoken words.**

Cut-and-paste from CC: RF.K.2b (p. 15)

Again, this is taken from a composite (and poorly written) standard in the Common Core that in its present, isolated form does not make much sense. Is this an exercise that teaches students how to know how many syllables are in a word? If so, fine. But we are not told how this exercise relates to spelling. Learning the number of syllables a spoken word has is, again, somewhat fun. But if not related to spelling, we do not get very far. If this standard is meant to be related to spelling, then we have a problem. The students still have not been taught the phonograms, and will not learn them in isolation at all according to these standards. What happens when we get to words such as *later* and *labor*: both which have two syllables, both whose first syllable is pronounced /lay/ and yet whose second syllable has a different spelling for the /er/ sound. Syllables isolated from the study of phonograms do not help us much.

Standard 4: **Orally blend the onset (e.g., the initial sound) and the rime (e.g., the vowel and ending sound) in words.**

Altered version of CC: RF.K.2c (p. 15)

We must first notice that the authors of this standard apparently do not understand the difference between the Latin abbreviations e.g. and i.e. E.g. (*exempli gratia*) means "for example." I.e. (*id est*) means "that is." Clearly in this sentence the words "initial sound" are meant to define "onset," not give an example of an onset.

Again the purpose of this standard is obscure. If the point is to show how words are composed of different sounds, and the easiest way to do this is to use rhyming words that isolate particular sounds (in this case, the "onset") then there may be some value to doing this. But we are not told that the spelling patterns should hold constant, so we still run the risk of confusing students. For example, *hot*, *pot*, *cot*, *lot*, *dot*, and *sot* (a great word for a five-year-old to learn) all hold to a consistent spelling pattern. But rhyming words do not always do so, as we saw above. And if somehow this exercise does not manifest itself on the board (and this only says "orally") and thus in reading and spelling, then it is simply a rhyming game: fun perhaps but hardly worthy of being turned into a *standard*.

Furthermore, the standard gets things backwards. It says students should *blend* the first part of the word and the rest of the word orally. Why? When learning to read, students

should learn to *break words apart* into their distinct sounds while looking at the letters on the board. What is the value of *orally* taking the sound /h/ and adding –ot on the end? People do not talk that way. This is one of the dubious games or exercises found in most faux-phonics programs.

Standard 5: **Tell the number and order of sounds heard in words with two or three phonemes, and identify the beginning, medial, and final sounds.**

Altered version of CC: RF.K.2d (p. 15)

This is yet another isolated standard that makes no sense outside the context of learning how to spell through an explicit phonics program. It is true that in learning the word *fun*, for example, teachers need to show how it consists of three sounds: /f/, /ŭ/, and /n/. But that must instantly be translated onto the board as *f*, *u*, *n*. There is no indication that the authors of the standards have this in mind. Notice the standard begins with "tell," not "write." In other words, students would simply be saying /f/, /ŭ/, /n/, not writing or reading the word.

Standard 6: **Add, delete, or substitute sounds to change words.**

Altered version of CC: RF.K.2e (p. 15), which reads, "Add or substitute individual sounds (phonemes) in simple, one-syllable words to make new words."

Okay, watch this: Teacher: "Johnny, give us a word that rhymes with *fun*." Johnny: "Ton!" "Great, Johnny, we'll have a *ton* of *fun*."

Uh-oh. We have a problem. *Ton* and *fun* do not use the same spelling for the /ŭ/ sound. Neither is irregular. (Consider the words *oven*, *nothing*, *money*, etc.) So once again we find ourselves in pseudo-phonics purgatory: we are either playing fun rhyming games, which hardly need to be written into state standards, or we are setting up children to be confused when they learn that all these rhyming words are not spelled the same way.

The problem with this entire category designated "phonological awareness" is that it accomplishes little. Students in kindergarten should begin right away learning how the phonograms map the sounds that constitute English words. That requires the teacher (who is absent in these standards as written) to write simple words on the board as the students learn to read them. Having students play rhyming games, while fun, does not teach them how to read. No doubt, teachers might have fun after teaching students to read the word "hit," for example, to think of other words that rhyme with "hit," thereby generating the spelling list of *sit, fit, kit, bit, lit,* and so on. That is simply a common-sense thing that every teacher should know how to do. It can hardly be considered a standard. And if not put on the board, as suggested by the use of the term "orally" in these standards, such exercises lead nowhere. Furthermore, I expect this approach leads to the use of rudimentary readers that feature "word families," such as those published by Scholastic. But this method is flawed, too. Strictly speaking, there is no "-ot family" or "-ish" family. Rather, *o* and *t* and *i* and *sh* are separate phonograms.

Phonics

Here is where we would expect all the problems of the previous category to be worked out. After all, the word used in this set of standards is *phonics*. I suspect that the word is used to keep educational traditionalists at bay. Indeed the following standards reveal that the standards makers (originally the Common Core writers and now the committee in Indiana) do not understand phonics at all, nor even the English alphabet all that well.

K Standard 1: **Know and apply grade-level appropriate phonics and word analysis skills.**

(First grade) Standard 1: **Know and apply grade-level appropriate phonics and word-analysis skills.**

Cut-and-paste from CC: RF.K.3 and RF.1.3 (p. 16 of Common Core ELA Standards), save for adding the word "appropriate" and dropping the phrase "in decoding words."

As used here, this standard is completely hollow and unhelpful. It is clearly a sop to those who insist that students be instructed in phonics, and, as we shall continue to see, everything else about these standards is hostile to genuine phonics instruction. The lack of specificity in these standards is alarming. What is "grade-level phonics"? What are "word-analysis skills"? In Indiana schools, I have seen students doing jumping jacks while spelling words and teachers calling it "phonics." I have seen students tracing "rainbow words" with different colored pencils and teachers calling it "phonics."

A standard embracing true phonics instruction would specify that students should learn the phonograms *in isolation*, that is, phonogram by phonogram. Since phonics is so misunderstood these days, the standard would feature a listing of the generally accepted phonograms. (A phonogram is a letter or a combination of letters that map a single sound in an English word. The word *through*, for example, consists in three phonograms: *th*, *r*, and *ough*. What makes English confusing is that many sounds can be mapped by several different phonograms, as in the /er/ sound in *her*, *sir*, *purse*, *hearse*, etc.) In addition to stating that phonograms should be learned in isolation, the standard should further state that each new spelling word should be taught by breaking it down into its constituent phonograms. Students should not just be given spelling words without instruction to "memorize." Rather, the teacher should go through the word systematically. That is the proven method of teaching how to read and spell. This standard does not call for such explicit instruction. It just says "apply grade-level phonics."

The truth is the teachers are not taught explicit phonics in education schools, as recently shown in an NCTQ study of Indiana education departments. The major publishing companies put forth pseudo-phonics programs that are whole language in disguise. This standard is a part of that deception. The education establishment knows that parents want phonics. Therefore it gives lip service to phonics and goes right ahead teaching versions of whole language. If the authors of the "new" Indiana standards really want students to

learn phonics, they need to explain it in a way that convinces us they really understand what genuine phonics instruction is.

Standard 2: **Use letter-sound knowledge to write simple messages and words, which accurately represent at least the initial sounds or many of the most frequent sounds for each consonant.** (Kindergarten)

Altered from CC: RF.K.3a (p. 16): "Demonstrate basic knowledge of one-to-one letter-sound correspondences by producing the primary sound or many of the most frequent sounds of each consonant."

This standard is an abomination. The authors of the new Indiana standard have actually made the train wreck found in the original Common Core standard even worse.

"Letter-sound knowledge" is awkwardly phrased. The Common Core's "letter-sound correspondences," though it doesn't roll off the tongue, is nonetheless more accurate.

"To write simple messages and words." Messages? What kinds of messages? Messages are composed of words, are they not? But at this point, students are just learning to write words, so how could they write messages? Letter-sound correspondences result in words, but not in messages. Why would the term *messages* be used rather than *sentences*? The only thing I can come up with is the letters used in instant messaging: TMI, OMG, etc.

Somehow the *messages* and *words* "accurately represent at least the initial sounds or many of the most frequent sounds for each consonant." How can a *word*, much less a message, accurately represent the sounds of a consonant? A word is indeed composed of consonants (and vowels), but the word does not *represent* consonants. This unreadable statement has things completely backwards. Consonants represent sounds found within words. As such, this so-called "standard" makes no sense whatsoever. But it gets worse.

Why does this standard refer to "the initial sounds" for each consonant? Which initial sounds? "Or many of the most frequent sounds": yes, the standard contradicts itself. For certain consonants, presumably, the students will know "at least the initial sounds"; for others, they will know "many" of the most frequent sounds. Which consonants will be learned partially, and which completely? How many sounds are implied in "initial": two, three? How many sounds are implied in "many of the most frequent"? Five, ten, more?

Please, authors of this standard, name a consonant that has *many* sounds! We are given no hint in the standards. Let's test this against the real behavior of consonants.

b: one sound, /b/. Though you may have been taught that it makes two sounds /ub/ and /buh/, that clearly is not true. The consonant, in isolation without vowels attached, only makes one sound.

c: two sounds, /k/ and /s/. Are students supposed to learn the "primary" sound or both sounds? Is there any reason they could not learn both? We are not told. (In foreign

words, the c can make the /ch/ sound as in *cello*. That is not a regular English usage but rather a foreign import which could be easily explained to children as the need arises.)

d: one sound, /d/, as in *dog*.

f: one sound, /f/, as in *foot*. (The /v/ sound in *of* is unique to that word.)

g: two sounds, /g/ and /j/. Should students learn only the "primary" sound? In other words, should students learn the word *golf* in kindergarten but not the word *gem*? That would simply hold back their reading.

h: one sound, /h/, as in *help*.

j: one sound, /j/, as in *jam*.

k: one sound, /k/, as in *kook.*

l: one sound, /l/, as in *look*.

m: one sound, /m/, as in *moon*.

n: one sound, /n/, as in *noon*.

p: one sound, /p/, as in *pop*.

q: always combined with *u* to make two sounds, /kw/ as in *queen*, and /k/ as in *plaque*.

r: one sound, /r/, as in *roar*.

s: two sounds, /s/, as in *sun*, and /z/ as in *raisin*. (The /sh/ sound in sugar is limited to a handful of words.)

t: one sound, /t/, as in *time*.

v: one sound, /v/, as in *violin*.

w: one sound, /w/, as in *win*.

x: two sounds, /ks/, as in *fox*; and (rarely) /z/ as in *xylophone*. Some would say that the letter x makes three sounds the other being /gs/ as in *example*.
(Because the distinction between the sounds in *fox* and *example* is so small, and the number of words beginning in *x* is so small, most phonics programs assign only one sound to *x*.)

y: (as a consonant) one sound, /y/, as in *yellow*. Obviously, *y* also acts as a vowel.
.

z: one sound, /z/, as in *zoo*.

So there you have it: seventeen consonants making only one sound, four consonants making two sounds, though a couple of consonants occasionally make three sounds (as in the *s* in *sugar*). We must ask, then, where are the consonants for which children must learn "**many** of the most frequent sounds"? *Many* still means more than two, and "many of the most frequent" implies that some consonants must have half a dozen sounds or more. Where are those consonants? **They do not exist**. Nor can you say that the letter *t*, for example, makes multiple sounds (as in *th* or the /sh/ sound in *ration*) because those are altogether separate, multi-letter phonograms. Once again we see the need for students to learn all the phonograms. This standard clearly refers to "each consonant," not letter combinations.

So what could this standard possibly mean? The standard calls upon words and messages to represent the sounds of consonants, but only the initial sounds in some instances, while at other times many of the most frequent sounds: as though students could only learn the initial sounds of the letter b (which has but one sound) but at least five of the ten sounds made by the letter g (which has two). What? This standard simply makes no sense, and the fact that it became a governing classroom practice in forty-five states in the union, with no one in a state department of education or on a state school board noticing it, and is now rewritten as a "new" Indiana standard, reveals just how off-track education is in this country.

Why not just say, "Students should be taught the sounds made by each consonant"? Then the standard could actually list those sounds, as I have done. Does such an approach not sound complex enough? Maybe not, but it happens to be accurate.

Standard 3: **Listen [to?] and blend consonant-vowel-consonant (cvc) sounds to make words.**

Is this a new Indiana standard?

If so, there is nothing wrong with it per se. What is intended here is teaching students words such as *fun*, *sun*, *bun*, *nun*, and *gun* that follow the cvc pattern. Chances are high that many children will come into kindergarten already having done such things with their parents or in pre-school. This is the approach taken by the Bob books.

Yet there is still a problem with this standard when lined up with the rest of the standards. Notice that the standard states cvc *sounds*, not actual consonants. The /k/ sound at the beginning of a word is made by either k or c, as in *kit* or *cot*. That still brings up all the questions we have raised so far about how letters are being taught. This still seems like a listening rather than a writing and reading exercises. Furthermore, at the end of a word the /k/ sound is usually made by the –ck combination, as in *sick*. It does not appear that these combinations are taught in kindergarten. They do seem to be taught in first grade since Standard 2 in this category refers to "consonant blends and digraphs." Fine. But

why the delay? According to the standards as written, students will make it through kindergarten without being able to read anything beyond cvc words—the words that they may very well know *coming into kindergarten*. (Assuming that this is a reading exercise, which is not actually clear.) Students will not be taught the spellings of words such as *duck, truck, tall, ball, chat, ship, thin, thick,* and so on. In short, this standard will in most cases delay reading by a year! This is yet another deficiency resulting from not having a genuine phonics program.

Standard 4: **Recognize the long and short sounds for the five major vowels**.

This is considerably cleaned up from the previous draft, which read:

Associate the long and short sounds with the common spellings (graphemes) for the five major vowels. (Standard 16; Cut-and-paste from CC: RF.K.3b, p. 16)

I do not know what prompted the rewriting of this standard, but I am glad it was cleaned up a bit, since I wrote an article about the absurdity of referring to "common spellings for the five major vowels." (How many ways are there to spell the letter *a*?)

Notice that it remains unclear whether students will be reading and writing. To recognize a sound can simply mean to hear it. Will students be writing the vowels? Will they be writing them in words?

Even if they will be, there is still another problem with this standard. Four of the five vowels make more than two sounds. The common lesson about short and long vowel sounds, which is what the vast majority of schools in the country teach, only takes us halfway. At no place in the standards (Indiana or Common Core) are students expected to learn the other sounds of the vowels. Here they are:

a: /ă/, /ā/, /ah/, /aw/, as in *at, tape, want, talk*
(Different phonics programs disagree over whether the last two sounds differ enough to constitute separate sounds, but clearly at least one sound is neither long nor short)

e: the vowel that has only the long and short sounds

i: /ĭ/, /ī/, /ē/, as in *if, silent, medium*

o: /ŏ/, /ō/, /oo/, /aw/, as in *odd, over, do, cost* (And, as we have seen, *o* often sounds like a short *u* /ŭ/, as in *oven*. Margaret Bishop calls *o* the "least reliable" vowel.)

u: /ŭ/, /ū/, /oo/, and short /oo/ (look), as in *up, music, super,* and *put*

How, then, are students taught to read and spell these words with vowels that do not fall into the circumscribed short-long choice? Typically, these words are branded "irregular" and put up on "word walls" as "sight words." In other words, failing to teach all of the sounds made by the consonants leads to memorization without system: whole language.

Consider this common word: *father*. The *a* in father does not correspond to the short-long choice. Therefore schools call it an irregular word or a sight word or even an outlaw word. Yet when we actually know that the letter *a* consists in four sounds, we see that there is nothing amiss. *Father* is neither irregular nor an outlaw. Yet somehow this obvious truth has been overlooked (or hidden) by the authors of the Common Core, the authors of the Indiana standards, the schools of education, and all the major textbook publishers. When all the sounds of the vowels are taught (i.e. when true phonics rather than pseudo-phonics mush is taught), the English language appears far more ordered and regular.

Standard 5: **Read common high-frequency words by sight (e.g., a, my)**.

(First grade) Standard 5: **Recognize and read common and irregularly spelled high-frequency words by sight (e.g., have, said)** . . .

(Second grade) Standard 4: **Recognize and read common and irregularly spelled high-frequency words and abbreviations by sight (e.g., through, tough; Jan., Fri)**

Cut-and-paste from CC: RF.K.3c (p. 16), absent the examples *the*, *of*, *to*, *you*, *she*, *my*, *is*, *are*, *do*, *does*.

Aha! Whole language. Notice that this is the first time we are told that students will be *reading*. Discounting the confusing assertion that students will be *writing* messages in order to represent the sounds of consonants (whatever that means), students up to this point are *orally* blending, listening to, and recognizing *sounds*. So when it comes time to read words—in the section called *phonics*, no less—we have students "reading" by using sight words. If this is not a whole-language approach, I do not know what is.

There is no reason to teach these or any other words as "sight words." All genuine research in reading reveals that true phonics is the way people learn to read an alphabetic (as opposed to a pictographic) language. This research has been confirmed by neuro-linguists who have tracked how the mind takes in letters as the eyes cross the printed page—even for short, familiar words called "sight words" by the whole-language crowd.

Furthermore, we see in the examples that the authors of this standard do not understand English spelling. The words *through* and *tough*, for example, are not irregularly spelled. True, they are not spelled *thru* and *tuff*, as we would expect without a knowledge of phonics. But the letter combination *ough* is a distinct phonogram or "letter team." (The Riggs Institute makes it the 71st and last phonogram; Margaret Bishop calls *ough* a "wild letter team." That is because it has 6 possible pronunciations: /ō/ as in *though*, /oo/ as in *through*, /ŭf/ as in *rough*, /off/ as in *cough*, /aw/ as in *thought*, and /ow/ as in *bough*. That is admittedly a lot to take in, which is why this phonogram is taught last. Nonetheless, in a true phonics program, the students learn the letter combination by pronouncing its six sounds. Despite the variety, that is a far better approach than treating these words as "sight words," that is, as random words with no discernable pattern.

The rest of these standards in the category called "phonics" betray a lack of familiarity with the explicit teaching of the 70-odd English phonograms. The phrase "word family," for example, is a common mistake. The words *hate*, *late*, *fate*, *gyrate*, *berate,* and *spate* do not form part of a word family. Rather, these are words composed of several distinct phonograms. The word *hate* consists in the sounds /h/, /ā/, and /t/, with the silent final *e* making the vowel "say its name." Thus rather than all –ate words being considered some kind of family, the rule that should be learned is that one job (and it has several more) of the silent *e* is to cause the vowel to make its long sound. Thus the word *kite* is no less a part of this "family," though the vowel is different. Furthermore, what happens with the so-called word family approach is that little attention is paid to the first part of the word. When the words are simple, most students (though not all) will intuitively recognize the sounds of the first letters. What about a more difficult word like *gyrate*, though? Here we again see the need for the teacher to work through the word systematically, showing the behavior of *all* the phonograms, not just the stars of the show that the publishing companies decide to feature at a particular moment.

One other consequence of failing to embrace a full-fledged phonics approach is the delay in reading. Notice that it is not until the second grade that we are told about "additional common vowel teams (e.g., oa)." Really? The phonogram *oa* should be introduced in kindergarten: "oa the /ō/ of boat." As it stands now, it appears that students will not have been instructed to read the words *boat, float, coat, throat, moat,* and so on. That is a lot of reading to miss out on for *two full years*. Alternatively, these words might be taught as "sight words," as we have seen throughout these standards. But "sight words" are both inaccurate explanations of spelling patterns and, except for the children who figure out the code intuitively (or who are taught by their parents), make reading far more difficult than it ought to be. Further, what are the other "additional vowel teams" that we are not being told about? Since the standards never tell us what precisely ought to be taught, we are left in the dark.

The complete failure of these Common Core-derived standards to embrace a genuine phonics approach to reading, writing, and spelling can only result in delayed reading, bad spelling, and a general confusion in the principles of English orthography. That is simply a recipe for semi-literacy at best. What we find in these so-called standards is not clarity in signaling how students learn to read and spell, but rather a jumble revealing that the authors of the standards are themselves utterly confused about the English language. How, then, does anyone learn to read in school these days? Not too long ago, I had a very revealing conversation with the principal of an elementary school in the Elkhart area. I asked her how many of her students come to her school already knowing how to read. She said that was a good question, thought about it a minute, and then ventured that it was probably over half. In other words, Indiana public schools, using methods similar to these, are *not* teaching students to read so much as parents and the private pre-schools do. Consequently, the students who do not become strong readers are most often those who depend exclusively on the public schools and are subjected to this mish-mash. As I stated earlier, I have seen Indiana teachers (even before the Common Core) having

students doing jumping jacks while “spelling” a word and calling it *phonics*. Whatever such an exercise may do for their physical well-being, it does nothing for their literacy.

Fluency

Standard 1: **Students demonstrate accuracy and fluency while reading grade-level appropriate texts**.

Standard 2: **Read emergent-reader text[s] with others, maintaining an appropriate pace and using self-correcting strategies while reading**.

These two standards are slightly re-worded for the rest of the grades, 1-5.

Altered from CC: RF.K.4 (page 16)

This is potentially a hollow standard. In general, yes, students should read aloud. They should read accurately and with fluency. What are the grade-level texts? Will deciding these grade-level texts be something that is farmed out to Accelerated Reader or another “reading program”? As we shall see in the next section of standards, “self-correcting strategies” can lead to dubious teaching techniques, particularly at the kindergarten and first-grade levels. The biggest problem that I see in schools is that when reading these “texts” *independently*, they almost never do so as a whole class. The students are given their assigned levels based on some test at the beginning of the year, and students read to themselves silently during long “reading blocs,” never having a discussion with a teacher or the rest of the class. They are like monks in a modern reading scriptorium. There is never any laughter; there is never any joy. The better students bring home prizes stating that they have read a hundred books in a year; none of the books is memorable, and even if one or two are, the students probably miss all the subtleties because they never get to talk about the books with anyone. I once asked a third-grade teacher in the Fort Wayne area whether her class would ever read and discuss a book, such as *Alice in Wonderland*, as a class. She said that if a student *wanted* to read *Alice in Wonderland* on her own, she could, but that during reading time the students read “independently” because they were at different levels. This approach to reading and to literature is a travesty.

While this standard may not call for that approach (it seems to be wholly neutral on how books are to be taught; indeed the teacher seems to have no place at all), it certainly does nothing to encourage the reading and teaching of great literature as a class.

Vocabulary Development Expectation (Tab 2)

Anchor Standard: **Use words, phrases, and strategies acquired through conversations, reading and being read to, and responding to literary and nonfiction texts to build and apply vocabulary** (K-2; the wording changes 3-5).

The first part of this standard is cut-and-paste from Common Core: L.1.6 found on p. 27

This phrasing suffers from mild jargon and in places does not make perfect sense. (For example, "Use words . . . to build . . . vocabulary." Strictly speaking, a person does not *use* words to build vocabulary but builds his vocabulary by learning words. So why not say, "Teachers should constantly introduce new words to students in order to build their vocabulary," or something like that? Such a statement would be plain common sense, but the anchor standard could be followed by some helpful suggestions.) Nonetheless, the standard itself is a laudable one. Schools should be in the business of teaching words to students. The question is whether the methods prescribed will in fact result in that end.

Vocabulary Building

Standard 1: **Students apply knowledge to determine or clarify the meaning of grade-level appropriate words** (Kindergarten).

Students use context and other strategies to determine or clarify the meaning of grade-level appropriate words (First—Fifth Grade).

These and the following standards seem to be based on the Language section of the Common Core ELA standards beginning on p. 27.

The kindergarten standard is unclear and possibly nonsensical. Presumably the words in question the students do not know. Then they encounter the words. Next, they apply "knowledge" to determine or clarify the meaning of these words. How does that work, exactly? What kind of knowledge?

If a student read the sentence "George was a bookish lad" and did not understand the last two words, what could the teacher do? (Notice how the teacher is never mentioned in these standards; the *kindergartner* is applying his knowledge!) Well, the teacher could ask the student whether he knew what a book is. The answer is obviously "yes." So, a person who constantly has his nose in books would be called *bookish*. Arguably that is an instance of drawing upon a student's prior knowledge, although the teacher must point out the connection. But what about *lad*? If the student has never heard the word, and since he is too young to look it up in a dictionary, there is no alternative but for the teacher to say, "A lad is a boy." The progressive education establishment does not like that approach. In ed schools, future teachers are taught to develop students' "critical thinking skills" by playing all kinds of elaborate and time-wasting guessing games to learn the meaning of words. "Well a lad is sort of like . . . but it's not quite . . ." The students guess wildly, and the teacher gives more hints, rather than just doing the obvious thing and say: "A lad is a boy. The word was used a lot more in the past, but the folks in Britain still use it regularly." What follows in these standards in this category called "vocabulary building" are more such methods that simply replace genuine teaching with "facilitating" and learning with guessing.

Standard 1: **Students use context and other strategies** . . . (Grades 1-5)

The use of context to determine the meaning of words is a losing "strategy." Every year I have college freshmen in my class who do not have a very good vocabulary and will not look up words in a dictionary. So they will encounter a line such as the following from the Mayflower Compact: "We whose names are underwritten, the loyal subjects of our dread sovereign lord, King James, by the Grace of God . . ." If I ask the question, what does the word "dread" mean, they cannot answer it. They may guess the meaning having something to do with "dreaded." But why would loyal subjects dread their king, much less call him *dreaded* in a public document? The answer is that the word *dread* means not just dreaded or dreadful but also "inspiring awe or reverence" (and perhaps fear, too), so it is thought to be a compliment to kings. In my second class of the year we come across this phrase from John Winthrop's "A Modell of Christian Charity": "secondly in the regenerate, in exercising His graces in them, as in the great ones, their love, mercy, gentleness, temperance etc." I ask, "Who or what are the *regenerate*?" Silence. I have to explain it to them. Then I ask, "What is temperance?" They do not know. Finally, I ask, "Why, if you do not know these words, do you not look them up in a dictionary?" Invariably, a slightly braver soul says sheepishly, "We were always taught in school to use the context to figure out the meaning of words." "Well, is the context helping you now?" I ask. They admit that it is not.

I offer this story because I constantly have to deal with the results of two colossal failures found in the public schools over the last forty years. First, they do not really teach words. Second, the schools create bad habits. The guessing game that has been called "inferring from context" or "using context clues" is one of the biggest dead ends found in public schools over the last half century. Just as schools do not teach the phonograms explicitly because of the ideological opposition to phonics, so the exact meaning of a word is never taught explicitly due to the progressive ideology insisting that students must "find their own answers" and use "critical-thinking skills." Some things—in fact most things at the elementary level—simply have to be taught directly. These standards are supposed to be geared toward "college and career readiness." In the case of the former, the vast majority of students coming into college these days are language poor precisely because they have not been taught the meaning of words, they have not read language-rich literature from an early age, and they have not been required to look words up in that old resource called a dictionary. To the extent that these standards still urge the use of "context" as a strategy for vocabulary, they offer no remedy to our modern verbal bankruptcy.

Standard 2: **Identify relationships among words, including patterns and categories, common synonyms and antonyms, and simple multiple meaning words**. (Second)

Rewritten, it seems, from Common Core Standards, Language, p. 27.

The first deficiency of this standard is that it lacks specificity. Which categories and patterns? The categories we see in the kindergarten version of this standard are colors, shapes, opposites. But we are given none for the second grade forward. Based on the kindergarten example and what appears in the Common Core (which does have more examples), this approach to "vocabulary building" seems simplistic. Which categories will fourth-graders be using? The lack of specificity in this standard will result in three

necessary consequences. First, anyone who does try to read it will be confused. Second, an undefined standard always tends to the lowest level of difficulty when interpreted by the education schools, the districts, etc. Third, since it is so undefined, this minimally different standard will become a default Common Core standard, and the same textbooks used throughout the nation will end up defining the standard.

While “patterns and categories” is a completely unhelpful and opaque phrase, “synonyms and antonyms” would seem to be somewhat clearer. Again we have no examples. When looking for a synonym for *strange*, for example, we could come up with the word *weird* or with the words *alien*, *idiosyncratic*, or *unorthodox*. Without any guidance, how are we to know that the teaching will entail antonyms of any greater sophistication than *fast* and *slow*, even at the upper-elementary level? The fact that this standard is simply cut-and-pasted across the page is also troubling. Students in kindergarten and first grade should certainly be introduced to the ideas of synonyms and antonyms and no doubt make lists of such words. By the time students reach third grade, however, synonyms and antonyms are simply a part of their working vocabulary in learning about words. They do not have to be told again and again what a synonym is. Is this really the best thing (as it is listed first) that the standards writers can come up with?

Standard 3: **Use a known root word as a clue to the meaning of an unknown word with the same root, and identify when a known prefix is added to a known word**.

Use knowledge of individual words to predict the meaning of unknown compound words. (Second grade)

Minimally reworded version of CC: L.2.4c,d

Like so many of these standards, the initial reading either leads to utter confusion or to imagining something wonderful and “complex” is taking place. Watch this.

Bird + house = birdhouse. Light + house = lighthouse. House + fly = housefly.

These are the actual examples in the Common Core given to illustrate the results of predicting unknown compound words. Do eight-year-olds really not know the compound word *birdhouse*? Most homes have one on the back porch. And *housefly*? My young sons love to kill them. What would this exercise in prediction actually look like in a classroom? “Today, students, we’re going to make a compound word out of two words that you already know: *bird* and *house*. Can you *predict* what these words will become? Birdhouse!” Underwhelming.

The examples of the study of prefixes taken from the Common Core (from which this standard is derived) are equally easy: happy/unhappy, tell/retell.

It is obviously the case that students should be introduced to the existence of compound words and to the use of prefixes and suffixes. Certainly, these concepts will be new to students in the first and second grades. And certainly the teachers should start with easier

words and work towards harder words. There is nothing particularly wrong with those first steps. The problem with these techniques, though, is that they occupy the central place in the category called "vocabulary building." The exercises presented here will not build vocabulary significantly. The key to the failure of the standard lies in the seemingly innocuous word *known*. Why *known* rather than *unknown*? It would seem that the effort of "vocabulary building" should aim at the acquisition of words that students do *not* currently know. Furthermore, why should schools aim only at "grade-level appropriate words"? Leave spelling aside for a moment since we are discussing the acquisition of a spoken vocabulary. To that end, the sky should be the limit. Anyone who has spent time around the children of professors and other learned people knows that young children readily take on the verbal patterns of adults. Just the other day my eight-year-old boy (who takes after his mother) announced to her in the evening, "My weariness leaves me no choice but to go to bed." That is a very different construction than "I'm tired." I could multiply this example with the astonishingly mature statements on the part of other children I know. Yet the obvious ideology governing this standard confines students to what they know already—and has low expectations for what they do know. Nothing new is to be learned that does not emerge out of some so-called critical-thinking skill such as inferring from context. This may seem like a small point, but it is in fact the heart of the matter.

As we speak, the SAT is being rewritten by the same man who is responsible for the Common Core Standards. In the new SAT, students will not have to know words that plumb the depths of their vocabulary, words that the old SAT was famous for, such as *egregious* and *plethora* and *erudite*. Rather, students will have to use context and other methods to divine the meaning of words on the exam. While such an approach may seem fairer for those who do not come from backgrounds rich in language, in fact it removes a leading incentive for acquiring a robust vocabulary (college entrance) and puts all our eggs in the ill-woven basket of critical thinking divorced from real knowledge. In other words, the critical thinking approach is hostile to genuine study and learning: teachers introducing children to things that are *unknown* and that cannot be *inferred from context* but must be *taught* outright. Sure, a student will easily pick up on the word *birdhouse* coming from *bird* and *house* and *unhappy* coming from the prefix un- and the adjective *happy* (things he already knows). How will he one day learn the words *circumlocution*, *perambulatory*, *counterintuitive*, and *subterfuge*? By inferring from context? Not likely.

<u>Vocabulary in Literary and Nonfiction Texts</u>

Standard 1: **Students apply knowledge to determine or clarify the meaning of words found in grade-level appropriate literary and non-fiction texts.** (Same language K-5)

More of the same. The phrase "students apply knowledge" refers to knowledge they already have. Thus, vocabulary building once again means working at a very simplistic level rather than learning new things. **Teachers, look up hard words in a dictionary and tell the students what they mean!** That's *teaching*.

Standard 2, Kindergarten/Standard 3, First Grade: **Ask and answer questions to help determine or clarify the meaning of words and phrases in a text**.

This is ridiculous. (Realize that the *students* are the ones doing the asking.) What kinds of questions? "Mrs. Smith, what does the word ravenous mean?" (as in "the ravenous wolf") is clearly not kind of question the standard implies. Rather, this standard turns the acquisition of words into a wild guessing game that chews up valuable class time and confuses children. Besides that, how does asking a question constitute an academic standard?

Here are three examples of rich vocabulary taken from children's books.

"There once was a man and a woman who longed in vain for a child." ("Rapunzel," from *Best-Loved Fairy Tales*, Little, Brown, 2007, first line.)

"The Peacock was greatly discontented because he had not a beautiful voice like the nightingale, and he went to complain to Juno about it." ("The Peacock and Juno," in *Aesop's Fables*, introduction by G. K. Chesterton, republished from the 1912 edition by Avenel Books.)

"A Jackdaw chanced to fly over the garden of the King's palace." ("The Vain Jackdaw and His Borrowed Feathers," in *The Aesop for Children*, Barnes & Noble, 2007).

How many kindergartners or first-graders will know the words *vain*, *discontented*, and *chanced* and be able to explain them to other children? Furthermore, how long would it take to land upon accurate definitions via the prescribed method? You would simply lose the flow of the story in these instances before the story had really begun. It may be a teaching technique to ask the class, "Do you know what 'in vain' means?" But after a couple of wild guesses, the teacher simply has to say "without success, without anything happening; the man and his wife tried and tried, but they could not have a child." And then the teacher must get back to the story. Otherwise, this asking/answering questions business (referring to the students) turns into a free-for-all. Trust me. I have spent a lot of time around kindergartners and first-graders.

Standard 2 (Grades 3-5): **Determine the meaning of words and phrases as they are used in works of literature, including figurative language (e.g., similes, metaphors, hyperbole, or personification).** (Grade 4 phrasing)

This phrasing is unclear. It appears to me that similes, metaphors, etc. were tacked on simply because "Determine the meaning of words and phrases as they are used in works of literature" is just a slightly embellished version of "learn words." The study of literary devices more properly belongs in the category of literary analysis. The simile "as quiet as a church mouse," for example, does not teach any new vocabulary.

Standard 3: **Determine the meaning of general academic and content-specific words and phrases in an informational text relevant to a grade-level appropriate topic or subject area.** (Third-grade phrasing)

My gosh! These are the people who are in charge of teaching us how to read, write, and speak English? O brave new world that has such bureaucratic banality in it!

This standard reminds one of the quip of Winston Churchill when the English housing authority started referring to homes as "accommodation units." In Parliament, he sung out (to the tune of "Home, Sweet Home"), "Accommodation Unit, Accommodation Unit, My Sweet Accommodation Unit." Again I say, "**Learn words**."

<u>Vocabulary Application</u>

Standard 1: **Students use and apply grade-level appropriate vocabulary in real-world situations.** (K-5)

What is a "real-world situation"? Paying taxes? How could the teacher possibly monitor students in "real-world situations"? This is yet another so-called standard that fills the void that these standards would have owing to the lack of genuine understanding of how young people acquire words, verbal dexterity, and even eloquence. The tried-and-true ways of building vocabulary are really quite straightforward. Here they are in a nutshell.

First: Students in the elementary school need highly articulate teachers who do not speak "down" to them because they are children. Rather, teachers should raise children up to an adult level.

This contention must seem like plain common sense to most folks and unworthy of being formed into a "standard." Yet the reality is that this fundamental truth is wholly rejected by the education establishment in this country. Unfortunately, the *standards* for the hiring and training of elementary teachers with regard to languages is as low as it can be. Every year the college major that ranks last (behind home economics) on the GRE verbal exam is early elementary education. The majors that rank among the top are philosophy, English, and foreign languages. Ergo, we should be hiring more English majors in our schools and fewer elementary education majors. This statement will be taken by some as "anti-teacher." It is not anti-teacher. It is *pro-teacher* and *pro-language*. I have long said that the ideal elementary teacher is a trained linguist (English major or Latinist) with a minor in math. And I have hired many teachers who have fit or at least come close to that description. This truth is undeniable: children imitate the verbal patterns of their parents and other adults whom they know. If we want articulate students, we must insist upon the most articulate teachers.

Second: Students should read classic literary works starting in the primary grades and throughout their time in school. It is from classic literature that children develop a keen sense of the English language. Consider the opening lines of *Aladdin and the Magic Lamp*:

> There once lived a poor tailor, who had a son called Aladdin, a careless, idle boy who would do nothing but play all day long in the streets with idle boys like himself. This so grieved the father that he died; yet, in spite of his mother's tears and prayers, Aladdin did not mend his ways.

How rich is the vocabulary in those two sentences! Reading books like this cannot but shore up the verbal arsenal of the child. Yet these are not the kinds of books being read in schools these days nor being recommended by the Common Core. On the contrary, "informational texts" are now all the rage. Informational texts, however, do not contain such beautiful language. Nor are they all that interesting, which means that children do not want to read them. What child would not want to keep reading, however, about a boy who was so careless and idle that his father died because of him? And that's before we get to the evil magician!

Third: Students throughout the early elementary years should have great, classic literature read to them.

While students should read only the best books possible once they can read, they will be somewhat circumscribed by their reading level in the primary years. Therefore teachers should read to them often—and read only the best books. Most of the books that are now used as "read-alouds" in schools are poor in language and vapid in content. This is the great sin of the phrase "age-appropriate." Consequently, students' spoken vocabularies stagnate at the very time of life when they should be picking up new and interesting words daily. For example, the novel *Robinson Crusoe* by Daniel Defoe is too difficult for children to read themselves since it is written in eighteenth-century prose. The story, however, is compelling. A good adapted version can be read by children in the fourth grade while the teacher should read significant passages from the original novel to the students. They will love it.

Fourth: Teachers should insist that students look up words in the dictionary.

While this may sound like the most blatantly obvious piece of advice imaginable and hardly worthy of being a "standard," the fact is that schools do not require students to look up words. The alleged "strategies" found in the standards above are anathema to the mastery of words. Every writer has a dictionary near at hand, sometimes several of them. William F. Buckley, a legendary wordsmith, who was himself an advisor to the American Heritage Dictionary, kept multiple dictionaries near him at all times and consulted them regularly—despite his lexicon far exceeding that of almost every living person. Such is the habit of people who genuinely love words and who work in the world of words and language. From the third grade on, students should have dictionaries in their desks. These dictionaries should get more sophisticated as the students advance in school.

Fifth: Teachers should require students to memorize poetry and important and elegant quotations from literature and oratory.

It is well-known that the education establishment has been at war with the human memory for the last half-century. Whereas for two-and-a-half millennia memorization was a chief means of building up knowledge in young people, progressive educational doctrine dismisses such scripted lessons as "mere rote memorization." Of course, young children easily learn songs and lines from movies and baseball statistics and a host of other things, but schools decry the use of such old-fashioned lessons. So much the worse for our acquisition of language and style. One result of the removal of the memory from the classroom is that students lack model phrases which guide them in their own speech and writing. Poetry provides not only beauty and insights into the human condition, but also insights into how words are deployed with perspicuity and power. Similarly, the memorable lines of orators show how powerful ideas can be cast in compelling terms. Every great writer and orator has memorized and mastered models of language. Franklin turned prose into poetry and back again. Lincoln knew virtually all of Shakespeare by heart and made actors nervous as he mouthed the lines during performances and caught them when they missed a line. Churchill famously memorized Macaulay's "The Lays of Ancient Rome" as a child in school. He also learned diction through repeating sentences such as "The Spanish ships I cannot see for they are not in sight." Significantly, these great men mastered the English language initially not to apply certain words to "real-world situations" but because it conveys truth and beauty. Yet when it came time to apply language to the great crises of their times (revolutions and wars are pretty "real-world," are they not?), they became the leaders of the free world, largely through their mastery of language. Where does the love of language appear in these standards?

Sixth: Teachers should instruct students in the etymology or "word histories" of hitherto unknown words.

That the standards are deficient in the inculcation of what might be called "word sense" is most obviously seen by the absence of the word *etymology*. Just as to know a people we must know its history, so in order to know language we must know its history. English is a composite of several European languages, most importantly Latin, Greek, French, and German. Thoroughly understanding words requires us to know their origins. Knowledge of words is not useful only in English class. For example, the word *science* comes from the Latin verb *sciō, scīre* which means "to know." The word *democracy* comes from the Greek words *demos* and *kratia*, which mean people and rule. The word *courage* is derived from the French *coeur,* for heart. A person with courage, then, literally means someone who has more *heart*. The formal teaching of Greek and Latin roots, in addition to a constant enlisting of the etymologies of all words, will enable students to speak and write with both scope and precision. Students coming out of schools these days cannot say much of anything about the words they use, have an extremely limited vocabulary, and often hit a brick wall whenever they encounter writing or speaking pitched above the vernacular. Consequently, college professors from every discipline often end up being in practice remedial English teachers who must translate their own speech to students so as to be understood. The standards as presented here are no remedy.

The foregoing pillars of language acquisition may not appear like standards because they are not written in the jargon of the modern authors of standards. But they are standards of English mastery nonetheless, and any school that embraces them will not only achieve higher test scores. They will create champions of the English language and, we hope, of truth and beauty.

Reading Nonfiction (Tab 3)

The first observation we must make about this set of standards is that it is based on an altogether unproven and questionable assumption, namely, that students at every grade level should read more in the way of nonfiction or "informational texts" than has been the case traditionally. This is one of the leading tenets of the Common Core. That the "new" Indiana draft standards put so much emphasis on the reading of nonfiction, even in the elementary grades, is a sure indication that the authors of these standards have swallowed the Common Core hook, line, and sinker. We must also observe that this emphasis on nonfiction occurs within the ELA standards. The time devoted to English in elementary school should be given almost wholly to imaginative literature. There are at least four reasons for this. First, the classics of children's literature are written in beautiful, moving language. As we saw in the previous set of standards, the mechanical ways of teaching young people vocabulary pale in comparison to the acquisition of words through reading. Second, the young mind is captivated by tales of the imagination. The world of young children is a world of knights and dragons, princes and princesses, lions and lambs. One does not have to "sell" children on the use of fiction. They thrive in an imaginative land filled with magic and talking animals. Third, the moral lessons derived from fables, fairy tales, and other classic children's works are unparalleled for their clarity, beauty, and persuasiveness. Childhood is not only the time ripe for the formation of the intellect; it is also the period most profitably devoted to the formation of the character. Great stories almost always build character, or at the very least give us insights into the character of others. Fourth, in all great children's stories, there is clearly something at stake: life or death, fame or fortune, happiness or unhappiness. Jack may be eaten by the giant. The grandmother is eaten by the wolf. There is no guarantee Cinderella will end up with the prince. (And why does she? Is it because her foot is a certain size or something else?) As a result of these four features of classic children's literature, so-called nonfiction texts (especially those that the Common Core recommends) pale in comparison. Whereas any classic tale may occupy children's minds for months, and be with them as a possession for their entire lives, children will not think about these "informational texts" for a minute beyond the time given to them in class—assuming that they even pay attention in class. They do not offer children much joy in either reading or in their lives. Joy is and should always be a leading aim in our schools.

The emphasis on non-fiction in the elementary school has at least four major flaws that are the converse of the foregoing. First, the informational texts are not written by great storytellers in beautiful and moving language. Nonfiction or "informational text" is a misleading category—and is probably meant to be so. Do the Common Core authors mean by it history or science or instructional manuals? Anything that is not a work of fiction could presumably be an informational text. Why can't such texts, then, be read

and contained in other standards, presumably in science or history, and therefore judged according to the quality of the information they convey? At any rate, even among the books in, say, history that are written for children, few attain the rank of a classic. The many books of Jean Fritz (e.g., *Where Are You Going, Christopher Columbus?*) should be read by every child. The writing even in those, however, does not attain the mastery of style to be found in anything written by Hans Christian Andersen. Therefore the rule should be, Give unto Caesar (who represents history) what is Caesar's, but do not crowd out great literature during the time that should be devoted to literature.

Second, the non-fiction works do not appeal to the imagination of children. Mostly, the authors of the Common Core (from which these standards are derived) do not have in mind history but rather basic encounters in everyday life that hardly need to be read about in school. The standards-makers cover their tracks by not offering any examples of what a non-fiction text really is. But it might be as simplistic as instructions on how to build a kite. Great: children like kites. But they would rather be outside flying them (ones that they have already built with their parents) rather than inside reading about them. A story about giants or evil stepmothers working mischief will grab their attention every time.

Third, there is no moral in these "informational texts." If we build the kite wrong, it is no vice. If we build the kite right, it is hardly a virtue.

Fourth, there is nothing at stake in these texts: at least nothing that children would find fascinating. Most of the readings are simply little vignettes on rather odd topics, such as how seeing-eye dogs are trained (yes, I have seen this in a fifth-grade class). As a result, children's sustained attention to a topic and ability to follow a story through to its logical conclusion are not really tested or improved. These informational texts are written in a way that never carries over from one day to the next. Moreover, since they do not stick in the memory, students (and teachers) will not be saying months later when reading another "text," "Remember how those seeing-eye dogs were trained? That's a lot like how plastic and glass get recycled nowadays." This last example is worth remarking on. Whereas nothing much is at stake in these information texts, the ONE THING that the editors of textbooks want to drill into young children's heads is that THE PLANET is in grave peril. And if we do not do our jobs as GLOBAL CITIZENS, that is, if we do not stop cutting down rain forests and using fossil fuels (notwithstanding the fact that all of Pearson/Prentice Hall's textbooks are made out of PAPER and delivered to schools in TRUCKS), we will all perish in an environmental Armageddon within a generation. I frankly think that the children get a little tired of listening to this broken record.

This whole category, then, should be scotched. Nonetheless, I shall point out some of the absurdities.

<u>Reading Complexity Expectation</u>

Standard One: **Read and comprehend proficiently a variety of nonfiction, including textbooks, simple biographies, and children's periodicals, within a range of complexity for grades 2-3, independently for texts at the second grade level, and**

with scaffolding as needed at the third grade level. (Second-grade standard; they all read somewhat like this one.)

"Read and comprehend proficiently . . ."

Sure, students should read proficiently. No ground is gained here.

"A variety of nonfiction . . ." See my comments above on the dubious nature of so-called nonfiction or "informational texts" and its open-endedness as a category. Nearly anything can be called "nonfiction" and then put into the classroom, regardless of its value.

"Including textbooks, simple biographies, and children's periodicals . . ."

Textbooks: Hoosier students will be the consumers/victims of the textbook industry's proclivities, which have been exposed as woefully superficial and inexcusably biased.
Biographies: Yes, students should read biographies. Which ones? Why would these not be addressed in *history* standards?
Children's periodicals: These are fraught with problems. First, the pages are distracting with lots of images that take students' minds away from reading. Second, the writing in them is inexcusably weak. Imagine poor writers (mostly bottom-tier "journalists" who cannot land a job with a local newspaper) writing dumbed-down stories aimed at what they imagine children's interests to be. Third, like most journalists, they interject their own political views. Many are the stories on the environment. These periodicals have also written favorable articles on the Common Core in an attempt to sell it to children. Realize that the foregoing can only serve to replace great, compelling literature such as stories written by Lewis Carroll and Rudyard Kipling.

"Within a range of complexity . . ."

This is language rewritten from the Common Core. It is simply edu-speak for saying that students in second grade should read books suited to their reading level. "Scaffolding" is a ridiculous term that simply means *teaching*. The problem with this constant harping on what is grade-appropriate is that states, districts, schools, and teachers almost always aim lower than students' true abilities. This is particularly acute in the realm of nonfiction, in which publishing companies contract nameless hacks to write "age-appropriate" material. In the case of literature, it is always the job of the teacher to bring students *up* to the story being read. In the case of nonfiction, there is always a strong temptation to go *down* to the students' present reading level or even shoot below it.

<u>Key Ideas and Textual Support</u>

All of the standards in this category can be summarized with one word: *summary*. The *main idea* of this standard is that students should know the *main idea* and a few details about the boring texts that the students are forced to read.

Finding the main idea in works of literature is problematic enough, as we shall see. But in these spiritless nonfiction vignettes the whole enterprise is simply boring. The authors of the standards try their best to make them sound rigorous, but in practice they are far from it. For example, consider the third standard for the second and third grades:

Identify the main topic of a multi-paragraph text and explain the topic of each paragraph.

Determine the main idea of a text; recount the key details and explain how they support the main idea.

How does this standard work in practice? Well, the students will read a short article on recycling. (The reader may think I am going overboard with my examples related to the environment, but I assure you I am not. Environmentalism—not English—is one of the leading aims of the authors of the Common Core.) The overall point of the article will be to show that recycling is good. After the introductory paragraph, the piece will have a paragraph describing how much trash people produce. The second paragraph will then indicate that humans consume a lot of natural resources. The third paragraph will dwell on how unused trash just goes to big landfills. The fourth paragraph will show us how great it is when we can reuse our trash. The final paragraph contemplates a world in which everything we wear and use to contain things (boxes, bottles, etc.) would be made out of our old trash. After reading this predictable article, the teacher will ask the class, "What is the main idea?" Answer: Recycling is good. Then, "What is the main idea of the first paragraph?" Answer: We make too much trash. And so on until the students will have been main-idea-ed out of their minds. Finding the main idea is just another way of saying "beating a dead horse."

No part of this exercise is useful or engaging. The students are not made to wrestle with a compelling story—in which they would have to judge characters and their actions. Nor do they acquire real knowledge, as they would in reading an account of a particular battle or of the life of George Washington. In the case of reading from history, the exercise of recounting things is useful because doing so stores knowledge in the students' memories. Yet simply stating the "main idea" of a worthless "informational text" does not have the same advantage. What is learned from the text is just *information* (and information not particularly difficult to fathom), which is to be distinguished from *knowledge*: something that is of permanent value.

This brings us to the final point. There is passing mention in this section of the standards to the reading of history. Consider the fourth standard in the third grade:

Describe the relationship between a series of historical events, scientific ideas, or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

There are similar claims or suggestions throughout these standards that students will be encountering biographies and other historical texts. You would think that such promises would make a professor of history happy. Not so.

The overarching philosophy governing the use of "informational texts" in the Common Core (and "non-fiction" texts in these standards clearly derived from the Common Core) is that we now live in an information age in which people have to make rapid decisions based on countless, unconnected articles of information that confront us every day. Thus, what we need to cultivate in young people is not so much *knowledge* in the traditional sense as so-called "critical thinking" that enables a person to solve any problem at any time. To this end, selected readings or "texts" are presented to children as disconnected vignettes on countless and unrelated topics. No text is connected to any other text; what the children read one day has no bearing on what they read tomorrow. For example, even when encountering selections drawn from history, the students one day may read about Abraham Lincoln, the next day about Babe Ruth or Hank Aaron. There is no rhyme nor reason in how these readings are ordered nor in their relation to each other. This approach is the very opposite of the genuine study of history. (That history is no longer called by that name in the schools, but rather "social studies," is also significant.)

History is a discipline whose purpose is to create an overarching story that collects and connects the human experience, though obviously parts of this story unfold in a certain place at a certain time with respect to a certain people. Every new part of the story that is encountered connects to what has preceded it. For example, the Boston Tea Party ought to be studied after students have a sense of the relations between King and colonies, who the Sons of Liberty were, where Boston is, and so on. Setting up the story will take days and more likely weeks, even at the first- or second-grade level. Knowing the whole story enables students to understand the individual parts of it better. History, then, so far from being an assault of random bits of "information," is the putting together of a sequential puzzle. Any piece left out compromises the whole. (Obviously, the puzzle becomes ever more sophisticated—has more pieces—as students proceed in school.)

History, then, as its name implies, is the recounting of a story. As such, history standards must be carefully crafted with that story in mind. History standards outside of a coherent *curriculum* (which in the Latin means *course*—as in "the course of human events") are simply worthless. The reading of random historical texts as presented in these standards lacks such a curriculum. Conversely, if the schools had a meaningful curriculum—and likewise adequately prepared teachers to teach it—simplistic standards that belabored the obvious would be wholly unnecessary.

In reality, "non-fiction" is a wholly contrived, indeed fictitious category. There are ways of understanding the world, and these ways have been carefully ordered into academic disciplines: history, economics, chemistry, grammar, and so on. The fact that the new standards are collapsing these important categories into one big monstrosity called non-fiction or "informational" indicates that the schools are actually moving from order to disorder, from organization to chaos. The result is that students become utterly confused, disengaged, and ultimately bored. What the people who advocate this approach do not

understand is that the leaders and thinkers who can really make sense of the assault of random bits of information (much as a general who constantly hears conflicting reports about what is happening on the battlefield) are those who understand "the big picture," whose perspective is built upon a solid foundation of knowledge. The person who does not know the great sweep of history is moved one way or another by the latest headline atop the latest newspaper. The person who *does* know the overarching narrative may use or discard in a second that article based upon a deep knowledge of human events. Which sort of understanding of the world should we encourage in our future citizens? Which is the Common Core and these derivative standards after?

Reading Literature (Tab 4)

Most of what I have to say about the manner of reading literature recommended in these standards I shall reserve for my analysis of the 6th-12th grade standards since the approach is the same. For now, I shall simply state that the method of reading literature in schools is extremely unproductive and has been an utter failure for the last forty years or more. That method, which I call two-bit literary criticism, is recommended here and therefore offers no improvement to the current teaching. While I reserve that analysis for later, at this juncture I shall point out a number of questionable or objectionable matters.

<u>Reading Complexity Expectation</u>

First Standard: **Read and comprehend, by the end of grade 3, a variety of literature, including stories, drama, and poetry, within a range of complexity appropriate for grades 2-3 independently and proficiently**. (Third grade) Grades 2 and 4 end with the phrase "**with scaffolding as needed for texts at the . . . grade level**."

This is a barely reworded version of Common Core RL, anchor standard 10.

First, we must observe that the draft standards, clearly taken from the Common Core, do not have any recommended readings to accompany these high-sounding promises. The recommended texts found in Appendix B of the Common Core are notoriously easy and uninteresting. How, then, do we know whether these high promises of reading "complex texts" will be fulfilled?

Second, will the Indiana standards embrace the Lexile framework to determine text complexity? The Lexile framework is woefully inadequate and filled with flaws. Some would call it a fraud.

Third, the category of complexity itself, reproduced in these standards, is highly suspect. What are the criteria of complexity? Some of the most simply told stories in the world are in reality the most complex. "Complexity" understood generally is a fine word. But the Common Core has done nothing but mischief with it. Using the Lexile framework and several dubious assumptions, they have replaced great, classic stories with modern fiction of marginal value and the kinds of informational texts we described in the last

section. The students would be far better served if the whole category of "complexity" were done away with and replaced with "classic" or something similar. Classic tales are always complex.

Fourth, just out of curiosity, I wonder: what *drama* did the makers of these draft standards have in mind? Could you offer one example, please? (I do not know of any good drama written for third-graders.)

<u>Key Ideas and Textual Support</u>

This entire section is devoted to two-bit literary criticism. See my critique in the 6^{th}-12^{th} standards.

Standard 1, Grade 3: **Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for answers**.

Does this "standard" really say anything? If so, what? The rest of the standards in this line are equally hollow. How are they different from the statement, "students should talk about books they have read"? Do we really need to be told that?

Standard 2: **Recount the beginning, middle and ending of stories, including fables and folktales[,] from diverse cultures, and determine their central message, lesson, or moral**. (Second Grade)

Standard 2: **Identify themes as the moral lessons in folktales, fables, and myths from diverse cultures**. (Third grade)

Recounting the beginning, middle, and end of stories could get a little boring. Thinking about the moral or lesson of stories, though, if done well, is certainly worth doing. But, how would the *theme* end up being the moral lesson of a folktale, fable, or myth? Please give an example. (This appears to be an instance of two-bit literary criticism interfering with otherwise a perfectly sensible way of reading.) The most important question to ask is, why must students read fables, stories, etc. from diverse cultures? Here is an instance of the Common Core (with the Indiana standards following suit) speaking with forked tongue. On the one hand, the authors of the Common Core claim that the standards have nothing to do with curriculum. Moreover, for years we have been told that standards and curricula are two separate things (whether they should be is a different question). Yet the injunction to teach folktales, etc. from "diverse cultures" clearly dictates a certain form of curriculum and discourages another. What if a school determined that in its second- and third-grade curriculum students would read only European and American literary works? Would that school be in violation of the modern shibboleth of *diversity*? What would be the consequences?

Standard 2, Second Grade. "Disconfirmed" is not a word.

<u>Structural Elements and Organization</u>

This section of standards reveals two-bit literary criticism at its worst. For example,

"**With prompting and support, define the role of the author and illustrator of a story in telling the story**." (Kindergarten, standard 2)

What does that look like in practice? "Okay, kindergartners, what do you think about the author's role in the story of *Goldilocks and the Three Bears*?" Silence. "Does the author take on a big role or a small role?" Silence. "Does this story remind you of any other stories we've read where the author has a similar role?" Silence. Finally, one or several children might interject some sense into the conversation: "I think Goldilocks shouldn't have gone into the bears' house."

Trust me. I have seen kindergarten teachers try this again and again. It always goes over like a lead balloon. The children want to talk about Goldilocks and the Three Bears, not the author! Who is the author, by the way? And what is the author's "role," really? Do not authors create stories that are supposed to offer a separate world for the reader to live in, rather than serve as targets for hokey categories like "author's point of view" served up by armchair critics and Monday-morning narrators who really do not understand the books they are reading? By the time the students reach high school and have been doing this nonsense for almost a decade, they are bored to death and no longer enjoy books or school in general. When it comes to literary "analysis" in our schools, the emperor truly has no clothes.

<u>Connection of Ideas</u>

Featuring the *Überstandard*: compare and contrast. In other words, when you do not know or understand one story very well, bring in another one to cover your tracks by switching back and forth between two unrelated things, drawing upon the most obvious similarities and differences.

Writing Standards (Tab 4)

This is a large and comprehensive topic. Writing is a very hard thing to teach and even harder to write about. Much of it relies upon the conversation that takes place between teacher and students in the ongoing effort to convey meaning through the written word. I am not going to address the topic at this juncture since, frankly, the idea of doing so meaningfully in the compressed amount of time given to review these standards is simply unfathomable.

Speaking and Listening (Tab 5)

This category strikes me as the most hollow. The practices or process described herein are no more than basic classroom behavior or etiquette. That simple things should be translated into standards, employing extra helpings of edu-speak to make them sound high and important, reveals just how questionable today's standards really are. To wit:

Comprehension and Collaboration

Standard One, or anchor standard: **Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with various partners on appropriately complex topics and texts, building on others' ideas and expressing their own clearly**. (Third grade, others use similar language)

Cut-and-paste from CC: SL.1.K-5. (p. 24 in the Common Core Standards) Mercifully, the new standards contain the word "various" rather than "diverse."

How does this standard say anything other than "Students should talk about books"? Do we really need such a statement acting as a *standard* to tell teachers what to do?

When re-written in edu-speak, the standard contains some flagrant deficiencies and absurdities. First, why must students participate in one-on-one and group discussions? Here is a case of the Common Core (as well as the Indiana standards-makers) dictating classroom practices and teaching styles. These methods, by the way, are progressive and have proven to be utter failures. What do you think children end up talking about in these one-on-one discussions? What do teenagers talk about? Not the text! Notice, too, how the "teacher-led" discussions come last in the list. Furthermore, even after the classes are made to have these three different kinds of discussion, we get the phrase "with various partners." Will the student ever be an individual offering his own thoughts, or is this just a case of group-work leading to group-think? Classical schools do not engage in this way of teaching, so this is actually a blow against school choice.

"Complex topics": outside of a book, what topics would ever come up in an English class or the time devoted to English in elementary school? Notice that we have gone from the use of literary and informational texts to the discussion of *topics*, presumably unrelated to "texts." Where will these topics come from? Since this standard is found in the section for speaking and listening, is this the place where we expect controversial political topics (unrelated to English in the traditional sense) to be introduced?

"Building on others' ideas": Is one student allowed (or encouraged) to contradict another or only to build on another's ideas?

Standard 2: **Draw on preparation and other information known about the topic to explore ideas under discussion**. (Third Grade on)

Slightly altered from CC: SL.3-5.1a. (p. 24)

Students, do your homework. (Notice that we are still discussing *topics*, not books.)

Standard 3: **Demonstrate knowledge and use of agreed-upon rules for discussions and identify and serve in roles for small group discussions or projects**. (Third Grade version; others much the same)

Taken from CC: SL.3-5.1b. (p. 24)

First part: Students, raise your hands before you speak. (That's an academic standard!?)

Second part: Roles and projects. This is ultra-progressive pedagogy. For the best and briefest account of its utter failure these past 60 years or more, read the first paragraph of chapter four in *To Kill a Mockingbird*.

Standard 4: (Students) **Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others**. (Third Grade, other standards similar)

Cut-and-paste from CC: SL.3.1c. (p. 24)

Is the teacher in the room at all?

The rest of the standards in this section are similarly silly and unnecessary.

<u>Presentation of Knowledge and Ideas</u>

Standard 1: **Recite poems, rhymes, songs, and stories, with careful attention to sensory detail when describing people, places, things, and events**. (First Grade)

Supplemented, revised version of CC: SL.1.4. First part seems to be original.

The first part of this standard is the best thing I have yet seen in these standards. Yes! More of this is what we need. I do not actually know what the second part means.

Unfortunately, after the second grade nothing else seems to be memorized. Instead we get into reports. If this is simply the old book report, it is nothing to write home about. We all did them in school. How much did we actually learn from them? The problem with reports in which students do their own "research" is that they often have nothing to do with what the class is studying at the time. Each report, therefore, is delivered in a vacuum. There are much better ways of making students' oral presentations relate to what the class is actually studying, but no hints are provided here.

The really new phenomenon is the reliance upon technology. Hence we get the phrases "various media," "using multimedia to enhance," "multimedia components and visual displays." The rush after technology is the new mania of schooling. There is no proof whatsoever that the use of technology teaches students anything. Moreover, requiring the use of technology, like insisting on group work, is not the province of state standards. It is an absurdity to have students who read and write poorly worrying over Power Point. Worse still, this injunction comes in the "speaking and listening" section of the standards. Have we become so language poor that we must rely on machines to give our speeches for us?

Standard 4: **Communicate ideas and information in a clear and concise manner appropriate for the purpose and setting (e.g., formality or informality, language, word choice, sequence, relevance)**.

This is simply an empty standard. When would we ask students to speak informally? The standard reveals no insight into the most debilitating cancer in our language: the "Valley Girl" craze of the Nineties that has taken over to the point of even many adults not being able to make it through a sentence without constant recourse to the filler "like." "It's like, I was just like . . . and then he said like, and I was like . . . so like you know and whatever." These bad habits are formed when children are in the elementary years, and if no measures are taken to counter them, the child's speaking will be wholly infected by the end of elementary school. These standards put up no fence around formal English, which reveals that the authors of the standards (originally the Common Core) haven't, like, been in a real classroom in like forever.

Media Literacy

Standard 1: **Evaluate the role of the media in focusing people's attention on events and in forming their opinions on issues**. (Fourth Grade)

Hats off to the standards writers for having only *one* tech standard and that one only beginning in the third grade. But do we really think that nine-year-olds can evaluate the media's role in forming public opinion? Do we want them to? What does this standard call on students to do? Watch CNN, FOX, and MSNBC in school? Let's let them keep their childhood innocence a little longer and learn things more beautiful and permanent and true.

Review of Indiana Draft ELA Standards, 6-12

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Reading-Literature Standards (Tab One)

Range of Reading Expectation

Read and comprehend proficiently by the end of grade 6 a variety of literature, including stories, dramas, and poems, within a range of complexity appropriate for grades 6-8, independently for texts at the low end of the range and with scaffolding as needed for texts at the high end of the range. (The language is much the same for the rest of the grades)

Slight rewording of Common Core RL.10.6. (page 37 of Common Core ELA Standards)

This is a completely empty standard. The fact that it is copied-and-pasted with minor alterations from grade to grade shows just how meaningless it is. If the purpose of the standard is to show us what the reading level should be at each grade, this standard fails completely. The standard does not tell us *how complex* the texts will be or give us any idea of *what* the texts will be. The loaded terms are obviously “complexity” and “range.” What will decide how complex a text is and the reading range of any given grade level? This is obviously a set-up to farm out the decisions about good literature to the Lexile framework or some equally worthless computer model. Likewise, this is an abnegation on the part of the state to define what good literature is and at what grades various kinds of literature should be read.

A real standard would be much more helpful to schools and teachers. For example, it might say, “Students should be able to read a complete Shakespeare play by the seventh grade. Examples of plays that are accessible to students of that age include *The Tempest* and *Julius Caesar*.” Or here is another one: “By the ninth grade, students should be able to read a Homeric epic. Since Homer is the foundation of all literature in the West, it makes sense to read either *The Iliad* or *The Odyssey* (preferably in full) in that grade.” Either the standards writers do not have the moxie to make that kind of statement or they do not value great literature enough entail the teaching of great books in the standards. We must ask, where are the genuine *standards* of great literature in the standards?

These example standards I have offered actually do what standards ought to do: tell us what students can read and point to what they should be reading. The standard as written now leaves us wholly in the dark.

“Scaffolding” is simply jargon. It means nothing more than teaching. Why should the education establishment have a phobia about the word *teaching*?

Key Ideas and Textual Support

Standard 1: **Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.** (Sixth grade; same verbiage for later grades)

(The way these standards are changed is comical. Plain old "textual evidence" in sixth grade becomes "*strong* and *thorough* textual evidence" in the ninth grade. Wow! What a leap.)

Copied and pasted from Common Core RL.1.6 (p. 36 of Common Core ELA)

This standard is also completely hollow, generic, vanilla, and unhelpful. It could be rewritten in a common-sense way to show its hollowness: "When talking about books in class, students should refer to the book." Or, more colloquially, "Students shouldn't just be allowed to make stuff up about a book but should actually have to prove their points by using the book." We are supposed to be bowled over by the word *analysis*.

Where does that take us? Do we really have to be told this? Without an example of the kinds of *analysis* teachers and students would be engaging in, virtually any bankrupt way of talking about literature could be justified under this standard.

Standard 2: **Determine how [a] theme or central idea of a text is conveyed through particular details: provide an objective summary of the text**.

A blend of Common Core RL.2.6 and RL.2.7 (p. 36 of Common Core ELA)

This so-called standard marks the beginning at the upper-school level of what I call two-bit literary criticism. This is the failed method of reading and interpreting literature that has been in the schools for at least the last forty years. Basically, two-bit literary criticism consists in reading stories through certain contrived, boilerplate categories that pertain to the elements of any story rather than reading stories as unique creations. On paper, these categories seem sophisticated. In practice, they suck the life out of stories and render the students who have supposedly read the books unable to discuss them and wholly unaware of any great work's deeper meaning. In fact, this method keeps students from even being able to discuss the most basic habits and traits, and virtues and vices, of the characters in a work of literature, who, after all, are meant to be like living people.

The codifying of the failed methods of reading stories into national or state standards is a gross violation of both sound teaching and school choice for a variety of reasons.

First, two-bit literary criticism does not prepare students for college. I was a diligent student in high school, trained to find "the main idea" and to determine characterization, setting, and plot, and a lot of other hokey things. After high school I went to one of the leading institutions of higher education in the country. I studied with some of the best professors of English at that college. Never once did my professors ask me to find the "main idea." My classmates and I (except a few who had gone to private school) were wholly unprepared to answer the questions my professors did ask, all of which pertained

to the book we were reading rather than generalized categories. Now I work at a college. The professors in the English department at that college (a couple of whom were trained at Notre Dame, which has an excellent English department) simply do not employ two-bit literary criticism. The students who come from public schools (many who are Hoosiers) struggle in the first year of college because they have never had to think deeply about a story—on its own terms.

Second, requiring these mind-numbing ways of reading books in academic standards is a violation of school choice. Schools that follow a traditional or classical curriculum and traditional ways of teaching do not resort to two-bit literary criticism. Increasingly, there is an interest in traditional education in Indiana. I am currently working with a founding board for a charter school in Bloomington. Chances are, classical charter schools will also emerge in Fort Wayne and Indianapolis. There are several budding classical private schools in the state. Since charter and voucher schools must abide by the standards, the requiring of these dead-end methods of teaching literature in effect stifles school choice in Indiana at the very moment we are about to reap its fruits.

Third, two-bit literary criticism violates the basic principles of common sense we should have about literature. Does anyone really believe that Homer, Virgil, Dante, Shakespeare, Milton, Austen, Dickens, Melville, Poe, and Twain wrote their great stories so that years or centuries or even millennia later script-following teachers and utterly bored students could sit in a spiritless classroom and intone, "The main idea of *The Iliad* is . . ."? The very idea is preposterous. No one who loves literature thinks this way. No one who is a lover of Jane Austen and finds herself crying at the end of *Pride and Prejudice* says, "the main idea of that novel is . . . and Elizabeth Bennett is a *conflicted* character and Mrs. Bennett is a *flat* character," and so on. The reason the reader is crying is that she (and more than one *he* whom I have taught) has gotten to know these characters *as if they are real people*, has entered this unique world and invested herself in the story as though it were really unfolding. Two-bit literary criticism keeps students out of the story through its pseudo-scientific jargon: "author's point of view," "main idea," "plot development." Consequently, students never understand the story, and they never love the story.

If two-bit literary criticism is so ridiculous, then why has it been so prevalent these last forty years? Could it be that the teachers (due to their forced preparation in intellectually bankrupt education schools) do not themselves know how to talk about stories without these artificial crutches? Could it be that the politicians who consent to this nonsense are not any great readers of literature either? Consider these two simple questions. When is the last time you heard a state or district education bureaucrat make a reference to Homer? And when is the last time you heard a politician quote Shakespeare? The truth is, these education politicians and political educators do not love these stories and therefore do not fight for them.

On to specifics: Why is the "theme" or "central idea" listed first in these standards? What is an example of a "central idea"? We need concrete examples. Are not the central ideas the standards-writers have in mind simply boilerplate? (E.g., man vs. society)

If there is a "central idea," that idea probably emerges from the story. One must invest oneself in the details of the story and then see how certain themes emerge from it. Yet without being given any examples of a theme, we cannot be sure that the authors of these standards even know what they are writing. In my book *The Story-Killers*, I expose how the actual assignments given as examples in the Common Core (derived from jargon like this) not only do not fully grasp the story, but in fact completely misinterpret the story. So I would insist that the authors of these standards offer an example of a theme that emerges from a classic work of literature. What happens in practice with the "central idea" is that once that label gets slapped on the book, every chapter is read so as to find the central idea. As a result, nothing else about the book is considered. In Harper Lee's *To Kill a Mockingbird*, for example, the central idea (we are told) is "racism." That is all students ever know about the novel. Obviously, the book is about a lot more than that, and even the theme of racial prejudice must be understood for its nuances.

Same standard, 11th-12th grades: **Compare and contrast the development of similar themes or central ideas across two or more texts and analyze how they emerge and are shaped and refined by specific details; provide an objective summary of each text**.

Here is a chance for the standards writers to provide an example of how they would compare and contrast similar themes or central ideas across two or more texts. I think we need to see such an analysis in order to know how productive such an assignment would be and how adept those who are writing these standards would be at analyzing texts. The books I would like to see them "compare and contrast" are Fyodor Dostoyevsky's *Crime and Punishment* and Joseph Conrad's *Heart of Darkness*. Since the authors of these new Indiana standards have no doubt studied these books in depth, we should expect such an exemplar "performance task" (the Common Core's language) within the month of April.

Standard 3: **Explain how a plot unfolds in a series of episodes as well as how the characters respond or change as the narrative advances and moves toward a resolution**. (Sixth Grade)

Standard 3: **Analyze the interaction of elements in a work of literature (e.g., how setting shapes the characters or plot)**. (Seventh Grade)

How does such a standard manifest itself in an actual classroom? Recently I visited a class studying Mark Twain's *The Adventures of Tom Sawyer*. They had gotten to the 31st chapter in which Tom and Becky are lost in the cave. This is obviously one of the most exciting moments of the story, and any sensible person (whether a teacher or not) who had simply read the book could hardly have failed to have a robust discussion with children about the same age as Tom. Yet that is not what happened. Rather, the teacher read the story in a monotone. Then she asked students to turn to the booklets they had made out of construction and notebook paper. On the outside of the booklets was written the words "setting," "characters" and "plot." The teacher told the students to write down in their notebooks answers to their "setting, character, and plot questions." The students dutifully wrote something like the following: "The setting is in a cave. The characters are

Tom and Becky and Injun Joe. The plot is them [*sic*] trying to get out of the cave." And that was it. Then the teacher started reading the next chapter.

Boring. This sort of "analysis" drains the life out of great stories and numbs the mind of countless children across the country, explaining why not one in twenty students coming out of public high schools can have a discussion about *Tom Sawyer*. Yes, that book has a setting. Every story does. Yes, that book has characters. Every story does. Yes, that book has a plot. Every story does. The way to teach the book, however, is not to play "find the setting," or even to talk about the setting directly *as a setting*. Rather, the point is to talk about what is happening in the story. Rather than saying, "What is the setting, class?" the teacher could simply start out by asking the common-sense questions, "What would it be like being stuck in a dark cave with little water and no food, and no sense of time, and no idea that anyone is looking for you? What would be going through your mind? What would you do?" Such questions would lead to many others. "So what do you think about this kite-line? Remember how we laughed about all that junk Tom and the other boys carry around in their pockets? It comes in pretty handy now. Would you know to set up this way of finding your way back to Becky and not get lost in looking for a way out? What can we say about Tom at this moment?" The students would have any number of things to say. Presumably, the words *clever, resourceful,* and *brave* would become a part of the discussion. The students (perhaps led by the teacher) would realize how all the escapades and adventures Tom embarked on earlier somehow prepared him for this moment in which he demonstrates qualities of the heroic. The words *characters, setting*, and *plot* would not even be spoken. Students would be living out the story in the classroom: without a skit, without any other gimmicks. Such a discussion is manifestly *not* taking place in most of the classrooms in Indiana or in any other state in the country. That failure is in large part due to the utterly mechanical way of treating great stories as prescribed in these so-called standards.

The rest of the standards found in the Reading Literature tab do more of the same thing. This is a surface-level way of looking at stories, which, if not intellectually bankrupt altogether, never gets to the heart of great literature. Great authors did not compose their stories so that discerning readers would puzzle over "characterization," "author's point of view," and "compare and contrast." The true reading of literature does not slap the same generalities on every book but rather delves into the unique qualities of each book: since each book presents a different world and entirely unique individuals. Just consider: Tom Sawyer is one of the most memorable, unique, entertaining, and likable characters ever produced in American literature. Following these boilerplate methods, students would know hardly anything about him. They would simply know that "the author" created this setting here and used that plot device there, and introduced this theme in about chapter x, and so on. Not only did Mark Twain not write *Tom Sawyer* so that teachers could bore their students with such lifeless drivel. He would have subjected it to the most merciless satire, just as he makes fun of the schoolmaster and school in general in chapters 6 and 7. In fact, Mark Twain tells us (at least in part) why he wrote his book:

> Although my book is intended mainly for the entertainment of boys and girls, I hope it will not be

> shunned by men and women on that account, for part of my plan has been to try to pleasantly remind adults of what they once were themselves, and of how they felt and thought and talked, and what queer enterprises they sometimes engaged in.

That is the **author's intent**—in his own words. There is nothing about plot devices and rising action and climax and setting, characterization, and plot. He clearly wants readers to enter into his entertaining story and lose themselves in the strange "enterprises" of boys and girls, in Tom's *adventures*. Such joy is not to be found in the mechanical way of reading stories mandated by these standards. Consequently, little understanding and no pleasure will be the result.

What is most remarkable about these standards for literature is what they do *not* include. Is there any guidance offered or suggestions made for what students should read in their English classes? Which books does the committee recommend? Does the committee think that the question *what* children read is less important than *how* they read? All of these standards concern *how* students should read, not what they should read. Even if these were good approaches to reading literature, we are still left in the dark about what students in Indiana will be reading.

We are forced to ask, then, will students be reading many of the books contained in the Common Core list of exemplar texts? Will they be reading Toni Morrison's *The Bluest Eye* or Maya Angelou's *I Know Why the Caged Bird Sings*, which contain graphic scenes of rape? Will our students still be reading Shakespeare in our twenty-first-century global economy, or has the Bard become passé in our "information age"?

These questions are not answered in these standards. In fact, the most important questions about literature are not answered in these standards.

Finally, I ask this basic question. Will mostly complete works of literature be read or mostly selections of literature as found in textbooks? Nowhere do I see this question addressed in these standards. Yet the greatest offense of the modern classroom is that students almost *never* read complete books. They get portions of stories that showcase these literary devices, never stopping to read an entire story. Worse still, the textbooks are filled with nonsense and often transparent attempts at indoctrination that should never be a part of an English class. Yet these standards set up no fence against these common occurrences. If the writers of the Indiana standards wished to compose one standard that would serve as a barrier to the real intent behind Common Core, they could adopt this one: **We encourage schools in their English classes to teach complete works of classic literature rather than relying upon textbooks that offer only selections of literature, questionable literary works, and superficial or biased interpretations of the classics**.

What are the chances of writing a standard like this one followed by recommendations of classic literary works? Whatever the chances, that is precisely what is needed.

Reading-Nonfiction (Tab Two)

This is a category of standards that should not exist. It derives from the principal aim of the Common Core English Standards: to replace great literature (called "literary texts" in their lingo) with so-called "informational texts." Replacing the word "information" with "non-fiction," as happens in these draft standards, does not change the score in any way. The alleged reason for replacing great literature with non-fiction seems to be that since we now live in an "informational age" and have to digest countless pieces of information each day, we should spend time in school reading the same kinds of information we will encounter in our jobs and day-to-day lives. That is based on several false premises, which I have treated in part in my evaluation of the K-5 standards. At the upper-school level, though, we encounter three new problems.

First, while the argument could be made in the elementary school students are "learning to read" rather than "reading to learn" (especially at the early elementary level), and thus the actual books read in class are not so important as their reading *something* (a faulty argument, by the way), in the upper grades students should be encountering extremely challenging books that are filled with what the great writer Flannery O'Connor said is essential to any significant work of literature: mystery. The great books and stories are not complex because of the difficulty of their language. That is the obvious mistake of the Lexile framework, which rates *The Grapes of Wrath* at a second-third-grade level. Rather, great literature is complex because of the depth of the story and the characters. Just read any story of O'Connor and marvel at how unique and memorable the characters are. It takes a lot of thinking to figure them out—if that is even possible. Non-fiction, and even more so "informational texts," if that is what is meant here, is by design meant to convey information. Any non-fiction writer who leaves his readers guessing what he is "trying to say" is probably a bad writer. As students advance in their education, they should read longer and more difficult works of literature, culminating in a novel such as Dostoyevsky's *Crime and Punishment*. To do justice to such great works, a class cannot waste time with innocuous informational texts which litter the best-selling textbooks and only seem to be growing in the erstwhile literature curriculum in high school.

Second, English teachers are not prepared to teach these non-fiction texts. Let us suppose for a moment that an English teacher had an excellent background in English, American, and Western literature and a sound grasp of grammar. Is there any guarantee that such a teacher would know much about history? What are the history, government, economics, and philosophy classes a college student would have to take in order to become what is now inelegantly called an "ELA teacher." I do not believe there are any. Yet by having to teach an ever-growing number of "non-fiction texts" that involve history, government, economics, philosophy, and, frankly, modern political issues, she will be instructing and commenting on those subjects. Why? Should music teachers be allowed to teach math and vice versa?

Third, the reason behind this change is obvious to anyone who bothers to look in today's high-school literature textbooks. They are filled with politically-biased and often poorly-written "informational texts" that range from government forms that students are asked to

fill out to articles on health care costs to "non-fiction" accounts of the horrors caused by dropping the Bomb on Hiroshima (with no discussion about why we did or what would have happened if we had not or the fact that hundreds of thousands of warning pamphlets were dropped on the city). Through the bogus category of non-fiction or informational texts, the progressive ideology can easily be impressed upon unthinking young people who do not know any better and who have at their disposal no rival account of the world and our place in it. This assertion is not a conspiracy theory. "Social change" has been the leading objective of progressive educators for one hundred years. Every page of John Dewey says so. And every page of a modern textbook is the proof. How otherwise could Jane Austen be turned into a proto-feminist, Tom Paine recast in modern terms as being in favor of redistributing wealth, and Ronald Reagan shown to be at his rhetorical best when he *restrained* his strongly anti-communist sentiments? Yet these are the things that happen in modern literature textbooks.

Although the category of Reading-Nonfiction should be done away with altogether, that is not to say that literature classes should be confined to reading only stories, plays, and poetry. There are certain well-known works that are both historical and literary treasures. These works are read both for their content and for their incomparable style. Yet these works are established and hardly need a separate category to secure them a place in the canon of great literature. They include Benjamin Franklin's *Autobiography*, Frederick Douglass's *Narrative*, Churchill's *My Early Life,* and other great autobiographies; both political speeches and sermons as those of Lincoln and Jonathan Edwards, respectively; and great essays, as those written by the Founding Fathers or George Orwell. True, the Common Core lists a few of these, and the current draft standards mentions them. Yet it is abundantly clear for many reasons that the real mischief will be done by introducing a host of non-classic, non-fiction texts throughout the curriculum.

By the way, what will be the proportion of non-fiction to fictional works? Will the new Indiana standards embrace the 70% non-fiction goal advocated by the Common Core? Since there is no comment on the proportion of non-fiction to fiction, and since these draft standards are essentially derived from Common Core, we must assume that will be the course adopted by the education establishment of Indiana.

Finally, does not the considerable attention given to non-fiction texts in English classes defy common sense? Should not the vast majority of these works be read in the history and government classes and therefore addressed in those standards?

Range of Reading Expectation

Standard 1: **Read and comprehend proficiently by the end of grade 6 a variety of literary nonfiction (e.g., biography, memoir, and personal essay), within a range of complexity appropriate for grades 6-8, independently for texts at the low end of the range and with scaffolding as needed for texts at the high end of the range**. (Sixth Grade; the same language is used for all grades)

Compare to Common Core RI.10.6-12 (p. 37 of Common Core ELA Standards)

"Literary non-fiction" is presumably reserved for non-fiction authors whose writing is on par with the great authors. That is a tall order. Which non-fiction authors rise to the level of a Twain or a Poe or a Dickinson?

A biography is the life of a person (usually a very famous person) written by another person. Whose biographies do you have in mind? What qualifies a biography as being "literary nonfiction"? Presumably, if it were Plutarch's *Lives* or John Marshall's *Life of Washington* or Churchill's *Life of Marlborough* the authors of this standard had in mind, that caliber of writing would be considered literary non-fiction. We must ask, then, what modern biographers have attained that height of literary style? Please, name one.

Let's choose a figure whose biography we should read: George Washington, the father of our country, the "indispensable man." Which biography should we read at, say, the tenth or eleventh-grade level? Flexner's (401 pages) John Marshall's edited for schools? (469 pages) Chernow's (817 pages) Douglass Southall Freeman's? (seven volumes) Do any of these biographies reach the heights implied by the phrase "literary non-fiction"?

Will students only be required to read a part of a biography of Washington? Okay, which part? How does one determine which part of a man or woman's life ought to be read in isolation from the rest of that person's life? Are not biographies similar to stories in that they have to be read all the way through for them to make complete sense? Did not the great philosopher Aristotle ask whether we could count any man happy until he was dead?

These questions expose obvious flaws in this alluring new idea of reading non-fictional works "across the curriculum." In an English class there is no call to read a biography unless it were the biography of an author. Doing so, however, would either be boring (no author is as great as his creations), or it would impose opinions on stories before students had read them and serve as yet another artificial crutch for teachers to use rather than just reading the book for its own value. Historical figures, outside of the occasional speech or classic autobiography, really have no place in a literature class. Flexner, Chernow, and Freeman are all really good writers. But they are not Melville or Twain or Poe. Finally, there is simply not time to give to a biography in an English class. Certainly, one could throw in a short account of one aspect of a hero's life. What would be the point of that exercise, though? Should that not be done in a history class where it makes more sense and where, presumably, the teacher knows what he is talking about?

What is a "personal essay"? Do Sandra Cisneros's various writings constitute personal essays? Will her autobiographical writing be juxtaposed to that of Benjamin Franklin's? Will Sandra Cisneros's challenges in making tortillas be "compared and contrasted" with Benjamin Franklin's founding a library, a school, and a fire department; forming a militia, an early colonial alliance and the first postal system; as well as his seminal discoveries in electricity? This is not a random example of the mischievous use of "personal essays," but rather one that comes straight out of an American literature textbook aligned to the Common Core.

What will determine text *complexity*? Once again this term is introduced. While it seems innocuous enough to an ordinary person reading the standards, it is nonetheless a loaded term. Complexity will clearly drive how the readings are selected. What criteria will be the measure of text complexity? Will Indiana use the Lexile framework?

As we have seen before, "scaffolding" is simply edu-speak.

<u>Key Ideas and Textual Support</u>

The most remarkable thing about this section is how closely it resembles the section called by the same name in the literature standards. Perhaps the inability of the standards writers to see the differences between a work of literature and an essay, speech, or history causes them to alter a few words but essentially treat them the same. Yet those who truly understand literature and history, for example, know that these different ways of writing engage different parts of the mind and offer different ways of viewing the world. Lord Bacon famously said that literature derives from the human imagination, history from the memory, and philosophy from reason. That these standards treat these different ways of viewing the world as essentially the same reveals that they do not understand the unique qualities of either literature or history.

Consider these two standards:

Literature: **Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text**. (Eighth Grade)

Nonfiction: **Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text**. (Eighth Grade)

Copied and pasted from Common Core RL.1.6-12 and RI.1.6-12 (pages 36 and 39)

Once again we are left in the dark as to what would constitute "analysis of what a text says explicitly." Could it be as basic as, for *Democracy in America* (which is not read in schools), "there is a whole lot of democracy in America," and for *Pride and Prejudice* (which is also not read in schools), "The characters show a lot of pride and prejudice in the book called *Pride and Prejudice*"?

The fact that literature and nonfiction are treated identically here and almost the same throughout these standards is further evidence that students in class will be given a brief selection of a "text" (whether literature or non-fiction), expected to cough up a main idea, and then move on to the next text, all in the name of "critical thinking" in an information age as well as—the real motivator—preparation for the standardized examinations that will follow this same drive-by format. Boilerplate questions elicit boilerplate responses.

Standard 2: **Determine how a central idea of a text is conveyed through particular details; provide an objective summary of the text**.

Compare to Common Core RI.2.7 (p. 39)

As a famous president once said, "There you go again."

First, the "central idea" approach is a bankrupt way of looking at literature. In reading "non-fiction," though, we do not even use that language. Rather, in the case of an essay, for example, we refer to its *thesis*. Even a longer work of scholarship, such as a doctoral dissertation, is usually called a *thesis*. So let's at least get our terms right.

Second, how applicable is this approach to looking at these "non-fiction texts"? If we were looking at great essays, such as those of Orwell, in a composition class, we would observe how he states a clear thesis and then follow how he proves that thesis. In the case of oratory or rhetoric, we would look at what the speaker wants to communicate to his audience and observe how he employs both style and the main elements of rhetoric (*logos*, *ethos*, and *pathos*, which are, of course, nowhere mentioned in these standards) in order to make his case. (Even then, though, we would not just slap categories on a great speech, but get to know it from the inside.) These are legitimate inquiries, and if that is what this business of the "central idea" really means, then we would give it a pass and ask the standards writers to use language that actually approximates how composition and rhetoric teachers actually discuss the art of argument.

But given the examples of our "nonfiction texts" above we run into yet another problem. Recall that biographies are one of the texts that students will be reading. What is the central idea of almost any biography? That is rather straightforward: that the subject of the biography is a good or a great person. (In the case of Benedict Arnold or Hitler, the "central idea" would presumably be that the person is not a good guy.) But would that qualify as a central idea or thesis? Well, maybe. True, certain biographies of George Washington hold that he was the "indispensable man" or a modern Cincinnatus. But is it really worth dwelling on such a thing as you would a thesis in an essay? The issue grows even murkier in this "personal essay" category. A certain style of essay writing, that of Montaigne, does not really emphasize a thesis or central idea so much as the expression of various experiences over the course of the essay. One can begin such an essay at one point and end up at an entirely different one. So this "central idea" business is far too general a category to be helpful or accurate in discussing what the students would read.

If this section of standards is to be salvaged at all, it should be put into a section on composition, since that is usually why essays would be studied in an English class. Even then, the writers need to be clearer about what they are trying to accomplish. In other words, they need to have a thesis and then support that thesis with concrete examples. What follows is an example of how that might be done.

Here is a standard:

Students should learn how to write an essay based on their study of classic essays such as *Federalist* #10 by James Madison.

And here is the example of how such a standard would be explained and followed:

Teachers should demonstrate how in *Federalist* #10 Madison addresses the threat of faction in free civil society. Attention must be given to Madison's definition of faction (and hence how great writers define their terms and explain difficult concepts for their readers) and his explanation of why factions are inevitable in free society. One should also be aware of how Madison faced fervent opposition to the idea of a large republic (hence the objections he had to overcome). How did Madison prove that the threats to liberty were worse in a smaller republic and therefore that any society hoping to remain free must "extend the sphere"? What sources did Madison draw on to prove his case? How did he combine two different, seemingly separate challenges to the Constitution in order to solve both of them? Above all, what is the purpose of government, according to Madison? Can the people often be their own worst enemy, that is, the greatest threat to their liberty? If so, then how can they be entrusted with power and why should they be? Does Madison give us hope for republican government despite his rather dark message about the nature of man? (Teachers may also bring in *Federalist* #51.) Students should write a convincing essay, with a clear thesis and supporting evidence, on how Madison makes his case.

Without such an example of what is supposed to be accomplished through these formless standards, there is no reason to think that the people who have written them know what they are talking about or that the teachers who read them will know what to do with them. Even so, the way of discussing "key ideas and textual support" in this section is wholly unlike any noted writer on style I have ever encountered. The standards writers need to spend some time with Strunk & White, Peter Elbow (*Writing with Power*), and Joseph M. Williams (*Lessons on Style and Grace*). Further, with Madison in mind (who defined *faction* clearly), we must ask whether the authors of these standards have ever defined what an academic *standard* is. I do not believe they have.

<u>Structural Elements and Organization</u>

Standard 2: **Determine an author's point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose**. (Ninth-Tenth Grade)

Copied and pasted from Common Core RI.6.9-10 (p. 40)

Author's "point of view," a bankrupt way of looking at literature, is no more helpful here. In an essay or longer work of prose, as we have said, a writer is usually attempting *to prove a thesis* or *to make a case*. The image of the lawyer arguing a case before a jury is often a helpful one to students. Asking the class what the author's point of view is does not advance our understanding of the argument. Presumably, the whole thing is the author's point of view. What does the standard enlist the student to do? Go outside the text to determine bias or some other motive for writing? What students should be doing with non-fiction works—essays being the best example—is determine the logic of the

argument and how the case is supported, not get lost in the forest of "author's point of view," which cannot really be proven.

The "uses rhetoric" part of this standard is interesting and worth pursuing. To give it any legs, though, we must be told what rhetoric is. This the standards do not do. The word is just thrown in there. Furthermore, rhetoric does not really belong in this section called "structural elements and organization" but rather deserves a category all its own.

The last parts of the eleventh-twelfth-grade standards in this category are interesting: "**whether the structure makes points clear, convincing, and engaging**," and "**how style and content contribute to the power, persuasiveness, or beauty of the text**." The phrases are actually well-written, one of the moments in the Common Core where a blind hog finds an acorn. Nonetheless, both the first and second standards are confusing. In this category's second standard, we go from determining the author's point of view (a bankrupt idea) to rhetoric (which has not been explained) to, parenthetically, the order of argumentation (which more properly belongs to logic than rhetoric) to the style (which is related to rhetoric) to content (which is a separate category from rhetoric) to "power, persuasiveness, and beauty" (a nice phrase that appears nowhere else in these standards but is just tacked on here). In other words, this is all one big jumble: a kind of omnibus standard. Recall that the entire standard is supposed to determine "an author's point of view." How does one determine an author's point of view through the logic or beauty of a text? What does *author's point of view* even mean and why should it be the overriding concern? This standard is further evidence that the authors are throwing around fancy or high-sounding terms that they do not even understand themselves.

<u>Synthesis and Connection of Ideas</u>

Standard 1: **Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account**. (Ninth-grade version; the other grades are almost the same)

Copied and pasted from Common Core RI.7.9-10 (p. 40)

This is another standard that reveals the idolatry of technology pervading the modern education establishment. Will all schools have to follow this standard? What if schools of choice *choose* not to have computers in their *English classrooms*? Let us go back to our biography of George Washington. Must we have his "life story" told through the web or Power Point? This seems like a colossal waste of time. Rather than working up Power Point presentations, the teacher should be studying the subjects of their lessons. Of course, the life of Washington should be studied in history, not in English, and I doubt Washington is who the authors of this standard have in mind. To use another example, why would we need multimedia to discuss Poe's "The Raven"? Will the teacher pull up an image of a raven each time the phrase "quoth the raven" appears?

The time wasted by the diversion of technology in the modern classroom is appalling. That such a bogus standard is being written to bring technology into an English class—

the class that should simply have students and teachers with their books open trying to make sense of great writing and beautiful stories—shows just how little the education establishment understands what constitutes teaching and studying great literature.

Standard 2: **Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims, noting instances of bias and stereotyping**. (Seventh Grade; other grades are similar)

Copied and pasted from Common Core: RI.8.7 (p. 39). The phrase "**noting instances of bias and stereotyping**" has been added. Thus the standard has been made worse.

This standard raises an interesting question. *Which* texts would the authors of these standards point to as examples of unsound reasoning, irrelevant evidence, bias, and stereotyping? Such texts must be read to make good on this standard. Will textbooks feature the arguments of modern politicians (and educators) that do not make any sense and are simply sophistry and demagoguery? If they did so, that would perhaps serve a useful function, but it still raises the question of why this exercise should be performed in an English class. Or will the editors of these textbooks be eager to illustrate alleged bias and stereotyping with the writings of the Founding Fathers, for example? Just such an outrage occurs in Appendix B of the Common Core, pages 95 and 176, where modern scholars are brought in to expose the alleged bigotry and sexism of the Founding Fathers through highly questionable interpretations of the Constitution.

This is no accident. In fact, this standard is the very heart of the Common Core. Under the guise of critical thinking, the authors of those standards (which are now reproduced in these copy-and-paste Indiana standards) are intentionally trying to discredit the Western and American tradition of liberty and self-government under the rule of law—which used to be seen as the greatest achievement in history. The way to do that is to take away the great stories of our tradition, replace them with biased "informational texts," and to the extent that the Founding Fathers and their achievements are still studied, to accuse them of supposed "bias."

This objective becomes clear, as I have shown at length, if one bothers to sit down for an afternoon with a modern textbook. These draft Indiana standards do nothing to combat this flagrant hijacking of education for political purposes. This standard looks innocent enough, admittedly. But the Devil is in the detail, or rather the application. Without any examples of unsound arguments, we must assume the worst. That assumption is based on the actual "lessons" taught in schools of education and found throughout textbooks. That this particular standard has been made worse by adding the words *bias* and *stereotyping* reveals either that the compilers of the Indiana standards are blissfully unaware of the real bias found in the modern classroom (and is clearly a design of the Common Core) or that they are themselves in on the act.

While a casual or novice reader of this document would think, after reading references to "foundational U.S. and world documents of historical and literary significance," that

these standards would lead to greater civic literacy and even a higher regard for American principles, such a view can only be regarded as naïve. The "bias" the standards-makers want to expose will be found in the American documents. The wonderful things the standards makers want to extol (such as environmental awareness) will be found in the "world documents." This script will be written in the margins of the teachers' editions to the textbooks. There will be lots of other supplemental material on the web, telling teachers how to tell children what to think: imparting bias in the name of exposing bias.

How could such obvious bias be avoided? How could a standard be written that would not become subject to the wiles of the textbook publishers and the makers of standardized examinations and other intruders into the state's classrooms? Just as I had suggestions for the better teaching of English, so I have several hints for how to secure a bona fide study of the documents mentioned here.

First, the monopoly of teacher certification should cease so that history and government majors coming out of college could teach in the high schools rather than requiring social studies ed majors who take far fewer upper-level classes in their disciplines, in large part due to the egregious number of required education courses whose content is utterly vapid.

Second, the social studies standards in Indiana would have to be rewritten with several objectives in mind: one being to teach primary sources in the high school, which is hardly being done at the moment.

Third, primary sources should be taught directly by using the documents themselves and not through the lens of modern "scholars" who provide commentary in the textbooks that invariably casts the Founding Fathers and other traditional heroes in a negative light.

Fourth, Indiana should take a hard look at the AP examinations, which drive the history curriculum in high school even in non-AP courses. The Advanced Placement exams are under the control of the College Board. The College Board is now run by the architect of the Common Core. For years the AP American History exam has been abandoning the older political narrative and concentrating on social history. In the hands of Mr. Coleman it would be more accurate to call the course AP *Anti*-American History. Why should the state of Indiana bow down to such nonsense? Districts are obviously free to offer AP courses if they wish. Yet the state education department should issue a warning to the school districts and, more important, to the parents of Indiana in order to let people know what exactly is taking place in these examinations that offer college credit and prestige.

Fifth, Indiana must "teach the teachers." When I talk to teachers of history at the high school level, they all pretty much tell me the same thing: "We would like to teach more in the way of primary sources; but we were not really trained to do that in college. How can we do that effectively?" There are two good resources that are close to Indiana teachers. One is Hillsdale College that through the Center for Teaching Excellence regularly offers workshops for teachers of the Constitution and American history. Another is the summer master's program sponsored by the Ashbrook Center at Ashland University. There are

also organizations in Washington, D.C. that offer similar programs. The Bill of Rights Institute is one.

What should not happen is that in the name of "informational texts" or "nonfiction texts" we slough off historical documents to the English classes which are not the right venue for the teaching of history, civics, or economics.

English classes need to get back to reading great literature and having discussions about more important and interesting things than the sterile categorization of setting, characters, and plot. Moreover, to the extent that basic logic and rhetoric should be taught in English class as a part of composition, we need to be very careful about what examples of "bias" or outright sophistry are employed in the classes. Could English classes be counted on to stay out of modern politics, we would not be so worried. But the entire aim of Common Core is to bring politics into the English classes.

Reading-Vocabulary (Tab Three)

I have already spent considerable time commenting on the failed methods of teaching words at the elementary level, so an extended discussion here is not warranted. Yet I shall follow up on several previous observations and offer a suggestion about the best way to build vocabulary.

Standard 3: **Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade (6,7,8,9-10, 11-12) reading and content, choosing flexibly from a range of strategies**.

Standard 4: **Use context as a clue to the meaning of a word or phrase** (Grade 6, 9-12 wording)

Copied and pasted from Common Core: L.4.6-12 and L.4a.6-12 (pages 53-54)

If a student encounters a word he does not know, or a usage of a word he does not know, then the best thing he can do is **LOOK THE WORD UP IN A DICTIONARY.**

Inferring from contexts and other *strategies* (significantly not listed here but just alluded to) DO NOT WORK.

At last, in the sixth grade, though in no grades before that, in the sixth standard down the page, after being urged to use context and other *strategies*, we are given this line:

Consult general and specialized reference materials, both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, or its etymology. (Grades 9-10 wording)

"General and specialized reference materials" must mean . . . the DICTIONARY. Why can't the writers of these standards just write it?—the d-i-c-t-i-o-n-a-r-y.

Clearly the authors of these standards (by which I mean the authors of the Common Core) do not like the word *dictionary* and perhaps not the book itself. Why not? Is it because looking things up in a dictionary seems dry, rote, and not a part of this "critical thinking" we keep hearing about and never see? Is it because a dictionary seems like such an old-fashioned resource, taking us back to the days of the great Samuel Johnson? Is it because they do not want ordinary folks looking up too many words in a dictionary since that is a sure way to their having a command over language? As both Plato and Orwell knew, the person who controls the language controls the regime.

The clear bias (something we were trained to look for in the previous section) in these so-called standards is against dictionaries and, more subtly, against learning words. We are not told about dictionaries until the sixth grade. At that point they are not even called dictionaries and are used as a last resort (after all the guessing games called "strategies"). The word *etymology* is not used until the ninth grade.

Admittedly, the standard above this one urges the use of **common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g. auditory).** That is in fact a good thing to do. What I wonder is how students will know those Greek and Latin roots. We are not told that Greek and Latin roots will be taught explicitly.

The best way to learn words, though, is actually more straightforward than the other things mentioned on this page. It is what many schools in the country used to require of their students, and I have had numerous men and women now in their seventies tell me this is what they did in school: learn Latin.

Consider the Latin vocabulary and the words derived from it listed in just the first chapter of the famous Wheelock's Latin: (I have left off the macrons; the multiple words for verbs are known as the four principal parts of verbs)

me: me, myself
quid: what (as in the phrase *quid pro quo*)
nihil: nothing (nihilism, annihilate)
non: not
amo, amare, amavi, amatum: to love, like (amatory)
cogito, cogitare, cogitavi, cogitatum: to think, ponder, consider (cogitate; Descartes' *cogito ergo sum*)
debeo, debere, debui, debitum: to owe; ought, must (debt, debit, due, duty)
do, dare, dedi, datum: to give, offer (date, data)
erro, errare, erravi, erratum: to wander, err, go astray, be mistaken (erratic, errant, erroneous, error, aberration)
laudo, laudare, laudavi, laudatum: to praise (laud, laudable, laudatory)
moneo, monere, monui, monitum: to remind, advise, warn (admonish, admonition, monitor, monument, monster, premonition)
salveo, salvere: to be well, be in good health (salvation, salvage)
servo, servare, servavi, servatum: to preserve, save, keep, guard (observe, preserve,

reserve, reservoir)
conserve, conservare, conservavi, conservatum: a stronger form of servo (conservative, conservation)
terreo, terrere, terrui, territum: to frighten, terrify (terrible, terrific, terrify, terrorist, deter)
valeo, valere, valui, valiturum: to be strong, have power, be well (valid, invalidate, prevail, prevalent, valedictory)
video, videre, vidi, visum: to see, observe, understand (provide, evident, view, review, vision, revision, television)
voco, vocare, vocavi, vocatum: to call, summon (vocation, advocate, vocabulary, evoke, convoke, invoke, provoke, revoke)

Now, admittedly, an English teacher does not have time to teach Latin, any more than she has time to teach history. But an understanding of how students best acquire vocabulary, in addition to the ways outlined in the K-5 evaluation, compels one to state this truth. A student armed with a good dictionary and a year or more of Latin, would be far ahead of the student who relied on the methods described in these standards, and miles ahead of the students subjected to word-guessing in context.

At the risk of beating a dead horse, let me summarize what I have stated about building a vocabulary in these two evaluations. Young people need to acquire a great reservoir of words. They do so in ways that have been proven over not just decades but centuries and millennia. They must hear the language spoken at its heights. That means having either really articulate parents or really articulate teachers. The state cannot do anything about the parents; it *can* make ways for schools to hire the most articulate teachers. Students must also read great literature. The language contained in great literature far exceeds that of even the most articulate people students will encounter. Students must look up words they do not know. There is no way around it. They will learn far more about a word by looking it up than by how it is used in a particular context. Further, students must begin to study words formally. The best way to do that is through a language, especially when it is an ancient language. It would go too far to require the study of Latin as an English standard. Yet if the educational leaders at the state level were serious about our students building their vocabularies, they could send strong signals to the schools that the study of Latin should be far from dead, even in a twenty-first-century global economy. The proof is in the pudding. The verbal scores on the SAT began to plummet in the early 1960's, and the test has actually had to undergo changes to make the decline seem less dramatic. The early 1960's is the time when the teaching of Latin and formal grammar began to disappear from the schools. Today's high school graduates are verbally impoverished. The methods listed here for teaching vocabulary (prefixes and suffixes, figures of speech, and so on) would obviously be a part of any English class. Reliance on these techniques alone, though, will not do much to raise the level of students' discourse or insights into the language.

Writing (Tab 4)

As I stated in the previous evaluation, a couple of weeks is not enough time to create a worthwhile document explaining how to teach students to write. Since it is based entirely

on the students' performance, writing is a much more difficult thing to pin down in any kind of standards. Furthermore, it is probably a mistake to discuss writing apart from a thing to be written about. What we find in these standards is the description of a generic, mechanical "writing process" that lacks useful instruction on how students learn to write and what good writing looks like. While I do not have time to write out the fundamentals of good writing (if even such a thing can be done in this format) I shall put forward a few observations about why these standards will fail to produce good writers.

Here is a riddle for the Sphinx: why, if virtually every English class in the land teaches students about what is inelegantly called "the writing process," are there so few students who can write well? You can ask almost any student what a paper is supposed to look like, and he could tell you. "It has an introduction, a body with supporting evidence, and a conclusion. To write a paper, you have to brainstorm first, then make an outline, then write a first draft, then take it to your teacher or professor if you care about your grade, then write a final draft, revising up to the last minute." Such is the writing catechism. It is outlined in these standards: a) introduce claim(s), b) support claim(s), c) use effective transitions, d) establish and maintain a consistent style, and e) provide a concluding statement. And, yes, if you wish to describe writing in a mechanical way, that is pretty much what a good essay would consist in. Why, we ask again, does describing such a "process" prove so unavailing in students' actual writing? "Freshman comp" is always an eye-opener for students throughout the nation who go off thinking that straight-As on writing assignments in high school have any value.

The answers could be found easily if we were to go "Jaywalking" and grab a student off the street. We could tell that student to "make a claim, support a claim," and so on. Most students would say "huh?" The cleverer ones would say, "About what?" Further, we could ask our student a straightforward question: "What is a *gerund*, and can you use a gerund in a sentence?' Double "huh?"

Good writing comes with work. Good writing is an art. And real writers call it an art, not a "process." Yet there is a foundation to good writing. That foundation consists in mastery of reading and mastery of the English sentence. Neither mastery is encouraged in these standards.

Good writing begins in good reading. Not every good reader is a good writer, but every good writer must be a good reader. Good reading consists in close observation of what you are reading: a habit of noticing things and asking questions. It also consists in noticing the style in which something is written and, often, emulating that style. Anyone who doubts that careful reading should lead to emulation in writing ought to read the first few pages of Franklin's *Autobiography*; for he learned to write by emulating Addison and Steele's *Spectator* papers, the most famous essays of their day. From truly careful reading questions emerge, questions that have to be answered in writing. Therefore, good writing does not emanate from the ether but rather in response to questions posed by the greatest writers and thinkers. The reader turned writer converses with the classic author and thus finds his own voice in writing, closely following both the wisdom and occasionally the style of the master. While engaged in this intensive reading, the student of writing must

undertake another course: the mastery of the English sentence, which Winston Churchill called "a noble thing." That mastery entails both the formal study of grammar and the love and active pursuit of style. The student who does not master English grammar lacks the bricks for building his house. The student who does not fall in love with good style lacks a design. He may write in a mechanical way. But he will never move anyone; he will not cause any reader to cheer.

The authors of these standards do not, then, describe how one becomes a good writer, though they may describe mechanically the order and characteristics of a basic essay. To learn to write a *good* essay requires more than is on display here. The student must learn to read books carefully. He must further learn to ask questions of them. Of course, those questions will first be posed by the teacher: the person who is most conspicuously absent in these standards. If the teacher does not pose good questions, he will not receive good responses, whether oral or written. Then the student must reread the story or the account with that question or those questions in mind. That leads to his having to make decisions about the things he reads after fully developing his thoughts. For example, to the question "Should Elizabeth have been mad at Darcy after their first meeting?" the student must go beyond the initial gut-level response of "Yeah, he was a jerk" or "No, he was his own man" and reconstruct the story with attention to details and insights into the characters involved. (As an example, it has never been clear to me how Elizabeth overheard Darcy. Was he speaking so loudly in that crowded company as to be overheard, or was she just eavesdropping and possessed with a keen sense of hearing? Who turned the room against Darcy, by the way? How one answers those questions matters for formulating a thesis.) In order to become good at *reading* that leads to *writing*, one must read and write all the time. Writers write. Therefore, students need to be asked questions continuously as they are reading so they can reflect upon the story they are reading and write in response.

The standards as they exist now fail utterly with regard both to good reading and to mastery of the English sentence. As we saw in the Reading-Literature standards, students are being asked the most mechanical, uninteresting, predictable questions about how texts are supposedly constructed. Yet there is never anything at stake about which to write, no questions to answer. Having to figure out whether Mr. Darcy is a jerk or not is far more difficult and interesting than trying to figure out how the setting interacts with the plot or his character. Moreover, the reader must be attentive to far more details. He cannot do the current pseudo-literary drive-by. The standards also fail with regard to mastery of the English sentence. Notice how grammar appears in both the K-5 and 6-12 standards as a happenstance. It is not given its own set of standards (a tab) but somehow just magically emerges out of students' writing. In the 6-12 standards we see minimal grammar appear in a category called "conventions of standard English" (i.e. not *grammar*, which is a dirty word in progressive education)—after "argumentative," after "narrative," after "literary response," after "the writing process," and after "the research process" (an entirely bogus category, especially in an English class). In the ninth grade, students will be taught to use a semicolon**;** that's really demanding stuff! When is the last time the people writing these standards graded a set of papers? Have they ever graded a set of papers? I am grading one right now, and I assure you that semicolons are the least of our worries.

Finally, good writing emerges out of a conversation between teacher and student over the style, structure, content, and grammar of the latter's papers. It is well-nigh impossible to describe that conversation, at least in a set of standards. It is in writing, then, that we see the limits of formulaic standards like these. Certainly, certain kinds of standards may exist that would help direct schools in what they should be teaching as well as serve as a guide for parents to hold schools accountable. Creating decent geography standards, for example, would be rather easy. "By the end of the fourth grade, students should know all the states and their capitals." That would be a model geography standard, and all the rest could follow that one. Creating good history standards would also not be that difficult. When one gets to literature, things get a little harder. Interpreting literature is not nearly as straightforward as knowing certain facts in geography and history. The insistence that certain generalized categories be created that apply to all literature indiscriminately—in other words, the *standardization* of great literature—is precisely what has led to the utter boredom of students in literature classes throughout the state and the country. Yet, a few great books could be chosen and meaningful things said about them, thus creating a guide if not a *standard* of how to teach literature. But students' writing is much harder since every paper has its own unique merits and difficulties. The authors of these standards have neglected the one thing they could have done: offer a comprehensive view of how grammar should be learned from Kindergarten to 12^{th} grade. And they have done a poor job of trying to standardize that aspect of teaching that is least subject to a mechanical or formulaic model: the art of writing.

Speaking and Listening (Tab 5)

The standards in this category are simply ridiculous. They do not map out or describe the kinds of Socratic discussions we just saw as a necessary prelude to writing. Consider this so-called standard:

Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternative views), clear goals and deadlines, and individual roles as needed.

Is this a literature class or student government? Is there a teacher anywhere in the room? What will these votes on key issues look like? "Okay, class, how many of you think that Raskolnikov should have killed the pawnbroker? Let's see a show of hands." (Not that *Crime and Punishment* would be what the class was reading. See media category below.)

This is clearly the work of an ultra-progressive educator who has not been a successful teacher, has no idea what is at stake in class discussion, does not know anything about the Socratic method, wants students working on projects and collaborating and taking votes on things, has no knowledge of or loyalty to an academic discipline and therefore is more than happy to have students fritter away their time, does not even care about reading great literature, in short, the sort of person who is largely responsible for the decline of public schooling in this country. This whole category should be dropped.

And how about this one?

Adapt speech to a variety of contexts and tasks (including interviews), demonstrating command of standard English when indicated or appropriate.

Does this mean that the standards makers want students to go into environments where Standard English is *not* spoken, affect an accent or colloquial way of speaking, and try to blend in? Didn't Hillary Clinton try to do that in an African-American church? When is there ever a time that students should not be taught Standard English? Teaching Standard English used to be the job of English teachers.

Media (Tab 6)

This section is, if anything, worse than the previous one. Consider this so-called standard:

Identify and analyze rhetorical and logical fallacies used in the media including ad hominem (appealing to the audience's feelings or prejudices), false causality (falsely identifying the causes of some effect), red herring (distracting attention from the real issue), overgeneralization, and the bandwagon effect (attracting the audience based on the show rather than the substance of the presentation).

Apparently, the students will be watching a lot of CNN.

This whole section, and the standards as a whole, reveal just how little the people in charge of public schools care about great literature and our students' minds and souls.

SUMMARY OF NATIONAL EVALUATOR INPUT INTO DRAFT #2 OF THE INDIANA ACADEMIC STANDARDS, VERSION DATED MARCH 14, 2014

On February 13-14, 2014, the academic standards Evaluation Panels met during a public meeting to complete a blind evaluation of standards that best aligned with college and career ready learning outcomes. This resulted in a draft set of academic standards, labeled "Draft #1", which was posted for public comment from February 19 through March 12. Six independent evaluators were also invited to provide feedback on Draft #1, and four agreed to do so. These individuals are:

- Dr. James Milgram, Ph.D., Stanford University
- Dr. Shauna Findlay, Ph.D., Indiana ASCD
- Ms. Janet Rummel, Indiana Network of Independent Schools
- Ms. Kathleen Porter-Magee, Fordham Institute

Following the close of the public comment period on Draft #1, the Standards Leadership Development Team and Indiana Department of Education content specialists incorporated the feedback from independent evaluators and the public comments into a second draft of the standards, labeled "Draft #2" and dated March 14, 2014. Draft #2 was distributed to six national evaluators, who were invited to provide feedback on Draft #2. These evaluators are:

- Dr. Sandra Stotsky – E/LA
- Dr. Terrence Moore, Hillsdale College – E/LA
- Joanne Eresh (Achieve) – E/LA
- Dr. James Milgram (Stanford University) – Math
- Professor Hung-Hsi Wu (UC Berkeley) – Math
- Kaye Forgione (Achieve) – Math

The attached document contains the evaluator reports on Draft #2. Full reports were submitted by April 1, 2014, and were used to inform the work of the Indiana College & Career Ready Panel.

It is important to note that the evaluators provided their feedback on Draft #2, and were not asked to provide input on the final proposed 2014 Indiana Academic Standards released to the public on April 15, 2014. By design, it was the Indiana College & Career Ready Panel that was responsible for assessing all independent evaluator input and determining how this input would be reflected in Indiana's new standards.

We are grateful to the national evaluators for their time and effort. Their input was invaluable to the development of Indiana's new academic standards, and their feedback is reflected throughout the version released to the public on April 15, 2014.

Comments on Draft #2 of Indiana's Future English Language Arts Standards:
A Report to Governor Michael Pence

Sandra Stotsky
Professor emerita, University of Arkansas
April 8, 2014

A month ago, Indiana Governor Michael Pence signed a bill requiring that: "Before July 1, 2014, the state board shall adopt Indiana college and career readiness educational standards, voiding the previously adopted set of educational standards. The educational standards must do the following:

(1) Meet national and international benchmarks for college and career readiness standards and be aligned with postsecondary educational expectations.
(2) Use the highest standards in the United States.
(3) Comply with federal standards to receive a flexibility waiver under 20 U.S.C. 7861, as in effect on January 1, 2014.
(4) Prepare Indiana students for college and career success, including the proper preparation for nationally recognized college entrance examinations such as the ACT and SAT.
(5) Maintain Indiana sovereignty.
(6) Provide strict safeguards to protect the confidentiality of student data."

This report responds to a request from Governor Pence to review a draft of English language arts (ELA) standards now being developed to address this bill by a committee of Indiana educators selected by the Indiana Department of Education. Before accepting the governor's invitation to review a draft of the standards, I indicated that I would not review a set of standards that looked like Common Core's ELA standards. I have criticized them steadily in various public venues since 2009. I have even testified twice about their deficiencies to Indiana legislators—in January 2013 and August 2013.

The standards for grades 6-12 in the draft sent to me on March 14, 2014 for review were not significantly different from the standards for grades 6-12 in the public comment draft (draft #1) that had been posted by the Indiana Department of Education in February 2014. Those standards (draft #1) received a great deal of public criticism for being mostly Common Core's standards. But draft #2 was not much different. According to the department's own analysis, 93% of the standards in grades 6-12 in draft #2 were identical to or slightly edited versions of Common Core's standards in grades 6-12. The differences between draft #1 and draft #2 lay mainly in K-5, even though K-5 in draft #2 was, according to the department's own analysis, also heavily repetitious of Common Core's standards.

On March 17, I wrote to Governor Pence indicating that I would not review draft #2. But I did promise to solicit suggestions for improving draft #2 from literary scholars attending a conference in Bloomington, Indiana on April 4 and 5, and from local high school English teachers who responded to an invitation to attend the conference. John Briggs, Professor of English at the University of California, Riverside and current president of the Association of Literary Scholars, Critics, and Writers, scheduled two workshops for this purpose at the conference, one on April 4, the other on April 5 (see the attachment for the conference program). He also sent letters of invitation, through English department chairs, to English teachers in Indiana high schools to attend the conference and the workshops.

I was eager to solicit the comments of literature professors and high school English teachers in Indiana at these workshops because very few are on the standards-drafting committee and the

review panel consisting of faculty in higher education institutions in Indiana. Members of these two committees were chosen by the Indiana Department of Education. It is not clear why so few high school English teachers and college-level literary experts in Indiana were selected to be on these two committees. According to the official list I was sent by the Indiana Department of Education, only two current high school English teachers are on the standards-drafting committee, and it is not clear if either of them teaches grade 11 or 12 or Advanced Placement courses. Nor is it clear if any literature professors are on the panel.

Clearly, it is important for Governor Pence and for Indiana citizens to hear from a larger number of literary experts and high school English teachers than were involved in the development and validation of Common Core's own ELA standards, adopted by the Indiana Board of Education in 2010. No high school English teachers were on Common Core's own Standards Development Work Group for ELA, and only one high school English teacher was on its Validation Committee. The relative absence of high school English teachers and literary scholars in the development, review, and validation of Common Core's ELA standards helps to explain the many deficiencies in Common Core's standards. Indiana had an opportunity to rectify this serious omission, but barely did so with respect to committee membership.

In my view, it was necessary to compensate for the failure of the standards-drafting committee to move far beyond the low level of academic challenge implicit in Common Core's own standards as this committee sought to develop an Indiana-oriented set of ELA standards that could meet Governor Pence's own criteria. The involvement of literary experts from across the country and a wider range of high school English teachers in Indiana was clearly needed and justified.

Over 25 people participated in the two workshops at the Bloomington conference. Most were teaching faculty in English departments at colleges or universities around the country. Four were high school English teachers in Indiana, most of whom taught upper-level high school English courses. Also in attendance as observers were a retired high school English teacher and a member of the Indiana Board of Education.

This report presents first the comments of the participants on major problems they saw in draft #2 and then their suggestions for a final version of ELA standards for Indiana that would meet Governor Pence's request for "uncommonly high standards written by Hoosiers for Hoosiers."

Comments. (Although no votes were taken, it should be noted that there was no disagreement about any comment.)

1. The cognitive load does not visibly increase from grade to grade. The progression from grade 8 to grades 9/10 and then to grades 11/12, in the standards below, was pointed out as an example of "distinctions without a difference" and of "one" standard with contradictory ideas in it. (These standards in Indiana's draft #2 were taken verbatim from Common Core's ELA standards.)

Analyze the development of a theme or central idea over the course of the text, including its relationship to the characters, setting, and plot; provide an objective summary of the text.	Analyze in detail the development of two or more themes or central ideas over the course of the text, including how they emerge and are shaped and refined by specific details; provide an objective summary of the text.	Compare and contrast the development of similar themes or central ideas across two or more texts and analyze how they emerge and are shaped and refined by specific details; provide an objective summary of each text.
Grade 8	Grades 9/10	Grades 11/12

2. Too few if any real progressions through the grades.
3. Excessive repetition/paraphrase of the same expectation/objective, as in the above example.
4. Jargon-laden language is excessive throughout.
5. The language of the standards suggests they are for assessment, not curriculum, purposes.

Suggestions:

1. Create separate literature standards for each of the four grades from 9 to 12.
2. Create standards at each grade for each major genre (fiction, poetry, drama, nonfiction, and traditional/classical literature).
3. Embed sample titles or authors in each standard, selected by current English teachers in Indiana, to suggest the level of reading difficulty and complexity desired.
4. Create standards that show an increasing cognitive load (greater intellectual demand) at successive grade levels.
5. Put in summative comments at grade 12 for each strand or skill: How should this strand or skill look by grade 12?
6. Provide a list of recognized Indiana-born writers (e.g., James Whitcomb Riley, Booth Tarkington, Theodore Dreiser) whose works are to be taught in the secondary grades.
7. Create a standard for the study of British literature before and after Shakespeare.
8. Create a standard requiring study of historically significant literature (i.e., literature written before the 20th century).
9. Create a standard requiring study of literature from Anglophone countries.
10. List the different kinds of informational/nonfiction texts to be taught in an English class.
11. Define text complexity clearly and succinctly, and specify approximate length of major works to be read from grade to grade.
12. Draw on Bloom's taxonomy for verbs where possible.
13. Provide examples for each level of performance in composition at each grade level, not just examples of the strongest and weakest writing as in Common Core.

Concluding Remarks:

One participant wrote: Any "uncommonly high" standards, written by Hoosiers for Hoosiers, must be written in a manner that is clearly understandable by all Hoosiers. It should be at a 12th grade level and be clear of "eduspeak" (educational jargon) so that parents can understand what is expected of their children. Where jargon is unavoidable, the term should be marked and defined in a glossary."

Another participant wrote: "Indiana in the 21st century will need to have students who have developed the complex, critical thinking skills that are built out of an engagement with complex literary texts that speak to the human condition. Without specific examples, and a sense of clear progression from one level of thinking and reading to another, standards will not help to assure the necessary and desired outcome. Draft #2 standards were too obviously constructed for the purpose of assessment, and assessments based on them will inadequately capture these skills."

It is clear from the language of the bill that Governor Pence signed that any set of proposed standards must meet international benchmarks. It is also clear from the comments and suggestions of the English professors and teachers at the Bloomington conference that a set of standards similar to Common Core's ELA standards does not meet international benchmarks for college readiness or other requirements of the bill. Any revised set of standards for Hoosiers must go well beyond what Common Core-based high school standards imply, even as a floor.

Many participants, especially those from Indiana, recommended a return to the 2006 Indiana standards as the right "floor" on which to build an even stronger set of academic standards than the 2006 standards were. The Indiana teachers noted the extent to which the literature standards in the 2006 document reflected the work of the state's own English teachers. The suggestions of the literary scholars and English teachers at the Bloomington conference point to the kind of changes that will address both the statutory requirements outlined in the bill Governor Pence just signed and his own charge as well.

The following people have reviewed this brief report and attest to its fidelity in reflecting the comments and suggestions of those who attended the workshops at the ALSCW conference in Bloomington, Indiana on April 4 and 5, 2014.

Karen S. Davis, English Department, Center Grove High School, Greenwood, Indiana, and ACP Adjunct, Indiana University

M. J. Fitzgerald, Associate Professor of English and Creative Writing, University of Minnesota

Jerry Maguire, English Department, Center Grove High School, Greenwood, Indiana

Joshua Surface, English Department, Center Grove High School, Greenwood, Indiana

Ann Taylor, Professor of English, Salem State University, Salem, Massachusetts

Attachment: Program for the 20th meeting of the Association of Literary Scholars, Critics, and Writers in Bloomington, Indiana, April 3 to April 6.

The Twentieth Annual Conference

of the Association of Literary Scholars, Critics, and Writers

Thursday, April 3–Sunday, April 6, 2014 | Indiana University, Bloomington

Conference Program

All events will be held at the Indiana Memorial Union

Thursday, April 3

7:30–9:30 PM

An Evening of Poetry Readings

The President's Room, Indiana Memorial Union, University Club

The gathering will feature Greg Delanty; briefer readings by John Burt, Rebekah Scott, Kevin Tsai, Brett Foster, Ben Mazer, Jacob Bennett, and Jee Leong Koh will follow. Refreshments will be served.

Open to the public

Friday, April 4

8:00–9:00 AM

Registration with Continental Breakfast

Conference Lounge, Indiana Memorial Union

9:15–11:15 AM

Panel 1: Literary Translation from German and Slavic Languages

Dogwood Room, Indiana Memorial Union

Moderator: Vincent Kling, *La Salle University*

Jacob Bennett, *La Salle University*:
"In Defense of 'Illiterate' Translation"

Hans Gabriel, *University of North Caroline School of the Arts*:
"Translating the Self-inclusive *Schadenfreude* of Gottfried Keller's *People of Seldwyla*"

Misha Semenov, *Princeton University*:
"Sorry, Wrong Address…Discovering Strategies for the Translation of the Russian Vy/Ty Distinction from Russian into English Through an Analysis of the English-Language Editions of *Anna Karenina* and *War and Peace*"

11:30 AM–12:45 PM

Panel 2: Listening to Victorian Poets: Performance, Interpretation, Discussion

Dogwood Room, Indiana Memorial Union

Moderator: Debra Fried, *Cornell University*

Rebekah Scott, *University of Nottingham*:
"Browning's Bluff"

Dustin Simpson, *Reed College*:
"Performance vs. Scrutiny: The Case of Gerard Manley Hopkins"

Giffen Mare Maupin, *Hendrix College*:
"Victorian Poetry's Family Voices"

Herbert Marks, *Indiana University*:
"Hardy's Voiceless Ghost"

Lunch break **12:45–2:30 PM**

Panel 3: Rhetoric and Asian American Poetry **2:30–4:00 PM**

Dogwood Room, Indiana Memorial Union

Moderator: Jee Leong Koh, *The Brearley School*

Kevin Tsai, *Indiana University*:
"*Dictée*'s Rhetoric Between Word and Image"

Alan Ramón Clinton, *Reconstruction: Studies in Contemporary Culture*:
"The Feeling Is Actualized: Completing the Aristotelian Triangle in the Poetry of Paolo Javier"

Jee Leong Koh, *The Brearley School*:
"Erratic as Thought: Goh Poh Seng's *Lines from Batu Ferringhi*"

Seminar: The Bible and Literature **4:15–5:30 PM**

Dogwood Room, Indiana Memorial Union

Leader: Stephen Cox, *University of California, San Diego*

Scott Crider, *University of Dallas*:
"The Test: Narrating God, Abraham, and Isaac in the English Bible, Genesis 22:1–19"

Margaret Ducharme, *Vaughn College of Aeronautics and Engineering*:
"Groanings From Within: Paul's Concept of Spirit in Romans 8:1–39"

James M. Kee, *College of the Holy Cross*:
"The Bible and Literature: A Hermeneutical Vision"

John Savoie, *Southern Illinois University, Edwardsville*:
"Literary Creation: Johnson, Lewis, Milton, Jesus Read—and Write—Genesis 1 and 2"

Workshop 1: "Indiana's Draft Literature Standards: What Are Your Suggestions for Improvement?" **5:45–7:00 PM**

Dogwood Room, Indiana Memorial Union

Moderator: Sandra Stotsky, *University of Arkansas*

Dinner break **7:00–8:00 PM**

Readings by this year's Meringoff Award Winners **8:00–9:30 PM**

Dogwood Room, Indiana Memorial Union

Host: John Briggs

George Kalogeris, Poetry
Anneliese Schultz, Fiction
Alex Effgen, Literary Nonfiction

Saturday, April 5

8:30–9:15 AM

Members' meeting with Continental Breakfast

Dogwood Room, Indiana Memorial Union

9:15–10:30 AM

Concurrent Seminars:

Seminar 1: Reading Literature and Learning to Write: A Discussion of Successful Pedagogies at University of California, Riverside

Persimmon Room, Indiana Memorial Union

Leader: John Briggs, *University of California, Riverside*

Lash Vance, *University of California, Riverside*

Paul Beehler, *University of California, Riverside*

Wallace Cleaves, *University of California, Riverside*

Seminar 2: Wonder and Literature

Dogwood Room, Indiana Memorial Union

Leader: David Smith, *Indiana University*

Brian Chappell, *Catholic University of America*:
"Wonder in the Age of Simulation: The Case of Don DeLillo"

Peter Cortland, *Quinnipiac University, Hamden, CT*:
"Wonder and Literature"

Ashish Patwardhan, *Sitwell Friends School*:
"The Secret Fire: Wonder, Grief and Recovery in Tolkien and Shakespeare"

John Wallen, *Nizwa University, Oman*:
"*The Great Gatsby* and the Wonder of the Green Light"

JHS McGregor, *University of Georgia*:
"Wonder? In the *Inferno*?"

10:45 AM–12:45 PM

Panel 4: The Role and Significance of Literature in the Common Core

Dogwood Room, Indiana Memorial Union

Chair: John Briggs, *University of California, Riverside*

Sandra Stotsky, *University of Arkansas*:
"The Fate of Poetry in a Common Core-Based Curriculum"

Mark Bauerlein, *Emory University*:
"It All Depends on Personnel"

(For background information, see the *Common Core State Standards for English Language Arts and Literacy* and the reading lists in that document's appendix at www.corestandards.org/ELA-Literacy.)

Luncheon for all Conference Registrants and Visiting Teachers

12:45–2:15 PM

Tudor Room, Indiana Memorial Union

Featured Speaker: Mark Bauerlein, *Emory University*:
"Why Informational Text?"

Two Events

2:30–4:30 PM

Panel 5: Compassionate Fictions: Fellow Feeling in Renaissance Literature

Dogwood Room, Indiana Memorial Union

Leader: Leah Whittington, *Harvard University*

Katherine Ibbett, *University College, London*:
"Compassion's Edge: Fictional Feeling and its Limits in Seventeenth-Century France"

Leah Whittington, *Harvard University*:
"Compassion in the Classroom or What Shakespeare Learned from Vergil"

John Staines, *CUNY*:
" 'It is no little thing to make / Mine eyes to sweat compassion': Compassion and Tragic Pity in *Coriolanus*"

Oliver Arnold, *University of California, Berkeley*:
" 'He to Hecuba': Impossible Relations and Compassion in *King Lear* and Early Modern England"

Workshop 2: The Indiana Literature Standards

Persimmon Room, Indiana Memorial Union

Moderator: Sandra Stotsky, *University of Arkansas*

4:45–6:30 PM **Panel 6: The Problem of the Chorus in Athenian Tragedy, Then and Now**

Dogwood Room, Indiana Memorial Union

Chair: Stephen Scully, *Boston University*

Thomas Hubbard, *University of Texas, Austin*:
"Choral Unwisdom and the Inadequacy of Democratic Man"

Francis Blessington, *Northeastern University*:
"The Greek Chorus and Alternative Tragedies"

Helaine L. Smith, *The Brearley School*:
"Aristophanes's Comic Choruses: Sixth Graders Perform *Clouds* and *Women at the Thesmophoria*"

Herbert Golder, *Boston University*:
"Cradle of Storms"

6:15 PM **Cash bar opens**

Tudor Room, Indiana Memorial Union

7:00 PM **Banquet with Dessert Readings of some favorite passages from the publications of the ALSCW**

Tudor Room, Indiana Memorial Union

Sunday, April 6

10:00 AM–12:00 PM **ALSCW Council Meeting**

Charter Room, Indiana Memorial Union

Franklin Hall and the Sample Gates | Indiana University, Bloomington

Directory of Participants

Oliver Arnold teaches in the English Department at U.C. Berkeley. Professor Arnold's publications include *The Third Citizen: Shakespeare's Theater and The Early Modern House of Commons* (Hopkins), *Julius Caesar: A Longman Cultural Edition*, and articles on Shakespeare's comedies, Congreve, historicism, and both early modern and recent political philosophy. He is currently finishing "England in Chains: Slavery and Freedom in the English Imagination, 1558-1714"; next up, a book-length study of the ways in which early moderns conceived artificial persons, populations, corporations, and abstractions as both compassionating subjects and compassionable objects and thus radically transformed the politics and aesthetics of pity.

Mark Bauerlein is Professor of English at Emory University. He is the author of many scholarly books including *Literary Criticism: An Autopsy* (1997) and *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future* (2008). His essays have appeared in the *Yale Review*, *Partisan Review*, *PMLA*, *Wilson Quarterly*, *New Criterion*, *First Things*, and *Commentary*, and his reviews and commentaries have appeared in the *Wall Street Journal*, *Washington Post*, *Chronicle of Higher Education*, *TLS*, *London Times*, the *Weekly Standard*, the *Guardian*, and *Reason Magazine*. He served on the Common Core feedback committee.

Paul Beehler is a lecturer in the University Writing Program at U.C. Riverside where he teaches all forms of composition from basic writing to narrative, argument, and semiotics. Paul has also taught courses in History of the English Language and Pre-Modern Literature. Currently, he is a lecturer in the School of Business Administration at U.C.R. where he teaches a core course, "Management Communication and Writing," for students interested in the undergraduate business major. Paul has published articles on Shakespeare, Disney in popular culture, and composition pedagogy. His panel paper is entitled "Impressions on the Use of Literature in Multi-Disciplinary Courses."

Jacob Bennett is a poet, translator, and critic living in Philadelphia, where he is a member of the English Department faculty at La Salle University. Jacob reviews poetry for *Phantom Limb*, and has a new chapbook, *Wysihicken [sic]*, under the Furniture Press Books imprint. For a more exhaustive list, see the "Publications" page at www.antigloss.wordpress.com.

Francis Blessington (Chorus in Athenian Tragedy) works as a poet, critic, fiction writer, and translator. He has published two poetry books, *Wolf Howl* and *Lantskip*, as well as "*Paradise Lost" and the Classical Epic*, "*Paradise Lost": Ideal and Tragic Epic*, *The Last Witch of Dogtown* (a novel), verse translations of Euripides' *Bacchae* and of Aristophanes' *Frogs*, and *Lorenzo de' Medici* (a verse play). He teaches English at Northeastern University.

John Briggs, Professor of English at UC Riverside, has been a member of the ALSCW since 1995. He is the author of *Francis Bacon and the Rhetoric of Nature*, *Lincoln's Speeches Reconsidered*, and the ALSCW *Forum* issue devoted to Literature and Composition. He has published essays on such topics as Chapman's Homer, literary catharsis in Shakespeare, Lincoln's understanding of Shakespeare and tyranny, Frederick Douglass's reading of *Macbeth*, and the history of rhetoric and composition pedagogy. He is currently the president of the Association of Literary Scholars, Critics, and Writers.

Brian Chappell is a doctoral candidate in the English Department at The Catholic University of America in Washington, D.C. He focuses on contemporary American novels and narrative theory. The working title of his dissertation is 'The Crisis of Authorship in Contemporary American Fiction.' It explores how major contemporary authors John Barth, Thomas Pynchon, Don DeLillo, and William Vollmann figure the act of authorship in their works as a source of anxiety.

Wallace Cleaves teaches composition as a lecturer in the University Writing Program at the University of California at Riverside. Wallace is currently master mentor for the TA development program, helping to run the yearlong series of teaching practicum courses for new instructors in the writing program. He has also taught courses in Medieval, Renaissance and Native American literature as a visiting lecturer at Pomona College in Claremont at Cal State Fullerton and at UC Riverside. In addition to teaching, Wallace has an educational remediation practice working with young adults to overcome a variety of learning disabilities. He is a member of the Gabrielino / Tongva Native American tribe, the indigenous peoples of the Los Angeles area, and has served in a variety of positions on the tribal council and as a member of the shamanic council, and he is a director of the Kuruvungna Springs Foundation. He lives in Claremont California and is active in supporting the Claremont Community Foundation.

Alan Ramón Clinton is a poet, novelist, and scholar of poetry and writing pedagogy who has a novel forthcoming from Montag Press entitled *The Autobiography of Buster Keaton*. Clinton is the author of the monograph, *Mechanical Occult: Automatism, Modernism, and the Specter of Politics* (Peter Lang), a volume of poems, *Horatio Alger's Keys* (BlazeVOX), and a collection of short fictions entitled *Curtain Call: A Metaphorical Memoir* (Open Books). His novel *Necropsy in E Minor*, published by Open Books in June 2011, was shortlisted for the Dundee International Book Prize. His most recent book is entitled *Intuitions in Literature, Technology, and Politics: Parabilities* (Palgrave, 2012).

Peter Cortland is an Associate Professor of English at Quinnipiac University in Hamden, Connecticut. He feels at home in the Nineteenth Century French novel, but between many sections of Freshman English and required sections of Community Studies he feels somewhat exiled. His interests are/were in the tendency of fiction to create its own vocabulary or word patterns which trap the characters in the uncanny of emptiness, a Flaubertian education of missed opportunities.

Stephen Cox is Professor of Literature and Director of the Humanities Program at the University of California, San Diego. His recent books include *The New Testament and Literature* (Open Court), *The Woman and the Dynamo: Isabel Paterson and the Idea of America* (Transaction), *The Big House: Image and Reality of the American Prison* (Yale), and *American Christianity: The Continuing Revolution* (Texas, forthcoming, 2014). He is most interested in individuals' ability to retain and resignify the ideas they receive from history.

Scott F. Crider is an Associate Professor of English at the University of Dallas, where he teaches widely in its Core Curriculum and has been awarded three teaching awards. His research interests have been focused on Shakespeare and Rhetoric/Composition, eventuating in two books: *With What Persuasion: An Essay on Shakespeare and the Ethics of Rhetoric* (2009) and *The Office of Assertion: An Art of Rhetoric for the Academic Essay* (2005). His research interests now include Shakespeare and the English Bible, as well.

Greg Delanty is a Professor of English at St. Michael's College. On his college webpage he writes that his "latest poetry collection is *The Blind Stitch* (Oxford Series, Carcanet Press and LSU 2002). Other published works include *The Hellbox* (Oxford Series, Oxford University Press, 1998), *American Wake* (Blackstaff/Dufour, 1995), *Southward* (LSU, 1992), and *Cast In The Fire* (Dolmen Press, 1986). My poems have appeared in American, Irish, English, Australian, Japanese, and Argentinean anthologies, including the *Norton Introduction to Poetry*. I also co-edited *Jumping Off Shadows: Selected Irish Poetry* (Cork UP, 1995) and *The Selected Poems of Patrick Galvin* (Cork UP, 1995). I have read my poems widely and was invited to give a recorded reading at The Library of Congress in 2002."

Dr. Margaret Ducharme is Assistant Professor at Vaughn College of Aeronautics and Engineering. Her doctoral thesis at the University of Toronto, Canada was *Historical and Political Imagery in Henry James*. Current research interests include religious and spiritual ideas in Henry James, and teaching Composition and Rhetoric. Recently, she has become involved in curriculum development at Vaughn College, and she is working on the development of a Humanities elective course on the Bible as Literature. She is the guest lecturer at The Common Ground Series at Vaughn College, discussing "What Would You Do If You Weren't Afraid? How Women Can Advance in Aviation."

Alex Brink Effgen of Boston University is this year's winner of the ALSCW's Meringoff Award for non-fiction.

Brett Foster is the author of two poetry collections, *The Garbage Eater* (Northwestern University Press, 2011) and *Fall Run Road*, which was awarded Finishing Line Press's Open Chapbook Prize. His writing has appeared in *Boston Review*, *IMAGE*, *Kenyon Review*, *Literary Imagination*, *Poetry Daily*, *Raritan*, *Shenandoah*, and *Southwest Review*. He teaches creative writing and Renaissance literature at Wheaton College.

Debra Fried teaches English and American literature at Cornell University, with a focus on the nineteenth century, lyric genres, prosody and poetics, and the rhetoric of the interpretation and teaching of poetry. Recent work includes an essay on the stanza for *A Companion to Poetic Genres* (2011). Current projects concern lyric particularity and errant sonnets.

Hans Gabriel is Associate Professor of German Studies at the UNC School of the Arts, the Performing Arts Conservatory of the University of North Carolina. His Ph.D. is in German Language and Literature from the University of Virginia, with additional study at the University of Tübingen and the Free University, Berlin. He participated in NEH Summer Seminars

on Vienna in 2001 and on Translation in the Humanities in 2013, and has also taught at Ohio University, Washington State University, Wake Forest University and at Middlebury College. His scholarly work includes publications on Stifter, Keller and Berthold Auerbach, German-language Realism, narrative structure and the German-language *Novelle*.

Herbert Golder is Professor of Classical Studies at Boston University and Editor in Chief of *Arion, A Journal of Humanities and the Classics*. He also served as General Editor, with the late William Arrowsmith, of *The Greek Tragedy in New Translations* series (Oxford University Press). With Stephen Scully, he coedited a two volume special issue of *Arion* devoted to the Chorus in Greek Tragedy and Culture. In addition to his own translations from Greek drama and writings on a variety of classical and related subjects, he has also worked in film, most notably on ten films in collaboration with Werner Herzog. *My Son, My Son, What Have Ye Done*, co-written with Herzog, about a Greek theater production that turns deadly, was nominated for the Golden Lion and premiered at the Venice Film Festival in 2009.

Thomas K. Hubbard is Professor of Classics and holder of the Mary Helen Thompson Centennial Professorship in the Humanities. He specializes in Greek literature and ancient sexuality. Among his books are *The Pindaric Mind* (1985), *The Mask of Comedy* (1991), *The Pipes of Pan: Intertextuality and Literary Filiation in the Pastoral Tradition from Theocritus to Milton* (1998), *Greek Love Reconsidered* (2000), *Homosexuality in Greece and Rome: A Sourcebook of Basic Documents* (2003), *Censoring Sex Research* (2013), and *A Companion to Greek and Roman Sexualities* (2014).

Katherine Ibbett is Reader in Early Modern Studies in the Department of French at University College London. She is the author of *The Style of the State in French Theater, 1630-1660* (2009) and the co-editor, with Hall Bjornstad, of a recent issue of *Yale French Studies* on *Walter Benjamin's Hypothetical French Trauerspiel*. She is currently completing a book on compassion and its limits in early modern France.

George Kalogeris, Assistant Professor of English at Suffolk University, is the author of a book of paired poems in translation, *Dialogos* (Antilever, 2012), and of a book of poems based upon the notebooks of Albert Camus, *Camus: Carnets* (Pressed Wafer, 2006). His poems and translations were anthologized in *Joining Music with Reason*, edited by Christopher Ricks (2010) He teaches English Literature and Classics in Translation at Suffolk University. He is nearing completion of a manuscript of poems, "Guide to Greece."

James M. Kee has taught at the College of the Holy Cross in Worcester, Massachusetts, since 1981. He is editor of *Northrop Frye and the Afterlife of the Word* (an issue of the journal *Semeia*), and has published essays on Milton, Wordsworth, Keats, and the relationship between religion and the intellectual life. He regularly teaches courses on medieval literature and Chaucer as well as courses on tragedy, literary theory, the Bible and literature, and poetry and philosophy. He has served as chair of the English Department and Associate Dean of the College, and has twice been appointed Interim Vice President for Academic Affairs.

Vincent Kling is Professor of German and comparative literature at La Salle University in Philadelphia. He divides his time between that city and Vienna, where he conducts research in the Austrian National Library and in various archives. He has written essays on Gert Jonke, Heimito von Doderer, Isabel Allende, Ödön von Horváth, Gerhard Fritsch, Lilian Faschinger, and W. G. Sebald, and on the "Viennese Robin Hood" Johann Breitwieser and problems of literary translation. He has translated Jonke, Doderer, Fritsch and Andreas Pittler, Aglaya Veteranyi, and other German-language authors. Kling was awarded the Schlegel-Tieck Prize in 2013 for his translation of Veteranyi's novel *Why the Child Is Cooking in the Polenta*. He is now at work on a translation of Doderer's *Die Strudlhofstiege* for New York Review Books and is editing a compendium volume of Doderer's critical essays for Contra Mundum Press.

Jee Leong Koh received his BA (first class honors) from Oxford University, his MFA in Creative Writing from Sarah Lawrence College, and his Postgraduate Diploma in Teaching from Singapore's Nanyang Technological University. A former vice-principal of a secondary school in Singapore, he now teaches English at The Brearley School in Manhattan. He is the author of four books of poetry, including *Equal to the Earth* (Bench Press, 2009), *Seven Studies for a Self Portrait* (Bench Press, 2011) and *The Pillow Book* (Math Paper Press, 2012). A new book of poems is forthcoming from Carcanet Press in 2015.

Lejla Marijam is a graduate student in Comparative Literature at the University of Georgia, currently working on her dissertation regarding the interplay between literature, performance and power.

Herbert Marks teaches courses in poetry and narrative, ancient and modern, in the Comparative Literature Department at Indiana University. Besides The English Bible (Old Testament)--an edition with full commentary of the KJV--his recent publications include a study of "gnostic comedy" in the work of the contemporary painter Robert Yarber and an essay on the paradox of predictive prophecy ("Prophetie und Prognostik"). Ouvertures bibliques. *L'Ancien Testament livre par livre* is due out in 2015.

Giffen Mare Maupin earned her Ph.D. from Cornell University in 2013 and is currently an assistant professor of English at Hendrix College. She teaches a wide range of courses in poetry, with a particular focus on nineteenth-century British verse. Her current projects include an essay on the process of reading voice in *Frankenstein*, and a study of siblinghood and friendship in nineteenth-century British writing. Her writing and teaching alike are propelled by a lifelong interest in the relationship between critical and creative work.

JHS McGregor is Professor of Comparative Literature Emeritus at the University of Georgia. He is the author of five books on world cities: Rome, Paris, Venice, Washington, DC, and Athens. His current work focuses on the practice and social culture of farming in Mediterranean history -- a rural complement to the urban studies.

Ashish Patwardhan studied English at the University of California, Riverside and then at St. John's College, Santa Fe for his Master's degree. He has been teaching high school English at Sidwell Friends School in Washington, D.C. for the past fifteen years.

John Savoie has degrees in literature from Michigan, Notre Dame, and Yale. He teaches great books at Southern Illinois University Edwardsville. His research interests include Homer, Milton, metaphysical poetry, the Bible and their various intersections. His poetry has appeared widely in print and pixels including *Poetry*, *Best New Poets*, and *Poetry Daily*.

Anneliese Schultz, a Senior Lecturer in French, Hispanic, and Italian Studies at the University of British Columbia. She is this year's winner of the ALSCW's Meringoff Award for fiction.

Rebekah Scott is Lecturer in Nineteenth- and Twentieth-Century Literature at the University of Nottingham. She gained her PhD from the University of Cambridge in 2010 with a thesis on Henry James, and has held a Junior Research Fellowship at St Anne's College, University of Oxford (2011-2013). She has published essays on Charles Dickens's style, the lyrics of Benjamin Britten, and numerous topics relating to James. She has worked extensively on the forthcoming Cambridge Edition of James's forgotten novel *Confidence* (1879), and is also the editor of a volume of James's tales. Her next research project is on voice and aurality.

Stephen Scully (Chorus in Athenian Tragedy) is a professor at Boston University. His teaching and scholarly interests range from Homer to the Renaissance. With Herbert Golder, he co-edited two volumes of *Arion, A Journal of Humanities and the Classics* on the Chorus in Greek Tragedy and Culture, and with Rosanna Warren, he translated Euripides' *Suppliant Women*. He has just completed a book, entitled *Hesiod's Theogony: from the Babylonian creation myths to "Paradise Lost"* and is co-editing an Oxford Companion to Hesiod.

Misha Semenov is a Russian-American student at Princeton University studying Translation and Architecture. His translations of Russian poetry from the Soviet period to the present have been published in several literary magazines. His research interests focus on translation strategies for cultural and linguistic idiosyncrasies, such as the Russian formal/informal distinction. His work can be found at www.mishasemenov.com.

Dustin Simpson earned a PhD from the University of Chicago in 2012. His academic focus includes the history and forms of lyric in English poetry, nineteenth-century French poetry, American modernism, and modern and contemporary American poetry.

David H. Smith, emeritus Professor of Religious Studies at Indiana University, chaired the department from 1976 to 1984 and received teaching awards in 1979 and 1986. He was also Adjunct Professor of both Medicine and Philanthropic Studies and director of the Poynter Center for the Study of Ethics and American Institutions, an interdisciplinary center that focused its attention on medical ethics, the teaching of ethics, and the relationship of religion and ethics. Smith's publications include *Health and Medicine in the Anglican Tradition* (1986) and *Caring Well: Religion, Narrative, and Health Care Ethics*. He is a joint author of *Faithful Living, Faithful Dying* (2000) and with Cynthia Cohen is the editor

of *A Christian Response to our New Genetic Powers*. The title of his recent lecture under the auspices of Indiana University's Spirit of Modern Medicine Program was "The Courage to Wonder in Medicine and Religion."

Helaine L. Smith, a member of the faculty of the Brearley School, has been a member of the ALSCW since 2005. Smith teaches English to grades 6 through 12 at The Brearley School, and is completing a book of adaptations of Aristophanes for Middle School. She has contributed articles to *Literary Matters*, written about Euripides for the *Classical Journal*, and is the author of several teaching texts, including *Homer and the Homeric Hymns: Mythology for Reading and Composition* and *Teaching Particulars: Literary Conversations with My Students*.

John Staines is Associate Professor of English at John Jay College of Criminal Justice in the City University of New York where he teaches Renaissance and Early Modern literature. The author of *The Tragic Histories of Mary Queen of Scots: Rhetoric, Passions, and Political Literature, 1560-1690* (Ashgate), he has also published articles on Milton, Spenser, and Shakespeare. He has written on the ethics and politics of pity and compassion and on problems in the practice of historicist criticism. Currently he is working on the experience of violence in Shakespeare and Milton.

Sandra Stotsky is professor of education *emerita* at the University of Arkansas, where she held the 21st Century Chair in Teacher Quality. She served as Senior Associate Commissioner at the Massachusetts Department of Elementary and Secondary Education from 1999-2003, where she was in charge of developing or revising all the state's K-12 standards, teacher licensure tests, and teacher and administrator licensure regulations, among other responsibilities. She also served on the Common Core Validation Committee, from 2009-2010 and was one of the five members of the Validation Committee who would not sign off on the standards as being validated. She also served as editor of *Research in the Teaching of English*, from 1991 to 1997. *RTE* is the premier research journal of the National Council of Teachers of English (NCTE). She has published extensively in professional journals and written several books. Her most recent book is *The Death and Resurrection of a Coherent Literature Curriculum* (Rowman & Littlefield, 2012). She co-authored two reports for the Pioneer Institute on the fate of literature under Common Core's standards. The first, co-authored with Mark Bauerlein, is titled *How Common Core's ELA Standards Place College Readiness at Risk* and was released in September 2012. The second, co-authored with Anthony Esolen of Providence College and Jamie Highfill, a now retired secondary English teacher, is titled *"The Dying of the Light": How Common Core Damages Poetry Instruction* and serves as the basis for her presentation here. It was just released—in April 2014. Copies are available from Professor Stotsky after the presentation.

Kevin Tsai is Assistant Professor of in the Department of Comparative Literature at Indiana University at Bloomington. His primary research interests lie in the comparative studies of pre-modern China, Greece, and Rome, particularly concerning issues of gender and genre, fictionality, and literary historiography. He has published on Tang Dynasty narrative, Roman epic poetry, early Chinese drama, and translation, and is currently completing a monograph on the Ming Dynasty *chuanqi* drama entitled *The Eternal Order of Kinship*. He is also working on a book-length translation of Li Qingzhao's poetry.

Lash Keith Vance, whose background includes a double major in English and German, a Master's and Ph.D. degrees in English from the University of California, Riverside, a Master's degree in Education from California State University, San Bernardino, and a Master's degree in Instructional Design and Technology from California State University, Fullerton, has been teaching composition and developmental courses at UC Riverside since 1995 (and full time since 2000). He is currently interested in reading strategies, coding/encoding cognitive theory, and assessment mechanisms for classroom use.

John Wallen has worked in the Middle East for nearly 20 years. Currently, he is an Assistant Professor at Nizwa University in Oman and he previously worked at the University of Bahrain and the University of Qatar. He is currently the editor of the *Victorian* journal and has had a number of books and articles published in recent years. He received his PhD from the University of London in 2011.

Leah Whittington is Assistant Professor of English at Harvard University, where she teaches Renaissance and Early modern literature. She is the author of articles on Shakespeare, Milton, and the afterlife of classical literature in the Renaissance, and is Associate Editor of the *I Tatti Renaissance Library*. She is currently working on a book on scenes of supplication from antiquity to the seventeenth-century.

HOTEL ACCOMODATIONS

Biddle Hotel

Front Desk Lobby .... Lobby Level

MEETING ROOMS

Alumni Hall 1
Charter Room .... Mezzanine
Commemorative Garden .... Mezzanine
Distinguished Alumni Room ... Mezzanine
Federal Room 2
Frangipani Room .... Mezzanine
Georgian Room 1
Hoosier Room .... Mezzanine
K.P. Williams Room 2
Memorial Room 1
State Room East & West 2
The University Club 1
Tree Suites Meeting Rooms .... Mezzanine
Whittenberger Auditorium 1

SHOPPING / SERVICES

900 Hair Design .... Mezzanine
Bloomington Shuttle
Ticket Machine .... Lobby Level
Campus Card Services .... Mezzanine
Computer Connection .... Mezzanine
Computer Lab .... Mezzanine
IU Bookstore .... Mezzanine & 1
IU Credit Union .... Lobby Level
Lactation Room .... Mezzanine
The UPS Store ® .... Lobby Level

DINING AND SNACK SHOPS

Baja Fresh ® .... Mezzanine
Burger King ® .... Mezzanine
Dunn Meadow Cafe .... Lobby Level
Freshens .... Mezzanine
Starbucks ® 1
Sugar & Spice .... Mezzanine
Sycamore Corner .... Hotel Lobby
The Market .... Mezzanine
Pizza Hut Express ®, Charleston Market, Cyclone Salads, Sakura Sushi & Hot Bowl
Tudor Room 1

ACTIVITIES AND ENTERTAINMENT

Activities & Events Office /
UNION BOARD .... Student Tower 2
IMU Bowling & Billiards .... Mezzanine

WI-FI LOUNGES & PUBLIC SPACES

Computer Lab .... Mezzanine
East Lounge .... Mezzanine
IMUG 1
South Lounge 1
Tree Suite Lounge .... Mezzanine

ADMINISTRATIVE OFFICES

Administrative Services .... Lobby
Business Office / Payroll / HR . Lobby
Director's Office .... Mezzanine
Dining and Catering Services .. Mezzanine
Dean of Students .... Mezzanine
IMU Marketing .... Lobby Level
IU Trustees Office .... Mezzanine
Meeting Room
Reservations & Services .... Mezzanine
Student Activities Office
& IUSA .... Student Tower & 3
Veteran Support Services ...... Mezzanine

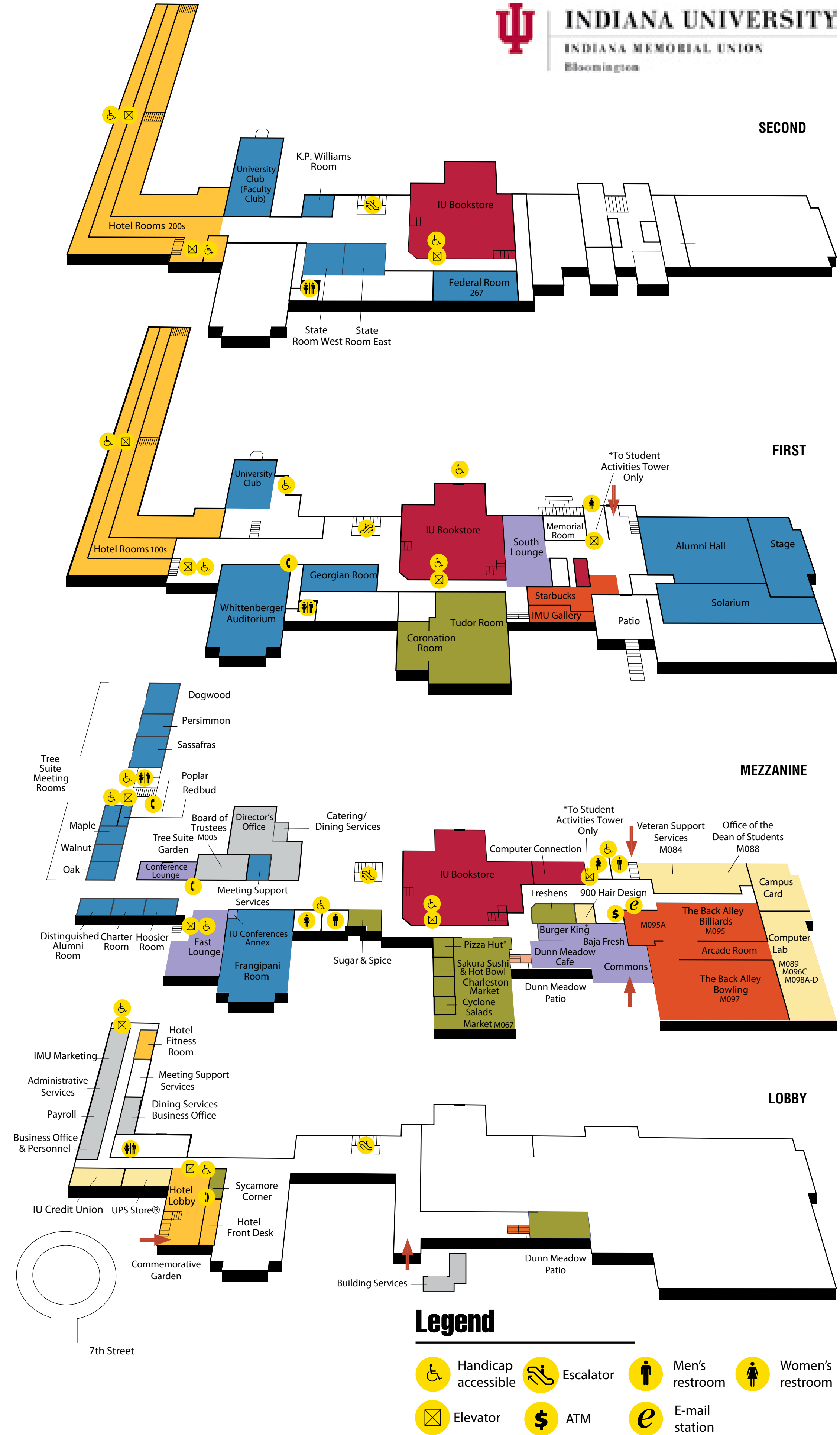
EMERGENCY

Tornado

In the event of a tornado or severe weather warning, move to interior areas without windows, such as restrooms, stairwells, or hallways and close any doors.

Fire

In the event of a fire, exit the building through the nearest exit door or stairwell. Do not use the elevator.



SUMMARY OF NATIONAL EVALUATOR INPUT INTO DRAFT #2 OF THE INDIANA ACADEMIC STANDARDS, VERSION DATED MARCH 14, 2014

On February 13-14, 2014, the academic standards Evaluation Panels met during a public meeting to complete a blind evaluation of standards that best aligned with college and career ready learning outcomes. This resulted in a draft set of academic standards, labeled "Draft #1", which was posted for public comment from February 19 through March 12. Six independent evaluators were also invited to provide feedback on Draft #1, and four agreed to do so. These individuals are:

- Dr. James Milgram, Ph.D., Stanford University
- Dr. Shauna Findlay, Ph.D., Indiana ASCD
- Ms. Janet Rummel, Indiana Network of Independent Schools
- Ms. Kathleen Porter-Magee, Fordham Institute

Following the close of the public comment period on Draft #1, the Standards Leadership Development Team and Indiana Department of Education content specialists incorporated the feedback from independent evaluators and the public comments into a second draft of the standards, labeled "Draft #2" and dated March 14, 2014. Draft #2 was distributed to six national evaluators, who were invited to provide feedback on Draft #2. These evaluators are:

- Dr. Sandra Stotsky – E/LA
- Dr. Terrence Moore, Hillsdale College – E/LA
- Joanne Eresh (Achieve) – E/LA
- Dr. James Milgram (Stanford University) – Math
- Professor Hung-Hsi Wu (UC Berkeley) – Math
- Kaye Forgione (Achieve) – Math

The attached document contains the evaluator reports on Draft #2. Full reports were submitted by April 1, 2014, and were used to inform the work of the Indiana College & Career Ready Panel.

It is important to note that the evaluators provided their feedback on Draft #2, and were not asked to provide input on the final proposed 2014 Indiana Academic Standards released to the public on April 15, 2014. By design, it was the Indiana College & Career Ready Panel that was responsible for assessing all independent evaluator input and determining how this input would be reflected in Indiana's new standards.

We are grateful to the national evaluators for their time and effort. Their input was invaluable to the development of Indiana's new academic standards, and their feedback is reflected throughout the version released to the public on April 15, 2014.

Comments on the Indiana Math Standards — Draft 031414

H. Wu

March 21, 2014

The standards of Draft 031414 in K–8 are predominantly those of the CCSSM, with a few amendments made and with a few nonessential standards added. It would appear that the amendments are not necessarily for the better. The 9–12 standards of Draft 031414 are of course different from those in CCSSM because the former is grade-specific and the latter is not. Unfortunately, the 9–12 standards of Draft 031414 are only half-baked and do not appear to have been carefully thought through. They are far from ready for prime time.

Because this is a brief review, there is no point in scanning the standards of all thirteen grades to make superficial comments here and there. Instead, I will pick out two critical grades in K–8, namely grade 5 and grade 8, and discuss them in some depth. These grades are critical because it is in grade 5 that the study of fractions turns serious, and because grade 8 sets up the mathematics of high school. A further comment on the latter will not be out of place: if the mathematics of grade 8 is not done correctly (and it is *not* in Draft 031414), both algebra and geometry in high school will suffer. I will also look at Algebra 1, Geometry, Algebra 2, and Trigonometry in high school and make a few comments about each of them. Through it all, I will slight the standards on data except when the error is too glaring, because statistics is not my field.

Grade 5

Everything is taken straight from the CCSSM with the exception of the following three standards:

Algebraic Thinking 3, Geometry 1, and Data Analysis and Statistics 1.

One can argue that Algebraic Thinking standard 3 would most likely be taught anyway in the CCSSM curriculum of grade 5, and that Geometry standard 1 would be taught somewhere in the CCSSM curriculum of grades 5–7. The last standard—Data Analysis and Statistics standard 1—is more problematic. First of all, there are very persuasive arguments as to why statistics should not be taught before grade 6 (and the CCSSM has observed this stricture). Getting past that, we have the serious problem that the first sentence in the standards makes no sense ("Formulate questions that can be addressed with data and make predictions about the data.") and that the last sentence is almost certainly too demanding for 5th graders ("Consider how data-collection methods affect the nature of the data set."). Moreover, shouldn't "observation" in the second sentence be "observational studies"?

(I am aware of eight **displaced standards**, i.e., those that are in the CCSSM but are not in grade 5—e.g., Number Sense 2 and 3 are essentially from grade 4 of CCSSM, and Number Sense 7 is from grade 6 of CCSSM—but no one should take such things too seriously. It is the overall mathematical and pedagogical integrity of the document that matters.)

Next, let us take a serious look at the standards that Draft 031414 has taken out of CCSSM.

(1) Computation standard 4: It says, "Add, subtract, multiply, and divide decimals to hundredths, using models or drawings and strategies based on place value or the properties of operations.". This sounds good until one asks how this standard about decimals should be taught. It makes sense in the CCSSM because a decimal is precisely defined in grade 4 of the CCSSM as a fraction whose denominator is 10, 100, 1000, etc. Then after the addition, multiplication, etc. of fractions have been taught in grade 5, one can make use of this knowledge to teach Computation standard 4. Unfortunately, Draft 031414 does not define decimal correctly in grade 4 and therefore putting Computation standard 4 in grade 5 is tantamount to asking

teachers to teach the arithmetic of decimals by rote (Draft 031414 has taken a page out of TSM.[1])

(2) Computation standard 5 says, "Add and subtract fractions with unlike denominators (including mixed numbers)". This is fine in the CCSSM because there is a description of how to add and subtract fractions correctly in the CCSSM. Unhappily, Draft 031414 gutted that standard but retained the shell, and the inevitable consequence is that Indiana's students will be taught how to add fractions by the use of LCD, as in TSM.[2] Is this really advisable? Haven't we inflicted enough suffering on students already?

(3) Algebraic Thinking standard 1, which says, "Write linear algebraic expressions in one or two variables and evaluate them for given values." The term *expression* is carefully defined at various stages in the CCSSM precisely because the abuse of this term in TSM has led to too much teaching by rote. But Draft 031414 seems oblivious to this fact and has not seen fit to give a careful definition of this term. Blandly asking it to be taught is not enough.

(4) Measurement standard 4, the last sentence is "Use the associative property of multiplication to represent volumes with whole number products." If we look closely, the corresponding sentence in the CCSSM is, "Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication". The latter means that *by interpreting the product of three numbers as a volume, one can see why the associative property of multiplication is true.* The cited sentence in Draft 031414 is unfortunately NMMS.[3]

Grade 8

Again, everything is taken straight from the CCSSM with the exception of the following two standards:

Geometry and Measurement 1, and

Data Analysis, Statistics, and Probability 7.

[1] TSM means *Textbook School Mathematics.* See Phoenix Rising. Bringing the Common Core State Mathematics Standards to Life .

[2] See the cited article in the preceding footnote.

[3] This means *not making mathematical sense.* Because I will be saying the same thing many times later, such an abbreviation would seem to be a good idea.

Neither significantly alters the curricular landscape. There are also four **displaced standards**, i.e., those that are in the CCSSM but not in grade 8. (Computation 1, Geometry and Measurement 2, and Data Analysis, Statistics, and Probability 5 and 6).

More significant is the way Draft 031414 makes use of the CCSSM standards in grade 8.

The most significant contribution of the CCSSM to grade 8 is the introduction of geometry, and especially the way it is introduced. A major focal point of this grade is the correct definition of the concept of the **slope** of a line in the coordinate plane. The importance of doing this is due to the fact that a lack of understanding of what *slope* means is known to account for much of students' non-learning of algebra. *Slope* has never been defined correctly in textbooks of the recent past, and all standards of the past three decades (including now Draft 031414) have shown no awareness that the definition of slope requires the *angle-angle criterion for similar triangles.*

In the CCSSM, many standards are devoted to the concept of congruence, which is by definition a composition of reflections, rotations, and translations, the so-called **basic rigid motions**. The CCSSM specify that the basic rigid motions be discussed informally through hands-on activities if possible. Then the concept of *dilation* is introduced again informally through hands-on activities, and the general concept of **similarity** is defined to be the composition of a dilation followed by a congruence. Then the CCSSM asks for an informal proof of the angle-angle criterion for similar triangles, thereby setting the stage for the definition of slope. But that is not all. This informal geometric discussion will provide the intuitive foundation for the more precise discussion of geometry in high school. In the CCSSM, grade 8 is the linchpin that holds together the algebra and geometry in high school. It is this *mathematical* decision—not any educational theory as some would have you believe—that provides the *coherence* of the CCSSM curriculum of grades 8-12.

Now back to the eighth-grade standards in Draft 031414. Because it shows no awareness of the raison-d'être of the geometry standards in the eighth-grade standards of the CCSSM, the adoption of so many CCSSM standards in Draft 031414 becomes almost completely pointless. Because slope is already (incorrectly) defined in grade 7,[4] many of the geometry standards taken over from the CCSSM now lose their

[4]More precisely, the slope of a *line* is actually never defined in grade 7!

meaning. Needless to say, the angle-angle criterion is mentioned in Geometry and Measurement standard 7 but is never put to use in grade 8. Moreover, the geometric foundation laid in grade 8 of the CCSSM (and taken over by Draft 031414) is ignored in the Geometry standards of Draft 031414. As a result, most of the standards of eighth-grade in Draft 031414 are NMMS (see footnote 3).

I will briefly mention an additional problem. Algebra and Functions standard 10 mentions that the graph of a linear function is a straight line; without the correct definition of slope, how will teachers be able to explain this fact?

High School

Most of the standards in Algebra 1, Geometry, Algebra 2, and Trigonometry are taken from the CCSSM but, unlike those in K–8, the standards in each course are put together without any guidance from the CCSSM. I will therefore focus exclusively on the way they are put together and not worry too much about the individual standards themselves.

Algebra 1

(1) *Exponential functions* are mentioned in Systems standard 13, but where do they come from? They are not so easy to define because one has to go through the definitions of *rational* exponents whereas only *positive rational exponents* are mentioned in Number Sense standard 3.

(2) Quadratics and Polynomials standards 21 and 22 should be reversed. If one doesn't know how to solve quadratic equations, one can hardly talk about why the Fundamental Theorem of Algebra is true for quadratic polynomials.

(3) Quadratics and Polynomials standards 21 is NMMS. How does one go from graphing quadratic functions to the Fundamental Theorem of Algebra?

(4) Functions standard 26 mentions finding "approximate solutions of exponential and power functions". What is meant by the "solution of a function"? If the intended meaning is actually the "zeros of a function", why do we need technology to find the zeros of 3^x ?

(5) Algebraic Rational Expressions standard 28 is NMMS. What does it mean to write rational expressions "in equivalent forms"? What is a "monomial expression with integer exponents"? Could it be a *polynomial?*

(6) Algebraic Rational Expressions standard 29 mentions "algebraic proportions". To my knowledge this is not standard terminology. What is it? If it means "ordinary proportions", this would be a standard in grade 6 or 7.

Geometry

As mentioned previously, this whole collection of standards is NMMS. There is no reason to make the effort of setting up a solid geometric foundation in grade 8 that gives meaning to the most fundamental concepts of congruence and similarity, only to abandon it completely in the high school course in geometry. In addition, this set of standards essentially follows the traditional axiomatic approach to the teaching of geometry, but history has taught us that this method will not work on a large scale, and there are also cogent reasons as to why it is not pedagogically sound.[5]

Here are a few specific comments.

(1) Proofs standard 1 lacks precision. Is this supposed to be an axiomatization of the plane or of 3-space? Segments, Lines and Planes standard 6 would seem to indicate that it is for 3-space.

(2) However, Proofs standard 2 now seems to indicate that the sole concern is with the plane. Mathematics cannot be done with so much imprecision.

(3) Construction Segments, Lines and Planes standard 7 seems to call for experimentations in geometry. If so, should it not precede Proofs standard 1?

(4) Segments, Lines and Planes standard 9 talks about coordinate systems. Now let us take stock of where we are: we are supposed to do geometry axiomatically. Therefore we should progress systematically from the simple to the complex and, as such, setting up a coordinate system requires the proofs of some basic theorems before it can proceed. Is there a standard that indicates when this step should be taken?

(5) Segments, Lines and Planes standard 10 does not make sense until one has

[5] See, for example, Euclid and high school geometry and Geometry: Our Cultural Heritage – A Book Review.

proved theorems about similar triangles. Unfortunately, similar triangles do not appear until Triangles standard 16.

There is no need to go on. These standards are so jumbled that they are not ready for a general discussion.

Algebra 2

(1) Quadratics standard 7 is already included in the standards of Algebra 1 (specifically, Quadratics and Polynomials standards 21 and 22).

(2) Quadratics standard 8 is NMMS. Why parabolas in the midst of a discussion of quadratic functions? What is the definition of a parabola, and how is it related to a focus and a directrix?

(3) Quadratics standard 9 is the same as Quadratics and Polynomials standard 24 in *Algebra 1*.

(4) Exponential and Linear standard 13 overlaps Systems standard 13 in *Algebra 1*.

(5) The following standards all need the laws of exponents: Exponential 15, Exponential and Logarithmic 17, and Rational and Radical 23. It would seem logical to have a standard that calls for the explanation of the laws of exponents.

(6) Exponential and Logarithmic standard 17 mentions "inverse function". Is there any awareness that this concept is difficult for students (even college students!) and therefore needs a separate standard all by itself in order to set the stage for the logarithm?

(7) Polynomials standard 20 is truly NMMS. What are some examples of real-world problems that can be modeled by polynomials which are *not* quadratic?

(8) Rational and Radical standard 23 is NMMS, period. Moreover, in what way is it different from Algebraic Rational Expressions standard 28 in *Algebra 1?*

(9) Rational and Radical standard 25 is also NMMS.

(10) Rational and Radical standard 27 is NMMS.

(11) Rational and Radical standard 28 is NMMS because why should school students find out about the "features such as, intercepts, zeros, domain and range, end behavior" of graphs of *relations* that are not functions?

Trigonometry

In writing a set of standards, one should try as much as possible to lay them out like a course syllabus so that teachers know at least one way to properly sequence the topics. Sometimes it is not possible, but for trigonometry it is. At the moment the standards are listed by strands, and I see no advantage by doing that because the structure of trigonometry is straightforward. I'd suggest omitting any reference to strands (what is the "Identity" strand?) and adopt this re-ordering:

> Geometry 1, 2, 3; Unit Circle 1, 2, 3; Geometry 4, 5, 6, 7; Identities 7; Algebra & Functions 8, 9; Functions 4, 5, 6.

There is a reason for this sequencing. For example, one cannot afford any possibility of misunderstanding that the Laws of Sines and Cosines should be taught before sine and cosine have already been extended beyond $[0, \pi/2]$ (there are obtuse triangles in this world after all). One also wants to establish the primacy of the sine and cosine addition formulas by teaching them and using them as early and as frequently as possible. Moreover, the definitions of arcsine and arccosine are the subtlest topics in elementary trigonometry and should be taught only when students have become truly comfortable with everything else. (Incidentally, the p in standard Geometry 4 should be π.)

Summary.

Draft 031414 seems to have little awareness that writing a set of mathematics standards is more than just assembling a collection of statements that address a given collection of topics. There is also no indication that it has the necessary *mathematical* capacity to get it done.