Recommendations for Indiana's College- and Career-Readiness Standards

A Path for Achieving the Best Possible Academic Standards for Indiana

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EXECUTIVE SUMMARY

The Process

The Indiana Chamber of Commerce commissioned Dr. Schauna Findlay, senior faculty at the Center for College and Career Readiness and president of the Indiana Association for Supervision and Curriculum Development, to analyze and compile recommendations for the draft of Indiana's College- and Career-Readiness Standards, released February 2014 by the Indiana Department of Education (IDOE). The goal of these recommendations is to offer alternative content that can be incorporated into the revised draft standards. The motivation of this effort is to assist with Indiana having among the highest, if not highest, K-12 academic standards in the country.

To reach her conclusions, Dr. Findlay's examination took into account Indiana's current and previous academic standards along with those from Massachusetts – which added state-specific adjustments to the Common Core State Standards base – and from two states (Virginia and Texas) that did not adopt the Common Core. The recently released IDOE draft standards did not look at the standards from these three states.

Specifically, the comparison included:

- The Massachusetts Curriculum Framework for English Language Arts & Literacy (2011)
- The Virginia Standards of Learning (2010)
- The Texas Essential Knowledge and Skills (2009, revised 2013)
- The Indiana Academic Standards for English/Language Arts (2006/2008)
- The Massachusetts Curriculum Framework for Mathematics (2011)
- The Virginia Standards of Learning (2010)
- The Texas Essential Knowledge and Skills (2012)
- The Indiana Academic Standards for Mathematics (2000/2008/2009)

This review used Indiana standards adopted in 2010 (Common Core State Standards) as the baseline for review, with additions, deletions and enhancements offered from previous Indiana standards, as well as those in Massachusetts, Virginia and Texas. Detailed comparisons of each state's standards placed side by side with their corresponding Common Core State Standards revealed subtle, but often important differences between the standards, in addition to standards that are completely missing from one set of standards compared to the other.

The Indiana Academic Standards (2000/2008/2009), Virginia Standards of Learning (SOL-2011), and Texas Essential Knowledge and Skills (TEKS-2012) each have a few similar concepts that are taught at a grade level different from each other. In instances where concepts are included in the existing standards but

at different grade levels, this report recommends that the grade level placement of those topics remain aligned to the learning progression of the Common Core State Standards so that mobile students are not disadvantaged by having content taught at different grade levels in Indiana.

Numbering used throughout the recommendations is consistent with standards adopted in 2010 and fit within the existing numbering structure.

In instances where content is recommended for addition that is not in the Common Core State Standards but occurs in more than one grade level in other states' standards, the wording and placement of the content is adapted to provide similar placement to Indiana's previous standards.

Using this comparison to guide an analysis, this report makes additional content recommendations to the February 2014 draft of Indiana's College- and Career-Readiness Standards to ensure that Indiana's standards are among the highest in the nation while safeguarding against a set of standards that will create a curriculum that focuses on breadth over depth.

While the K-12 review committee's recommendations for Indiana's College- and Career-Readiness Standards were abundant, they often stripped clarity and rigor and added content beyond what is viable during a school year. The Indiana Department of Education/State Board of Education draft standards also removed the organizing features of both sets of standards that were one of the significant advances over Indiana's previous standards. This report recommends using the structure of the standards adopted in 2010 along with the accompanying Introductions and Appendices A and C (both at www.indianachamber.com/education) from the English Language Arts & Literacy Standards. Additionally, a new draft Appendix B (at www.indianachamber.com/education) serves as a new Recommended Reading List for Indiana. It is recommended that this list be reviewed by a committee of Hoosier educators and community stakeholders.

Moreover, both the English Language Arts & Literacy Standards and the Mathematics Standards should include comprehensive glossaries (Appendices E and F at www.indianachamber.com/education).

Standards for three additional math courses – Pre-Calculus, Advanced Quantitative Reasoning and Mathematical Models with Applications (found in Appendix D at www.indianachamber.com/education) – are also included in this report. Dual credit and AP math courses provide additional math options which pick up from any of these pathways.

The Recommendations

There are nearly 100 detailed recommendations listed by grade levels in this report; more than 50 in English Language Arts & Literacy Standards and over 40 in Mathematics.

The 10 recommendations below represent the Indiana Chamber's top recommendations (in no ranking order) for the draft of Indiana's College- and Career-Readiness Standards:

English Language Arts & Literacy Standards

- Add a Reading Literature Anchor Standard and grade level standards which build students' knowledge and analysis skills of literature. Indiana's previous standards had very strong literature standards. Adding this anchor standard and the grade level standards ensure this strength remains in our state standards. *Anchor Standard: "IN.8.A. Analyze the meanings of literary texts by drawing on knowledge of literary concepts and genres."*
  – Source: Massachusetts Curriculum Framework for English Language Arts & Literacy; similar content is included in the Texas Essential Knowledge and Skills (2009)

- Add a Writing Anchor Standard and grade level standards which build students' knowledge and application of literary concepts and genres. *Anchor Standard: "IN.W.3.A. Write fiction, personal reflections, poetry and scripts that demonstrate awareness of literary concepts and genres."*
  – Source: Massachusetts Curriculum Framework for English Language Arts & Literacy; similar content is included in the Texas Essential Knowledge and Skills (2009)

- Add a high school writing standard which teaches students how to write the kinds of college and career documents to open the door to their next step into the post-secondary world. *"IN.W.11-12.2.A. Read and follow directions to complete an application for college admission, for a scholarship or for employment."*
  – Source: Virginia Standards of Learning (2010)

- Add appendix (Appendix B at www.indianachamber.com/education) which utilizes appropriately complex text as called for in the research, but which includes an Indiana Recommended Reading List which should be reviewed and approved by Hoosier educators and community stakeholders.
  – Source: Massachusetts Curriculum Framework for English Language Arts & Literacy

- Add detailed glossaries for both English Language Arts & Literacy Standards and Mathematics Standards including Tables and Illustrations of Key Mathematical Properties, Rules and Number Sets for Mathematics. (Found at www.indianachamber.com/education.)
  – Source: Massachusetts Curriculum Framework for English Language Arts & Literacy and Mathematics

Mathematics

- Add "calendar time" to the Measurement and Data strand for kindergarten where this content has traditionally been taught in Indiana. *"IN.K.MD.4. Understand that clocks and calendars are tools that measure time. Use calendar and time language appropriately (e.g., names of the months, days of the week, year, morning, afternoon, evening, today, yesterday, tomorrow, next week, last week); identify specific days and dates on a given calendar."* This new standard combines the best ideas from multiple Virginia and Indiana standards.
  – Source: Indiana Academic Standards for Mathematics (2000/2008/2009) and Virginia Standards of Learning (2010)

- The return of the standard algorithm at the grade levels in which it appeared in Indiana's standards prior to 2010:

  Add this 3rd grade standard to Number and Operations in Base Ten strand: *"3.IN.NBT.2.A. Understand and use standard algorithms for addition and subtraction"*

  Add the bold, non-italicized words to: *"4.NBT.5 in the 4th grade standards in Number and Operations in Base Ten: "4.NBT.5. 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, the properties of operations* **and the standard algorithm**. *Illustrate and explain the calculation by using equations, rectangular arrays and/or area models."*

  While there has been much discussion about the use of the standard algorithm, these two additions keep the introduction and use of the standard algorithm in the grade levels where it has always

appeared in Indiana's standards without weakening students' development of number sense.
– Source: Indiana Academic Standards for Mathematics (2000/2008/2009)

- Add a 6th grade math standard to the Number System strand: *"6.IN.NS.4.a. Apply number theory concepts, including prime factorization and relatively prime numbers to the solution of problems."* This addition prepares students for graphing of functions in Algebra.
  – Source: Massachusetts Curriculum Framework for Mathematics

- Add two advanced mathematics courses with comprehensive standards for those courses: Pre-Calculus and Advanced Quantitative Reasoning. These course additions address the concerns that have been raised that the draft standards did not include content beyond what is required in our current Core 40 requirements, which is not sufficient for students majoring in STEM fields.
  – Source: Massachusetts Curriculum Framework for Mathematics

- Add a high school mathematics course, Mathematical Models and Applications, to give students additional time to master the college and career readiness math standards with the addition of an applications and modeling class using K-8 and Algebra content. This additional course ensures students who have struggled with math content in the past have the necessary content and skills before moving into Geometry and Algebra II while ensuring a strong four-year math pathway for these students.
  – Source: Texas Essential Knowledge and Skills (2012)

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NOTE: All supporting materials available at www.indianachamber.com/education.

Comparison of Draft Standards and Indiana's Current Standards

The new draft of the Indiana College and Career Readiness Standards relies heavily on content from Indiana's last two sets of K-12 academic standards, the 2006 Indiana Standards and the current Common Core State Standards. Areas of change, removal or addition from the current standards are indicated below.

ELA and Literacy

Major Findings in ELA and Literacy

Things included in our current standards, which are now removed in the draft standards:

- The language standard asking students to spell correctly has been removed from the standards.
- The writing standard asking students to produce clear and coherent writing in which development and organization are appropriate to task, purpose and audience has been removed from the standards.

Language, Speaking and Listening and Writing Findings

A few minor additions have been made to Language Standards, such as the grade 8 standard (Standard 6): Identify and use parallelism in all writing to present items in a series and items juxtaposed for emphasis.

Also, two to four additional standards have been added in Speaking and Listening in almost all grade levels. For example, in grades 11-12, students will analyze media's impact and strategies. In Writing, students will also be asked to complete resumes and applications in high school.

Reading Literature Findings

The Reading and Literature findings are where the greatest differences between the current standards and the draft standards exist.

In a few instances, minor wording changes blend a Common Core Standard with a 2006 Indiana Standard to add greater specificity.

In some grade levels, one to five additional standards have been added. The Reading Literature standards include everything that was in the current standards and have added some of the rich literature topics and skills to this new set of standards that have historically been in Indiana's prior standards that were not part of Common Core.

There are a couple of standards from the current standards which were removed.

- Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning…
- Analyze 17th, 18th, and 19th century foundational U.S. documents of historical and literary significance…

Reading Informational Text Findings

In some grade levels, one to three additional standards have been added. For example, grade 3 adds the following standards:

- Distinguish between fact and opinion in informational text
- Distinguish between the author's purpose in various genres of informational text

- Restate and follow simple multi-step written instructions

Reading: Foundational Skills

The wording in several of these standards has been changed from current expectations that teachers have already been teaching, and the wording often makes the standard less rigorous and/or more vague. By pulling out specific examples, we are actually losing context of how specific standards should be taught. For example, "having students respond to multiple books" has been removed.

Other examples:

- In grade K, Phonological Awareness Standard 2.c – "Blend and segment onsets and rimes of single-syllable spoken words" has been changed to "Orally blend the onset and the rime in words."
- Phonological Awareness Standard 2.d – Isolate and pronounce the initial, medial vowel, and final sounds (phonemes) in three-phoneme (consonant-vowel-consonant, or CVC) words" has been changed to "Identify the beginning, middle, and ending of sounds."

Math

Major Findings in Mathematics

The Mathematical Practices and Math Process Standards now are just the simplified list at the end of the document. Both of these need to actually be incorporated back into our new standards.

In most grade levels, additional content has been added on top of the content and skills in our current standards. That will result in our standards having breadth over depth, again – which should not be the goal. (The last time we adopted standards this was determined to not be the best course.)

Because standard statements were pulled together from multiple sets of standards to gather the "best" standards, there are places where terminology is inconsistent, and there are standards which are near duplicates.

Areas where further examination/recommendations may be needed:

- Language consistency where different terminology is being used within or across grades
- Redundancies which need to be eliminated by combining standards or moving content to just one heading
- Moving content to an appropriate heading to keep it grouped appropriately
- Removing specific standards which make the curriculum too crowded, making it not viable
- Better organization of the standards, e.g., clusters, headings, domains, numbering system
- Adding examples where needed since most previously included examples have been removed

Kindergarten

Additions to current standards: Patterning, Calendar, Time and Measurement.

- There are 4 additional standards for Number Sense
- There are 3 additional standards for Algebra
- There is 1 additional standard for Geometry
- There is 1 additional standard for Measurement
- There are 3 additional standards for Data Analysis and Probability

1st Grade

- The draft standards include a new Algebra strand
- There are 2 additional standards for Number Sense
- There are 2 additional standards for Computations-Operation

- There are 7 additional standards for Algebra
- There are 2 additional standards for Geometry
- There are 2 additional standards for Measurement
- There are 2 additional standards for Data Analysis and Probability

2nd Grade

- The draft standards also include a new Algebra strand and additional measurement content
- There are 2 additional standards for Number Sense
- There is 1 additional standard for Computations-Operation
- There are 5 additional standards for Algebra
- There are 3 additional standards for Geometry
- There are 4 additional standards for Measurement
- There are 2 additional standards for Data Analysis and Probability

3rd Grade

- The draft standards put back in the standards the abstract concepts that 3rd grade students struggle to grasp conceptually in Data Analysis and Probability and more content on measurement.
- There are 4 additional standards for Number Sense
- There are 2 additional standards for Computations-Operation
- There are 5 additional standards for Algebra
- There are 3 additional standards for Geometry
- There are 6 additional standards for Measurement
- There are 7 additional standards for Data Analysis and Probability

4th Grade

The draft standards put back in the standards Data Analysis and Probability and more content on measurement, which is also taught in grades above or already contained in the science standards. Students must have time to focus on developing understanding of fractions. Multiplying a fraction by a whole number has been removed. This standard is foundational to understanding multiplication of fractions in grade 5.

Also missing in grade 4 is "Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. 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."

Also missing in grade 4 is "Fluently add and subtract multi-digit whole numbers using the standard algorithm."

- There are 6 additional standards for Number Sense
- There is 1 additional standard for Computations-Operation
- There are 6 additional standards for Algebra
- There are 4 additional standards for Geometry
- There are 5 additional standards for Data Analysis and Probability

5th Grade

- There are 7 additional standards for Number Sense
- There are 3 additional standards for Computations-Operation
- There are 6 additional standards for Algebra
- There are 6 additional standards for Geometry
- There are 7 additional standards for Measurement
- There are 2 additional standards for Data Analysis and Probability

6th Grade

- There are 3 additional standards for Number Sense and Computation
- There are 3 additional standards for Geometry and Measurement

7th Grade

Changes from current standards:

- "Describe situations in which opposite quantities combine to make 0."
- "Convert a rational number to a decimal using long division."
- "Use variables to represent quantities in a real-world or mathematical problem and construct simple equations in inequalities to solve problems by reasoning about the quantities."
- "Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach."

In Number Sense and Computation, standard 1 is actually performed at a higher level in the 6th grade standard (Algebra and Functions, standard 3). It does not need to be repeated in 7th grade and with a lower expectation.

In Number Sense and Computation, standards 2, 3, and 4 are 8th grade standards.
In Algebra and Functions, standards 2, 3, 4, and 5 are 8th grade standards.
In Geometry and Measurement, standard 2 is an 8th grade standard.

These do not need to be added to the 7th grade curriculum. Time needs to be protected to learn deeply the 7th grade content.

There are 2 additional standards for Data Analysis and Probability. There are 2 additional standards for Number Sense and Computation.

8th Grade

Change from current standards: "Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other."

In Algebra and Functions, standards 1, 2, 3, 4 and 5 are Algebra standards. These do not need to be added to the 8th grade curriculum. Time needs to be protected to learn deeply the 8th grade content.
There are also three additional standards for Geometry and Measurement.

Major Findings in High School

Because standard statements were pulled together from multiple sets of standards to gather the "best" standards, there are places where terminology is inconsistent, and there are standards which are near duplicates. The high school standards are listed by strand through grades 9-12.

Until these standards are divided into courses, it is incredibly difficult to provide feedback on this draft because we can't determine which statement might be a foundational skill taught in Algebra I that goes deeper in Algebra II, for example, or if there are two closely related/redundant standards.

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ENGLISH LANGUAGE ARTS & LITERACY RECOMMENDATIONS

1.1 RECOMMENDATIONS BASED ON THE MASSACHUSETTS CURRICULUM FRAMEWORK FOR ENGLISH LANGUAGE ARTS & LITERACY (2011)

Add to the College- and Career-Readiness Anchor Standards the following reading standard:

IN.8.A. Analyze the meanings of literary texts by drawing on knowledge of literary concepts and genres.

Add the following grade level Reading Literature standards which build toward the preceding anchor standard:

IN.RI.K.8.A. Identify and respond to characteristics of traditional poetry for children: rhyme; regular beats; and repetition of sounds, words and phrases.

IN.RI.1.8.A. Identify characteristics commonly shared by folktales and fairy tales.

IN.RI.2.8.A. Identify dialogue as words spoken by characters (usually enclosed in quotation marks) and explain what dialogue adds to a particular story or poem.

IN.RI.3.8.A. Identify elements of fiction (e.g., characters, setting, plot, problem, solution) and elements of poetry (e.g., rhyme, rhythm, figurative language, alliteration, onomatopoeia).

IN.RI.4.8.A. Locate and analyze examples of similes and metaphors in stories, poems, folktales and plays, and explain how these literary devices enrich the text.

IN.RI.5.8.A. Locate and analyze examples of foreshadowing in stories, poems, folktales and plays.

IN.RI.6.8.A. Identify the conventions of legends and epics (e.g., the hero, quest, journey, seemingly impossible tasks, circle stories) in historical and modern literary works. (Circle stories is from TEKS, and this standard appears in grade 7 in TEKS.)

IN.RI.7.8.A. Interpret a literary work by analyzing how the author uses literary elements (e.g., mood, tone, point of view, personification, symbolism, extended simile). (Extended simile is from TEKS.)

IN.RI.8.8.A. Identify and analyze the characteristics of irony and parody in literary works.

IN.RI.9-10.8.A. Relate a work of fiction, poetry or drama to the seminal ideas of its time.

IN.RI.11-12.8.A. Analyze a work of fiction, poetry or drama using a variety of critical lenses (e.g., formal, psychological, historical, sociological, feminist).

Add to the College- and Career-Readiness Anchor Standards the following Writing standard:

IN.W.3.A. Write fiction, personal reflections, poetry and scripts that demonstrate awareness of literary concepts and genres.

Add the following grade level Writing standards which build toward the preceding anchor standard:

IN.W.K.3.A. With prompting and support, write or dictate poems with rhyme and repetition.

IN.W.1.3.A. Write poems with rhyme and repetition.

IN.W.2.3.A. Write stories or poems with dialogue.

IN.W.3.3.A. Write poems, descriptions and stories in which figurative language and the sounds of words (e.g., alliteration, onomatopoeia, rhyme) are key elements.

IN.W.4.3.A. Write stories, poems and scripts that use similes and/or metaphors.

IN.W.5.3.A. Write stories, poems and scripts that draw on characteristics of tall tales or myths or of modern genres such as mysteries, fantasies and historical fiction.

IN.W.6.3.A. Demonstrate understanding of traditional literature by writing short narratives, poems or scripts that use the conventions of myths, legends or epics (e.g., explanations of natural phenomena; the hero's journey, quest or task).

IN.W.7.3.A. Write short narratives, poems, scripts or personal reflections that demonstrate understanding of the literary concepts of mood, tone, point of view, personification or symbolism.

IN.W.8.3.A. Write short narratives, poems, scripts or personal reflections that demonstrate understanding of the concepts of irony or parody.

IN.W.9-10.3.A. Demonstrate understanding of the concept of point of view by writing short narratives, poems, essays, speeches or reflections from one's own or a particular character's point of view (e.g., the hero, anti-hero, a minor character).

IN.W.11-12.3.A. Demonstrate understanding of the concept of theme by writing short narratives, poems, essays, speeches or reflections that respond to universal themes (e.g., challenges, the individual and society, moral dilemmas, the dynamics of tradition and change).

Add the following 2nd grade Language standard:

IN.L.2.1.g. Read, pronounce, write and understand the meaning of common abbreviations for titles, locations, and time periods (e.g., Dr., Ms., Mrs., St., Rd., Ave., IN, U.S., months, days of the week, a.m., p.m.)

Add the following 4th grade Language standard:

IN.L.4.1.h. Write legibly by hand. For the use of computer technology in writing, see Writing standard 6.

1.2 Recommendations based on the Virginia Standards of Learning for English Language Arts (SOL-2010)

Add the following 4th grade Reading Standard for Informational Text (Also in TEKS):

IN.RI.4.8.a. Distinguish between fact and opinion and explain how to verify what is a fact.

Add the following 4th grade bold, italicized information to Writing Standard 9:

Draw evidence from literary or informational texts to support analysis, reflection and research.

a. Apply grade 4 Reading standards to literature (e.g., "Describe in depth a character, setting or event in a story or drama, drawing on specific details in the text [e.g., a character's thoughts, words or actions].").

b. Apply grade 4 Reading standards to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text; differentiate between fact and opinion.").

The Virginia SOL include a strand for Mass Media where content and skills are developed across several grades. To protect against fragmented and overcrowded curriculum, this report recommends the topics be combined in one Reading Informational Text standard for grade 7 and one Speaking and Listening standard for grades 11-12.

Add the following 7th grade Reading Standard for Informational Text:

IN.RI.7.7.A. Identify the characteristics and effectiveness of various auditory, visual and written media messages, how media messages are constructed and for what purposes.

Add the following 11th-12th grade Listening and Speaking Standard:

IN.LS.11-12.2.A. Analyze author's purpose and intended effect on the audience of mass media messages, how media influences beliefs and behaviors and possible cause and effect relationships between mass media coverage and public opinion trends.

Add the following 11th-12th grade Writing Standard:

IN.W.11-12.2.A. Read and follow directions to complete an application for college admission, for a scholarship or for employment.

1.3 Recommendations based on the Texas Essential Knowledge and Skills (TEKS) for English Language Arts (2009, revised 2013)

The TEKS include several sub-standards in the early grade levels which further explain the skills required for achieving the standards. These additional sub-standards are encompassed within Appendix A of the Indiana Common Core (2010). Rather than add each of those discrete sub-standards, or indicators, the entire explanation of how students develop foundational reading skills in Appendix D (at www.indianachamber.com/education) is a more comprehensive and supportive approach for teachers ensuring they understand how those skills build toward the reading process rather than becoming a checklist of skills students can complete in isolation.

Add the following Reading Standard: Foundational Skills for Kindergarten:

IN.RF.K.1.e. Recognize that sentences are comprised of words separated by spaces and demonstrate the awareness of word boundaries (e.g., through kinesthetic or tactile actions such as clapping and jumping)

IN.RF.K.1.f. Identify a sentence made up of a group of words.

Add the following Speaking and Listening Standard for Kindergarten:

IN.SL.K.3.A. Follow oral directions that involve a short related sequence of actions.

IN.SL.K.6.A. Speak in complete sentences to communicate.

Add the following Writing Standard for 2nd Grade (Also found in IAS):

IN.W.2.2.A. Write a friendly letter complete with the date, salutation (greeting, such as Dear Mr. Smith), body, closing and signature.

Add the following Writing Standard for 3rd Grade (Also found in IAS and TEKS at Grade 4):

IN.W.3.2.A. Write personal, persuasive and formal letters, thank-you notes and invitations.

a. Show awareness of the knowledge and interests of the audience.

b. Establish a purpose and context.

c. Include the date, proper salutation, body, closing and signature.

Add the following 4th grade Reading Standard for Informational Text (Also in VA-SOL):

IN.RI.4.8.a. Distinguish between fact and opinion and explain how to verify what is a fact.

Add the following 6th grade Reading Standard for Literature:

IN.RL.6.A. Read grade-level text with silent and oral fluency and adjust when reading aloud based on the reading purpose and the nature of the text.

Add the following 7th grade Reading Standard for Literature:

IN.RL.7.A. Read grade-level text with silent and oral fluency and adjust when reading aloud based on the reading purpose and the nature of the text.

Add the following 8th grade Reading Standard for Literature:

IN.RL.8.A. Read grade-level text with silent and oral fluency, and adjust when reading aloud based on the reading purpose and the nature of the text.

Add the following 8th grade Reading Informational Text Standard (Found in Grade 7 in TEKS):

IN.8.B. Identify such rhetorical fallacies as ad hominem, exaggeration, stereotyping or categorical claims in persuasive texts.

Add the following 9th-10th grade Reading Standards for Literature:

IN.RL.8.B. Analyze the effects of diction and imagery (e.g., controlling images, figurative language, understatement, overstatement, irony, paradox), structure (e.g., meter, rhyme scheme) and graphic elements (e.g., line length, punctuation, word position) in poetry.

IN.RL.8.C. Explain how dramatic conventions (e.g., monologues, soliloquies, dramatic irony) enhance dramatic text and how archetypes and motifs in drama affect the plot of plays.

Add the following 11th-12th grade Reading Standards for Literature:

IN.RL.4.A. Relate figurative language of a literary work to its historical and cultural setting.

IN.RL.8.B. Analyze the effects of metrics, rhyme schemes (e.g., end, internal, slant, eye) and other conventions in American poetry.

IN.RL.8.C. Analyze the themes and characteristics in different periods of modern American drama.

IN.RL.9.A. Relate the main ideas, characters, setting and theme found in a literary work to primary source documents from its historical and cultural setting or to the historical, social and economic ideas of its time.

The TEKS include a strand for Media Literacy. To protect against fragmented and overcrowded curriculum, this report recommends using the previously included Virginia SOL Mass Media standards and two additional TEKS standards added to the Speaking and Listening standards for grades 11-12.

Add the following 11th-12th grade Speaking and Listening Standards:

IN.3.A. Evaluate how messages presented in media reflect social and cultural views in ways different from traditional texts.

IN.3.B. Evaluate the objectivity of coverage of the same event in various types of media.

1.4 Recommendations based on the Indiana Academic Standards for English Language Arts (2006/2008)

Add the following Writing Standard for 2nd Grade (Also found in TEKS):

IN.W.2.2.A. Write a friendly letter complete with the date, salutation (greeting, such as *Dear Mr. Smith*), body, closing and signature.

Add the following Writing Standard for 3rd Grade:

IN.W.3.2.A. Write personal, persuasive and formal letters, thank-you notes and invitations.

a. Show awareness of the knowledge and interests of the audience.
b. Establish a purpose and context.
c. Include the date, proper salutation, body, closing and signature.

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MATHEMATICS RECOMMENDATIONS

1.1 RECOMMENDATIONS BASED ON THE MASSACHUSETTS CURRICULUM FRAMEWORK FOR MATHEMATICS (2011)

Add the following 1st and 2nd grade standards to Operations and Algebraic Thinking OA:

1.IN.OA.9. Write and solve number sentences from problem situations that express relationships involving addition and subtraction within 20.

2.IN.OA.2.a. By the end of grade 2, know from memory related subtraction facts of sums of two one-digit numbers.

Add the following 1st grade standard to Measurement and Data MD (Also found in TEKS in grade K-1):

Work with money – 1.IN.MD.5. Identify the values of all U.S. coins and know their comparative values (e.g., a dime is of greater value than a nickel). Find equivalent values (e.g., a nickel is equivalent to 5 pennies). Use appropriate notation (e.g., 69¢). Use the values of coins in the solutions of problems.

Add the following 4th grade standard to Number and Operations in Base Ten NBT:

4.IN.NBT.5a. Know multiplication facts and related division facts through 12 X 12.

Add the following 5th grade standard to The Number System NS:

Gain familiarity with concepts of positive and negative integers.

5.IN.NS.1. Use positive and negative integers to describe quantities such as temperature above/below zero, elevation above/below sea level or credit/debit.

Add the following 6th grade standard to The Number System NS:

6.IN.NS.4.a. Apply number theory concepts, including prime factorization and relatively prime numbers to the solution of problems.

Add the following 6th grade standard to Ratios and Proportional Relationships RP:

6.IN.RP.3.e. Solve problems that relate the mass of an object to its volume.

Add the following 6th grade standard to Statistics and Probability SP:

6.IN.SP.4.A. Read and interpret numerical data represented in circle graphs.

6.IN.SP.4. Display numerical data in plots on a number line, including dot plots, stem-and-leaf plots*, histograms, box plots and circle graphs+.

** stem-and-leaf plots were added from TEKS* *+ circle graphs were added to data display*

Add the following 7th grade standard to Expressions and Equations SP:

7.IN.EE.4.c. Extend the study of patterns to include analyzing, extending and determining an expression for simple arithmetic and geometric sequences (e.g., compounding, increasing area), using tables, graphs, words and expressions.

Add the following high school standard to Number and Quantities NQ:

IN.NQ.3.a. Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements. Identify significant figures in recorded measures and computed values based on the context given and the precision of the tools used to measure.

Add the following high school standard to Algebra-Arithmetic with Polynomials and Rational Expressions A-APR:

IN.A-APR.1.a. Divide polynomials.

Add the following high school standards to Algebra-Reasoning with Equations and Inequalities A-REI:

IN.A-REI.3.a. Solve linear equations and inequalities in one variable involving absolute value.

IN.A-REI.4.c. Demonstrate an understanding of the equivalence of factoring, completing the square or using the quadratic formula to solve quadratic equations.

Add the following high school standards to Functions-Interpreting Functions F-IF:

IN.F-IF.8.c. Translate among different representations of functions and relations: graphs, equations, point sets and tables.

IN.F-IF.10. Given algebraic, numeric and/or graphical representations of functions, recognize the function as polynomial, rational, logarithmic, exponential or trigonometric.

Add the following high school standard to Geometry-Congruence G-CO:

IN.G-CO.11.a. Prove theorems about polygons. Theorems include measures of interior and exterior angles, properties of inscribed polygons.

Add the following high school standard to Geometry-Circles G-C:

IN.G-C.3.a. Derive the formula for the relationship between the number of sides and sums of the interior and sums of the exterior angles of polygons and apply to the solutions of mathematical and contextual problems.

Add the following high school standard to Geometry-Expressing Geometric Properties with Equations G-GPE:

IN.G-GPE.3.a. Use equations and graphs of conic sections to model real-world problems.

Add the following high school standard to Geometry- Modeling with Geometry G-MG:

IN.G-GM.4. Use dimensional analysis for unit conversions to confirm that expressions and equations make sense.

1.2 Recommendations based on the Virginia Standards of Learning (2011)

Add the following 4th grade standard to Measurement and Data MD:

Develop understanding of statistical variability.

4.IN.MD.4.C. Define mean, median and outlier.

4.IN.MD.4.D. Find the mean and median of a set of data.

Add the following 5th grade standards to Measurement and Data MD:

Develop understanding of statistical variability.

5.IN.MD.2.D. Describe mean, median and mode as measures of center.

5.IN.MD.2.E. Describe mean as fair share.

5.IN.MD.2.F. Find the mean, median, mode and range of a set of data.

5.IN.MD.2.G. Describe the range of a set of data as a measure of variation.

1.3 Recommendations based on the Texas Essential Knowledge and Skills (TEKS-2012)

The TEKS include a strand for Personal Financial Literacy in grades K-8 and Mathematical Modeling in Personal Finance in high school. Indiana has separate standards for financial literacy for students through grade 8 and for students through grade 12. It is a local decision how schools choose to deliver those standards. In other words, these standards are not required to be taught in a particular order or at particular grade levels, but schools are required to teach all of these standards. Because financial literacy standards already exist in Indiana's standards, it would be redundant to add the Personal Financial Literacy standards to the Indiana mathematics standards as Texas standards have done in the TEKS.

Add the following 1st grade standard to Measurement and Data MD:

TEKS begins this in grade K and finishes in grade 1; this report recommends combining the grade K and 1 topics into one standard so that the content is able to be applied and is not just discretely introducing money.

Work with money.

1.IN.MD.5. Identify the values of all U.S. coins and know their comparative values (e.g., a dime is of greater value than a nickel). Find equivalent values (e.g., a nickel is equivalent to 5 pennies). Use appropriate notation (e.g., 69¢). Use the values of coins in the solutions of problems.

Add the following 2nd grade standard to Measurement and Data MD:

2.IN.MD.10.A. Draw conclusions and make predictions from information in a graph.

TEKS ask 2nd grade students to partition objects in 1/2, 1/4 and 1/8. Indiana's standards limit fractions to 1/4 in 2nd grade. One-eighth is added in 3rd grade. This report recommends this limit remain.

TEKS ask 2nd grade students to generate a number that is greater than or less than a given whole number up to 1,200. Indiana's standards limit this concept to 1,000. This report recommends that the limit of 1,000 remain in place to ensure students have depth of understanding of place value up to 1,000 before introducing additional concepts. However, the next recommendation extends this concept to 100,000 in grade 3.

Add the following 3rd grade standards to Number and Operations in Base Ten 3. NBT:

Represent and compare whole numbers and understand relationships related to place value.

3.IN.NBT.4. Compose and decompose numbers up to 100,000 as a sum of so many ten thousands, so many thousands, so many hundreds, so many tens and so many ones progressively using hands-on manipulatives, pictorial models and numbers, including expanded notation as appropriate.

3.IN.NBT.5. Describe the mathematical relationships found in the Base Ten place value system through the hundred-thousandths place.

3.IN.NBT.6. Represent a number on a number line as being between two consecutive multiples of 10; 100; 1,000; or 10,000 and use words to describe relative size of numbers.

3.IN.NBT.7. Compare and order whole numbers up to 100,000 and represent comparisons using the symbols >, < or =.

Add the following 4th grade standard to Measurement and Data MD:

4.IN.MD.4.A. Represent data on a frequency table, dot plot or stem-and-leaf plot marked with whole numbers and fractions.

4.IN.MD.4.B. Solve one- and two-step problems using data in whole number, decimal and fraction form in a frequency table, dot plot or stem-and-leaf plot.

Add the following 5th grade standard to Measurement and Data MD:

5.IN.MD.2.A. Represent categorical data with bar graphs or frequency tables and numerical data, including data sets of measurements in fractions or decimals, with dot plots or stem-and-leaf plots.

5.IN.MD.2.B. Represent discrete paired data on a scatterplot.

5.IN.MD.2.C. Solve one- and two-step problems using data from a frequency table, dot plot, bar graph, stem-and-leaf plot or scatterplot.

1.4 Recommendations based on the Indiana Academic Standards (2000/2008/2009)

Add the following kindergarten standard to Measurement and Data MD:

IN.K.MD.4. Understand that clocks and calendars are tools that measure time. Use calendar and time language appropriately (e.g., names of the months, days of the week, year, morning, afternoon, evening, today, yesterday, tomorrow, next week, last week); identify specific days and dates on a given calendar.

Add the following 2nd grade standards to Measurement and Data MD:

2.IN.MD.7.A. Know 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.

Measure temperature.

2.IN.MD.11. Estimate temperature. Read temperature to the nearest degree from a Celsius thermometer and a Fahrenheit thermometer.

While there has been much discussion about the use of the standard algorithm, the two additions below keep the introduction and use of the standard algorithm in the grade levels where it has always appeared in Indiana's standards without weakening students' development of number sense.

Add the following 3rd grade standard to Number and Operations in Base Ten NBT:

3.IN.NBT.2.A. Understand and use standard algorithms for addition and subtraction.

Add the **bold, italicized** words to 4.NBT.5 in the 4th grade standards in Number and Operations in Base Ten NBT:

4.NBT.5. 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, the properties of operations ***and the standard algorithm***. Illustrate and explain the calculation by using equations, rectangular arrays and/or area models.

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NOTE: All supporting materials available at www.indianachamber.com/education.

SUPPORTING MATERIALS

GLOSSARY: ENGLISH LANGUAGE ARTS & LITERACY

This glossary contains those terms found and defined in Appendix A of the Common Core State Standards document, as well as terms added by Indiana.

Adjectival phrase – A phrase that modifies a noun or a pronoun. Infinitive phrases (He gave his permission *to paint the wall*), prepositional phrases (I sat next to a boy *with red hair*), and participial phrases (His voice, *cracked by fatigue,* sounded eighty years old) can all be used as adjectival phrases. See **Adjective**

Adjective – A word that describes somebody or something. *Old, white, busy, careful,* and *horrible* are all adjectives. Adjectives either come before a noun, or after linking verbs (*be, seem, look).* See **Adverb, Noun, Verb, Adjectival phrase**

Adverb – A word that modifies a verb, an adjective, or another adverb. An adverb tells how, when, where, why, how often, or how much. Adverbs can be cataloged in four basic ways: time, place, manner, and degree. See **Adjective, Noun, Verb, Adverbial phrase**

Adverbial phrase – A phrase that modifies a verb, an adjective, or another adverb. Infinitive phrases (The old man installed iron bars on his windows *to stop intruders*) or prepositional phrases (The boys went *to the fair*) can be used as adverbial phrases. See **Adverb**

Allegory – A story in which people, things, and actions represent an idea or generalization about life; allegories often have a strong moral or lesson. See **Symbol, Symbolism**

Alliteration – The repetition of initial consonant sounds in words. For example, *rough and ready*.

Allusion – A reference in literature, or in visual or performing arts, to a familiar person, place, thing, or event. Allusions to biblical figures and figures from classical mythology are common in Western literature.

Archetype – An image, a descriptive detail, a plot pattern, or a character type that occurs frequently in literature, myth, religion, or folklore and is, therefore, believed to evoke profound emotions.

Argumentation – A speech, writing, or oral debate intended to convince by establishing truth. Most argumentation begins with a statement of an idea or opinion, which is then supported with logical evidence. Another technique of argumentation is the anticipation and rebuttal of opposing views. See **Persuasion, Persuasive writing**

Aside – A dramatic device in which a character speaks his or her thoughts aloud, in words meant to be heard by the audience but not by the other characters. See **Soliloquy**

Assonance – The repetition of vowel sounds without the repetition of consonants. For example, *lake* and *fake*. See **Consonance**

Ballad – A poem in verse form that tells a story. See **Poetry, Refrain**

Character – A person who takes part in the action of a story, novel, or a play. Sometimes characters can be animals or imaginary creatures, such as those found in Emergent Reader texts (texts consisting of short sentences comprised of learned sight words and CVC words; may also include rebuses to represent words that cannot yet be decoded or recognized; see also **Emergent reader texts, Rebus**).

Characterization/Character development – The method a writer uses to develop characters. There are four basic methods of characterization: (a) description of the character's physical appearance; (b) revelation of the character's nature through his/her own speech, thoughts, feelings, or actions; (c) description of a character through the speech, thoughts, feelings, or actions of other characters; and (d) a narrator's direct comments about a character.

Chorus – In ancient Greece, the groups of dancers and singers who participated in religious festivals and dramatic performances. In poetry, the refrain. See also **Refrain.**

Clause – A group of related words that has both a subject and a predicate. For example, '*because the boy laughed.'* See **Phrase**

Cliché – A trite or stereotyped phrase or expression. A hackneyed theme, plot, or situation in fiction or drama. For example, "*it rained cats and dogs."*

Climax – The high point, or turning point, in a story—usually the most intense point near the end of a story. See **Plot, Conflict, Rising action, Resolution**

Cognates – Words having a common linguistic origin. For example, *café* and *coffee* both derive from the Turkish *gahveh.*

Conflict – In narration, the struggle between opposing forces that moves the plot forward. Conflict can be internal, occurring within a character, or external, between characters or between a character and an abstraction such as nature or fate. See **Plot, Climax, Exposition, Rising action, Resolution**

Connotation – The attitudes and feelings associated with a word. These associations can be negative or positive, and have an important influence on style and meaning. See **Denotation**

Consonance – The repetition of consonant sounds within and at the ends of words. For example, *lonely afternoon.* Often used with assonance, alliteration, and rhyme to create a musical quality, to emphasize certain words, or to unify a poem. See **Assonance, Alliteration, Rhyme**

Controlling image – A single image or comparison that extends throughout a literary work and shapes its meaning. See **Extended metaphor, Metaphor**

Denotation – The literal or dictionary definition of a word. Denotation contrasts with connotation. See **Connotation**

Denouement – See **Resolution**

Description – The process by which a writer uses words to create a picture of a scene, an event, or a character, or to report facts. In literary texts, a description contains carefully chosen details that appeal to the reader's senses of sight, sound, smell, touch, or taste. See **Narration, Exposition,**

Persuasion

Dialect – A particular variety of language spoken in one place by a distinct group of people. A dialect reflects the colloquialisms, grammatical constructions, distinctive vocabulary, and pronunciations that are typical of a region. At times writers use dialect to establish or emphasize settings as well as to develop characters.

Dialogue – Conversation between two or more people that advances the action, is consistent with the character of the speakers, and serves to give relief from passages essentially descriptive or expository. See **Description, Exposition, Drama**

Diction – An author's choice of words based on their correctness, clearness, or effectiveness. See **Style, Imagery**

Digraph – Two successive letters that make a single sound. For example, the *ea* in *bread*, or the *ng* in *sing*.

Diphthong – Speech sound beginning with one vowel sound and moving to another vowel sound within the same syllable. For example, *oy* in the word *boy*.

Discourse – Formal, extended expression of thought on a subject, either spoken or written. See **Rhetoric**

Domain-specific words and phrases Vocabulary specific to a particular field of study (domain); in the standards, *domain-specific words and phrases* are analogous to Tier Three words (see Language standards).

Drama/Dramatic literature – A play; a form of literature that is intended to be performed before an audience. Drama for stage is also called theatre. In a drama, the story is presented through the dialogue and the actions of the characters.

Editing – A part of writing and preparing presentations concerned chiefly with improving the clarity, organization, concision, and correctness of expression relative to task, purpose, and audience. Editing often involves replacing or deleting words, phrases, and sentences that sound awkward or confusing and correcting errors in spelling, usage, mechanics, and grammar. Compared to *revising*, editing is a smaller-scale activity often associated with surface aspects of a text. See **Revising, Rewriting**

Emergent reader texts – Texts consisting of short sentences comprised of learned sight words and consonant-vowel-consonant (CVC) words; may also include rebuses to represent words that cannot yet be decoded or recognized. See **Rebus**

Epic – A long narrative that tells of the deeds and adventures of a hero or heroine. See **Poetry, Hero/Heroine**

Epigraph – A quotation on the title page of a book or a motto heading a section of a work, suggesting what the theme or central idea will be.

Epithet – An adjective or phrase used to express the characteristic of a person or thing in poetry. For example, *"rosy-fingered dawn."*

Essay – A brief work of nonfiction that offers an opinion on a subject. The purpose of an essay may be to express ideas and feelings, to analyze, to inform, to entertain, or to persuade. An essay can

be formal—with thorough, serious, and highly organized content—or informal—with a humorous or personal tone and less rigid structure. See **Exposition, Non-narrative nonfiction**

Evidence – Facts, figures, details, quotations, or other sources of data and information that provide support for claims or an analysis, and that can be evaluated by others; should appear in a form and be derived from a source widely accepted as appropriate to a particular discipline, as in details or quotations from a text in the study of literature, and results from experiments in the study of science.

Exposition/Expository text/Explanatory text – Writing that is intended to make clear or to explain something using one or more of the following methods: identification, definition, classification, illustration, comparison, and/or analysis. In a play or a novel, exposition is the portion that helps the reader to understand the background or situation in which the work is set. See **Description, Narration, Persuasion**

Extended metaphor – A comparison between unlike things that serves as a unifying element throughout a series of sentences or a whole piece. An extended metaphor helps to describe a scene, an event, a character, or a feeling. See **Controlling image, Metaphor**

Fable – A short, simple story that teaches a lesson. A fable usually includes animals that talk and act like people. See **Folktale, Traditional narrative**

Fairy tale – A story written for, or told to, children that includes elements of magic and magical folk such as fairies, elves, or goblins. See **Folktale, Traditional narrative**

Falling action – In the plot of a story, the action that occurs after the climax. During the falling action conflicts are resolved and mysteries are solved. See **Narration, Exposition, Rising action, Climax, Resolution**

Fiction – Imaginative works of prose, primarily the novel and the short story. Although fiction may draw on actual events and real people, it springs mainly from the imagination of the writer. The purpose is to entertain as well as enlighten the reader by providing a deeper understanding of the human condition. See **Exposition/Expository text, Nonfiction, Informational text, Novel, Short story**

Figurative language – Language that communicates ideas beyond the ordinary or literal meaning of the words. See **Simile, Metaphor, Personification, Hyperbole**

Figure of speech – A literary device used to create a special effect or feeling, often by making some type of comparison. See **Hyperbole, Metaphor, Simile, Understatement**

Fluency – An automatic recognition of words and the ability to rapidly decode and quickly check words for meaning; the ability to express oneself readily and effortlessly.

Focused question – A query narrowly tailored to task, purpose, and audience. For example, a research query. A query that is sufficiently precise to allow a student to achieve adequate specificity and depth within the time and format constraints.

Folktale – A short narrative handed down through oral tradition, with various tellers and groups modifying it, so that it acquires cumulative authorship. Most folktales eventually move from oral tradition to written form. See T**raditional narrative, Tall tale**

Foreshadowing – A writer's use of hints or clues to indicate events that will occur in a story.

Foreshadowing creates suspense and at the same time prepares the reader for what is to come.

Formal English – See ***Standard English***

General academic words and phrases – Vocabulary common to written texts but not commonly a part of speech; in the standards, *general academic words and phrases* are analogous to Tier Two words and phrases (see Language standards).

Genre – A category of literature. The main literary genres are fiction, nonfiction, poetry, and drama.

Gerund – A verb form that ends in *–ing* and is used as a noun. For example, *"Cooking is an art."*
Grammar – The study of the structure and features of a language. Grammar usually consists of rules and standards that are to be followed to produce acceptable writing and speaking.

Hero/Heroine – A mythological or legendary figure, often of divine descent, who is endowed with great strength or ability. The word is often broadly applied to the principal male or female character in a literary or dramatic work. See **Protagonist**

Heroic couplet – Two rhyming lines written in iambic pentameter. The adjective *heroic* is attached due to the fact that English poems having heroic themes and elevated style have often been written in iambic pentameter. See **Iambic pentameter, Poetry, Meter**

Homograph – One of two or more words spelled alike but different in meaning and derivation or pronunciation. For example, the noun *conduct* and the verb *conduct* are homographs. See **Homonym, Homophone**

Homonym – One of two or more words spelled and pronounced alike but different in meaning. For example, the noun *quail* and the verb *quail*. See **Homograph, Homophone**

Homophone – One of two or more words pronounced alike but different in meaning, derivation, or spelling. For example, the words *to, too,* and *two*. See **Homonym, Homograph**

Hyperbole – An intentional exaggeration for emphasis or comic effect.

Iambic pentameter – A metrical line of five feet or units, each made up of an unstressed then a stressed syllable. For example, *'I have thee not, and yet I see thee still.'* (Macbeth, II.1.44) See **Meter, Poetry**

Idiom – A phrase or expression that means something different from what the words actually say. An idiom is usually understandable to a particular group of people. For example, using *"over his head"* to communicate *"doesn't understand."*

Image/Imagery – Words and phrases that create vivid sensory experiences for the reader. Most images are visual, but imagery may also appeal to the senses of smell, hearing, taste, or touch. See **Style, Sensory detail**

Imaginative/Literary text – Fictional writing in story, dramatic, or poetic form. See **Informational/Expository text**

Improvisation – A work or performance that is done on the spur of the moment, without conscious preparation or preliminary drafts or rehearsals. See **Drama**

Independent clause – Presents a complete thought and can stand alone as a sentence. For

example, *"When she looked through the microscope, she saw paramecia."* See **Subordinate clause, Sentence**

Independent(ly) – A description of a student performance done without scaffolding from a teacher, other adult, or peer; in the standards, often paired with *proficient(ly)* to suggest a successful student performance done without scaffolding; in the Reading standards, the act of reading a text without scaffolding, as in an assessment. See **Proficient(ly), Scaffolding**

Infinitive – A verb form that is usually introduced by *to*. The infinitive may be used as a noun or as a modifier. For example, an infinitive can be used as a direct object *(The foolish teenager decided to smoke);* as an adjective (*The right to smoke in public is now in serious question);* or as an adverb *(It is illegal to smoke in public buildings)*. See **Verb**

Informational/Expository text – Nonfiction writing in narrative or non-narrative form that is intended to inform. See **Imaginative/Literary text**

Internal rhyme – Rhyme that occurs within a single line of poetry. For example, in the opening line of Eliot's *Gerontion, "Here I am, an old man in a dry month,"* internal rhyme exists between *an* and *man,* and between *I* and *dry*. See **Rhyme, Poetry**

Irony – The contrast between expectation and reality. This incongruity has the effect of surprising the reader or viewer. Techniques of irony include hyperbole, understatement, and sarcasm. See **Hyperbole, Understatement**

Jargon – Language used in a certain profession or by a particular group of people. Jargon is usually technical or abbreviated, and difficult for people not in the profession to understand.

Literacy – The ability to read, write, speak, and understand words.

Main character – See **Protagonist**

Main idea – In informational or expository writing, the most important thought or overall position. The main idea or thesis of a piece, written in sentence form, is supported by details and explanation. See T**heme, Thesis**

Metaphor – A figure of speech that makes a comparison between two things that are basically different but have something in common. Unlike a simile, a metaphor does not contain the words *like* or *as*. For example, *in the evening of life*. See **Figurative language, Figure of speech, Simile**

Meter – In poetry, the recurrence of a rhythmic pattern. See **Iambic pentameter**

Monologue – See **Soliloquy**

Mood – The feeling or atmosphere that a writer creates for the reader. The use of connotation, details, dialogue, imagery, figurative language, foreshadowing, setting, and rhythm can help establish mood. See **Style, Tone**

More sustained research project – An investigation intended to address a relatively expansive query using several sources over an extended period of time, such as a few weeks of instructional time.

Moral – The lesson taught in a work such as a fable; a simple type of theme. For example, *"Do not count your chickens before they are hatched"* teaches that one should not number one's fortunes or

blessings until they appear. See **Theme**

Myth – A traditional story passed down through generations that explains why the world is the way it is. Myths are essentially religious, because they present supernatural events and beings and articulate the values and beliefs of a cultural group.

Narration – Writing that relates an event or a series of events; a story. Narration can be imaginary—as in a short story or novel—or factual—as in a newspaper account or a work of history. See **Description, Exposition, Persuasion**

Narrator – The person or voice telling the story. The narrator can be a character in the story or a voice outside the action. See **Point of view**

Nonfiction – Writing about real people, places, and events. Unlike fiction, nonfiction is largely concerned with factual information, although the writer shapes the information according to his or her purpose and viewpoint. Biography, autobiography, and news articles are examples of nonfiction. See **Fiction**

Non-narrative nonfiction – Nonfiction written to inform, explain, or persuade that does not use narrative structure to achieve its purpose.

Noun – A word that is the name of something: a person, place, thing, or idea (for example, a quality or action). See **Adjective, Adverb, Verb**

Novel – An extended work of fiction. Like a short story, a novel is essentially the product of a writer's imagination. Because the novel is much longer than the short story, the writer can develop a wider range of characters and a more complex plot. See **Fiction, Short story**

Onomatopoeia – The use of a word whose sound suggests its meaning. For example, *clang, buzz, twang.*

Onset – The part of the syllable that precedes the vowel. For example, / *h* / in *hop,* and / *sk* / in *scotch.* Some syllables have no onset, as in *un* or *on.* See **Rime**

Oral – Pertaining to spoken words. See **Verbal**

Overstatement – See **Hyperbole**

Palindrome – A word, phrase, or sentence that reads the same backward or forward. For example, *Able was I ere I saw Elba.*

Paradox – A statement that seems to contradict itself, but, in fact, reveals some element of truth. A special kind of paradox is the oxymoron, which brings together two contradictory terms. For example, *cruel kindness* and *brave fear.*

Parallel structure – The same grammatical structure of parts within a sentence or of sentences within a paragraph. For example, the following sentence contains parallel infinitive phrases: *He wanted to join the swim team, to be a high diver, and to swim in relays.*

Parody – A work that imitates or mocks another work or type of literature. Like a caricature in art, parody in literature mimics a subject or a style. Its purpose may be to ridicule, to broaden understanding of, or to add insight to the original work.

Participle – A verb form ending in *–ing* or *–ed*. A participle functions like a verb because it can be paired with an object; a participle functions like an adjective because it can modify a noun or pronoun. For example, in *"a glowing coal," glowing* is a participle; in *"a beaten dog*," *beaten* is a participle.

Pastoral – A poem presenting shepherds in rural settings, usually in an idealized manner. The language and form are artificial. The supposedly simple, rustic characters tend to use formal, courtly speech, and the meters and rhyme schemes are characteristic of formal poetry. See **Poetry, Epic**

Personification – A form of metaphor in which language relating to human action, motivation, and emotion is used to refer to non-human agents or objects or abstract concepts. For example, *The weather is smiling on us today; Love is blind.* See **Metaphor, Figure of speech, Figurative language**

Perspective – A position from which something is considered or evaluated; standpoint. See **Point of view**

Persuasion/Persuasive writing – Writing intended to convince the reader that a position is valid or that the reader should take a specific action. Differs from exposition in that it does more than explain; it takes a stand and endeavors to persuade the reader to take the same position. See **Description, Exposition, Narration**

Phonemic awareness/Phonological awareness – Awareness that spoken language consists of a sequence of phonemes. Such awareness is demonstrated, for example, in the ability to generate rhyme and alliteration, and in segmenting and blending component sounds. See **Phoneme, Phonics**

Phoneme – The smallest unit of speech sound that makes a difference in communication. For example, *fly* consists of three phonemes: / *f* / - / *l* / - / `*I* /.

Phonetic – Representing the sounds of speech with a set of distinct symbols, each denoting a single sound. See **Phonics**

Phonics – The study of sounds. The use of elementary phonetics in the teaching of reading. See **Phonetic**

Phrase – A group of related words that lacks either a subject or a predicate or both. For example, *by the door; opening the box*. See **Clause**

Plot – The action or sequence of events in a story. Plot is usually a series of related incidents that builds and grows as the story develops. There are five basic elements in a plot line: (a) *exposition;* (b) *rising action;* (c) *climax;* (d) *falling action;* and (e) *resolution or denouement.* See **Climax, Conflict, Exposition, Falling action, Resolution, Rising action**

Poetry – An imaginative response to experience reflecting a keen awareness of language. Its first characteristic is rhythm, marked by regularity far surpassing that of prose. Rhyme, when it exists in poetry, affords an obvious difference from prose. Because poetry is relatively short, it is likely to be characterized by compactness and intense unity. See **Prose, Meter**

Point of view – The vantage point from which a story is told, chiefly occurring in literary texts. For example, in the first-person or narrative point of view, the story is told by one of the characters; in the third-person or omniscient point of view, the story is told by someone outside the story. More broadly, the position or perspective conveyed or represented by an author, narrator, speaker, or character. See **Perspective**

Prefix – A word part that is added to the beginning of a base word that usually changes the sense or meaning of the root or base word. For example, *re-, dis-, com-*. See **Suffix, Root**

Print or digital (texts, sources) – Sometimes added for emphasis to stress that a given standard is particularly likely to be applied to electronic as well as traditional texts; the standards are generally assumed to apply to both.

Proficient(ly) – A description of a student performance that meets the criterion established in the standards as measured by a teacher or assessment. In the standards, often paired with *independent(ly)* to suggest a successful student performance done without scaffolding; in the Reading standards, the act of reading a text with comprehension. See **Independent(ly), Scaffolding**

Prose – Writing or speaking in the usual or ordinary form. Prose becomes poetic when it takes on rhythm and rhyme. See **Poetry**

Protagonist – The main character or hero of a story. See **Hero/Heroine**

Pun – A joke that is created by a unique and specific combination of words. It can make use of a word's multiple meanings or a word's rhyme.

Rebus – A mode of expressing words and phrases by using pictures of objects whose names resemble those words.

Refrain – One or more words repeated at intervals in a poem, usually at the end of a stanza, such as the last line of each stanza in a ballad. Used to present different moods or ideas, as in Poe's use of *"Nevermore"* in his poem "The Raven." See also **Chorus.**

Resolution – Also called *denouement,* the portion of a play or story where the problem is solved. The resolution comes after the climax and falling action, and is intended to bring the story to a satisfactory end.

Revising – A part of writing and preparing presentations concerned chiefly with a reconsideration and reworking of the content of a text relative to task, purpose, and audience. Compared to *editing*, revising is a larger-scale activity often associated with the overall content and structure of a text. See **Editing, Rewriting**

Rewriting – A part of writing and preparing presentations that involves largely or wholly replacing a previous, unsatisfactory effort with a new effort, better aligned to task, purpose, and audience, on the same or a similar topic or theme. Compared to *revising*, editing is a larger-scale activity more akin to replacement than refinement. See **Editing, Revising**

Rhetoric – The art of effective expression and the persuasive use of language. See **Discourse**

Rhyme scheme – In poetry, the pattern in which rhyme sounds occur in a stanza. Rhyme schemes, for the purpose of analysis, are usually presented by the assignment of the same letter of the alphabet to each similar sound in the stanza. For example, the rhyme scheme of a Spenserian stanza is *ababbcbcc*.

Rhythm – The pattern of stressed and unstressed syllables in a line of poetry. Poets use rhythm to bring out the musical quality of language, to emphasize ideas, to create mood, to unify a work, and/or to heighten emotional response.

Rime – The vowel and any consonants that follow it. For example, in *scotch,* the rime is /*och*/. See **Onset**

Rising action – The events in a story that move the plot forward. Rising action involves conflicts and complications, and builds toward the climax of the story. See **Conflict, Climax, Exposition, Falling action**

Root (Root word) – A word or word element to which prefixes and suffixes may be added to make other words. For example, to the root *graph*, the prefix *di-* and the suffix *–ic* can be added to create the word, *digraphic.* See **Prefix, Suffix**

Rubric – An authentic (close to real world) assessment tool for making scoring decisions. A printed set of guidelines that distinguishes performances or products of different quality. See **Scoring guide**

Rule of three – When the number three (3) recurs, especially in folk literature and fairy tales. For example, *three characters, three tasks, repetition of an event three times.*

Satire – A literary technique in which ideas, customs, behaviors, or institutions are ridiculed for the purpose of improving society. Satire may be gently witty, mildly abrasive, or bitterly critical, and often uses exaggeration for effect.

Scaffolding – Temporary guidance or assistance provided to a student by a teacher, another adult, or a more capable peer, enabling the student to perform a task he or she otherwise would not be able to do alone, with the goal of fostering the student's capacity to perform the task on his or her own later on. Though Vygotsky himself does not use the term *scaffolding*, the educational meaning of the term relates closely to his concept of the zone of proximal development (see L. S. Vygotsky (1978), *Mind in society: The development of higher psychological processes,* Cambridge, MA: Harvard University Press).

Scoring guide – List of criteria for evaluating student work. See **Rubric**

Script – The text of a play, motion picture, radio broadcast, or prepared speech that includes dialogue and stage directions.

Sensory detail – See **Imagery, Style**

Sentence – A group of words expressing one or more complete thoughts.

Setting – The time and place of the action in a story, play, or poem.

Short research project – An investigation intended to address a narrowly tailored query in a brief period of time, such as a few class periods or a week of instructional time.

Short story – A brief fictional work that usually contains one major conflict and at least one main character.

Simile – A comparison of two unlike things in which a word of comparison (often *like* or *as*) is used. For example, Maya Angelou's *"She stood in front of the alter, shaking like a freshly caught trout."* See **Metaphor**

Soliloquy – A speech in a dramatic work in which a character speaks his or her thoughts aloud. Usually the character is on the stage alone, not speaking to other characters and perhaps not even consciously addressing the audience. (If there are other characters on the stage, they are ignored temporarily.) The purpose of a soliloquy is to reveal a character's inner thoughts, feelings, and plans to the audience.

Sonnet – A poem consisting of fourteen lines of iambic pentameter. See **Iambic pentameter, Poetry**

Source – A text used largely for informational purposes, as in research. See **Text.**

Standard English – The most widely accepted and understood form of expression in English in the United States. In the Standards, "standard English" refers to formal English writing and speaking. Standard English is the particular focus of Language standards 1 and 2. See **Standard English conventions, Standard written English**

Standard English conventions – The widely accepted practices in English punctuation, grammar, usage, and spelling that are taught in schools and employed by educated English speakers and writers. See **Standard written English**

Standard written English – The variety of English used in public communication, particularly in writing. It is the form taught in schools and used by educated English speakers. It is not limited to a particular region and can be spoken with any accent. See **Standard English conventions**

Stanza – A recurring grouping of two or more verse lines of the same length, metrical form, and, often, rhyme scheme. See **Poetry, Rhyme scheme, Verse**

Style – A writer's unique way of communicating ideas. The particular way a piece of literature is written, not only in what is said but in how it is said. Elements contributing to style include word choice, sentence length, tone, figurative language, and use of dialogue. See **Diction, Imagery, Tone**

Subordinate (dependent) clause – A clause that does not present a complete thought and cannot stand alone as a sentence. For example, *"The boy went home from school <u>because he was sick.</u>"* See **Independent clause, Sentence**

Suffix – A word part that is added to the end of a root word and establishes that word's part of speech. For example, the suffix *-ly* added to the adjective *immediate* creates the word, *immediately*, which is an adverb. See **Prefix, Root**

Symbol – A person, place, or object that represents something beyond itself. Symbols can succinctly communicate complicated, emotionally rich ideas.

Symbolism – In literature, the serious and extensive use of symbols. See **Symbol**

Synonym – A word that has a meaning identical with, or very similar to, that of another word in the same language. For example, in some situations, *right* is a synonym of *correct*.

Syntax – The way in which words are put together to form constructions such as phrases or sentences.

Tall tale – A distinctively American type of humorous story characterized by exaggeration. Tall tales and practical jokes have similar kinds of humor; in both, someone gets fooled, to the amusement of the person or persons who know the truth. See **Traditional narrative, Folktale**

Technical subjects – A course devoted to a practical study, such as engineering, technology, design, business, or other workforce-related subject. The technical aspect of a wider field of study, such as art or music.

Text complexity – The inherent difficulty of reading and comprehending a text, combined with consideration of reader and task variables. In the standards, a three-part assessment of text difficulty that pairs qualitative and quantitative measures with reader-task considerations. See Appendix A of the *Common Core State Standards* for a larger discussion of text complexity.

Text complexity band – A range of text difficulty corresponding to grade spans within the standards; specifically, the spans from grades 2–3, grades 4–5, grades 6–8, grades 9–10, and grades 11–CCR (college and career readiness).

Textual evidence – See **Evidence.**

Theme – A central idea or abstract concept that is made concrete through representation in person, action, and image. No proper theme is simply a subject or an activity. Like a thesis, theme implies a subject and predicate of some kind—for instance, not just *vice* as a standalone word, but a proposition such as, *"Vice seems more interesting than virtue but turns out to be destructive."* Sometimes the theme is directly stated in the work, and sometimes it is revealed indirectly. There may be more than one theme in a given work. See **Main idea, Thesis, Moral**

Thesis – An attitude or position taken by a writer or speaker with the purpose of proving or supporting it. Also, the paper written in support of the thesis. See **Theme, Main idea**

Tone – An expression of a writer's attitude toward a subject. Unlike mood, which is intended to shape the reader's emotional response, tone reflects the feelings of the writer. Tone can be serious, humorous, sarcastic, playful, ironic, bitter, or objective. See **Mood, Style**

Traditional narrative – The knowledge and beliefs of cultures that are transmitted by word of mouth, including both prose and verse narratives, poems and songs, myths, dramas, rituals, fables, proverbs, and riddles. Traditional narrative exists side by side with the growing written record. See **Folktale, Tall tale**

Trickster tale – Story relating the adventures of a mischievous supernatural being given to capricious acts of sly deception, who often functions as a cultural hero or symbolizes the ideal of a people.

Understatement – A technique of creating emphasis by saying less than is actually or literally true. Understatement is the opposite of hyperbole or exaggeration, and can be used to create humor as well as biting satire. See **Hyperbole**

Verb – A word, or set of words, that expresses action or state of being.

Verbal – [noun] A word that is derived from a verb and has the power of a verb, but acts like another part of speech. Like a verb, a verbal may be attached to an object, a modifier, and sometimes a subject; but unlike a verb, a verbal functions like a noun, an adjective, or an adverb. Three types of verbals are gerunds, infinitives, and participles. [adjective] Pertaining to words, either written or spoken. See **Oral**

Verse – A unit of poetry such as a stanza or line. See **Poetry, Stanza**

Voice – (1) The order of words that indicates whether the subject is acting or being acted upon—*active voice* indicates that the subject is acting, doing something (for example, "Benjamin Franklin discovered the secrets of electricity"; *passive voice* indicates that the subject is being acted upon (for example, "The secrets of electricity were discovered by Benjamin Franklin.") (2) A writer's unique use of language that allows a reader to perceive a human personality in his or her writing. The

elements of style that determine a writer's voice include sentence structure, diction, and tone. (3) The narrator of a selection. See **Diction, Tone**

With prompting and support/with (some) guidance and support – See **Scaffolding.**

This glossary contains those terms found in the* Indiana College- and Career-Readiness Standards for Mathematics*, as well as selected additional terms.

Glossary Sources

(DPI) http://dpi.wi.gov/standards/mathglos.html

(H) http://www.hbschool.com/glossary/math2/

(M) http://www.merriam-webster.com/

(MW) http://www.mathwords.com

(NCTM) http://www.nctm.org

AA similarity. Angle-angle similarity. When two triangles have corresponding angles that are congruent, the triangles are similar. (MW)

ASA congruence. Angle-side-angle congruence. When two triangles have corresponding angles and sides that are congruent, the triangles themselves are congruent. (MW)

Absolute value. A nonnegative number equal in numerical value to a given real number. (MW)

Addition and subtraction within 5, 10, 20, 100, or 1000. Addition or subtraction of two whole numbers with whole number answers, and with sum or minuend in the range 0–5, 0–10, 0–20, or 0–100, respectively. *Example: 8 + 2 = 10 is an addition within 10, 14 – 5 = 9 is a subtraction within 20, and – 55 – 18 = 37 is a subtraction within 100.*

Additive inverses. Two numbers whose sum is 0 are additive inverses of one another. *Example: $3/4$ and $-3/4$ are additive inverses of one another because $3/4 + (-3/4) = (-3/4) + 3/4 = 0$.*

Algorithm. A finite set of steps for completing a procedure, e.g., long division. (H)

Analog. Having to do with data represented by continuous variables, e.g., a clock with hour, minute, and second hands. (M)

Analytic geometry. The branch of mathematics that uses functions and relations to study geometric phenomena, e.g., the description of ellipses and other conic sections in the coordinate plane by quadratic equations.

Argument of a complex number. The angle describing the direction of a complex number on the complex plane. The argument is measured in radians as an angle in standard position. For a complex number in polar form $r(\cos\theta + i \sin\theta)$, the argument is θ. (MW)

Associative property of addition. See Table 3 in this Glossary.

Associative property of multiplication. See Table 3 in this Glossary.

Assumption. A fact or statement (as a proposition, axiom, postulate, or notion) taken for granted. (M)

Attribute. A common feature of a set of figures.

Benchmark fraction. A common fraction against which other fractions can be measured, such as ½.

Binomial Theorem. A method for distributing powers of binomials. (MW)

Bivariate data. Pairs of linked numerical observations. *Example: a list of heights and weights for each player on a football team.*

Box plot. A graphic method that shows the distribution of data values by using the median, quartiles, and extremes of the data set. A box shows the middle 50% of the data. (DPI)

Calculus. The mathematics of change and motion. The main concepts of calculus are limits, instantaneous rates of change, and areas enclosed by curves.

Capacity. The maximum amount or number that can be contained or accommodated, e.g., a jug with a one-gallon *capacity;* the auditorium was filled to *capacity*.

Cardinal number. A number (as 1, 5, 15) that is used in simple counting and that indicates how many elements there are in a set.

Cartesian plane. A coordinate plane with perpendicular coordinate axes.

Cavalieri's Principle. A method, with formula given below, of finding the volume of any solid for which cross-sections by parallel planes have equal areas. This includes, but is not limited to, cylinders and prisms. Formula: Volume = Bh, where B is the area of a cross-section and h is the height of the solid. (MW)

Coefficient. Any of the factors of a product considered in relation to a specific factor. (W)

Commutative property. See Table 3 in this Glossary.

Complex fraction. A fraction A/B where A and/or B are fractions (B nonzero).

Complex number. A number that can be written as the sum or difference of a real number and an imaginary number. See Illustration 1 in this glossary. (MW)

Complex plane. The coordinate plane used to graph complex numbers. (MW)

Compose numbers. a) Given pairs, triples, etc. of numbers, identify sums or products that can be computed; b) Each place in the base ten place value is composed of ten units of the place to the left, i.e., one hundred is composed of ten bundles of ten, one ten is composed of ten ones, etc.

Compose shapes. Join geometric shapes without overlaps to form new shapes.

Composite number. A whole number that has more than two factors. (H)

Computation algorithm. A set of predefined steps applicable to a class of problems that gives the correct result in every case when the steps are carried out correctly. *See also:* ***algorithm***; ***computation strategy***.

Computation strategy. Purposeful manipulations that may be chosen for specific problems, may not have a fixed order, and may be aimed at converting one problem into another. *See also:* ***computation algorithm***.

Congruent. Two plane or solid figures are congruent if one can be obtained from the other by rigid motion (a sequence of rotations, reflections, and translations).

Conjugate. The result of writing sum of two terms as a difference, or vice versa. *For example, the conjugate of* $x - 2$ *is* $x + 2$. (MW)

Coordinate plane. A plane in which two *coordinate axes* are specified, i.e., two intersecting directed straight lines, usually perpendicular to each other, and usually called the x-axis and y-axis. Every point in a coordinate plane can be described uniquely by an ordered pair of numbers, the *coordinates* of the point with respect to the coordinate axes.

Cosine. A trigonometric function that for an acute angle is the ratio between a leg adjacent to the angle when the angle is considered part of a right triangle and the hypotenuse. (M)

Counting number. A number used in counting objects, i.e., a number from the set 1, 2, 3, 4, 5,…. See Illustration 1 in this Glossary.

Counting on. A strategy for finding the number of objects in a group without having to count every member of the group. *For example, if a stack of books is known to have 8 books and 3 more books are added to the top, it is not necessary to count the stack all over again; one can find the total by counting on—pointing to the top book and saying "eight," following this with "nine, ten, eleven. There are eleven books now."*

Decimal expansion. Writing a rational number as a decimal.

Decimal fraction. A fraction (as $0.25 = 25/100$ or $0.025 = 25/1000$) or mixed number (as $3.025 = 3\ 25/1000$) in which the denominator is a power of ten, usually expressed by the use of the decimal point. (M)

Decimal number. Any real number expressed in base 10 notation, such as 2.673.

Decompose numbers. Given a number, identify pairs, triples, etc. of numbers that combine to form the given number using subtraction and division.

Decompose shapes. Given a geometric shape, identify geometric shapes that meet without overlap to form the given shape.

Digit. a) Any of the Arabic numerals 1 to 9 and usually the symbol 0; b) One of the elements that combine to form numbers in a system other than the decimal system.

Digital. Having to do with data that is represented in the form of numerical digits; providing a readout in numerical digits, e.g., a digital watch.

Dilation. A transformation that moves each point along the ray through the point emanating from a fixed center, and multiplies distances from the center by a common scale factor.

Directrix. A fixed curve with which a generatrix maintains a given relationship in generating a geometric figure; specifically: a straight line the distance to which from any point in a conic section is in fixed ratio to the distance from the same point to a focus. (M)

Discrete mathematics. The branch of mathematics that includes combinatorics, recursion, Boolean algebra, set theory, and graph theory.

Dot plot. *See:* ***line plot***.

Expanded form. A multi-digit number is expressed in expanded form when it is written as a sum of single-digit multiples of powers of ten. *For example, 643 = 600 + 40 + 3.*

Expected value. For a random variable, the weighted average of its possible values, with weights given by their respective probabilities.

Exponent. The number that indicates how many times the base is used as a factor, e.g., in $4^3 = 4 \times 4 \times 4 = 64$, the exponent is 3, indicating that 4 is repeated as a factor three times.

Exponential function. A function of the form $y = a \bullet b^x$ where $a > 0$ and either $0 < b < 1$ or $b > 1$. The variables do not have to be x and y. *For example, $A = 3.2 \bullet (1.02)^t$ is an exponential function.*

Expression. A mathematical phrase that combines operations, numbers, and/or variables (e.g., $3^2 \div a$). (H)

Fibonacci sequence. The sequence of numbers beginning with 1, 1, in which each number that follows is the sum of the previous two numbers, i.e., 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144….

First quartile. For a data set with median M, the first quartile is the median of the data values less than M. *Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the first quartile is 6.*[1] *See also:* ***median, third quartile, interquartile range***.

Fraction. A number expressible in the form a/b where a is a whole number and b is a positive whole number. (The word *fraction* in these standards always refers to a nonnegative number.) *See also:* ***rational number***.

Function. A mathematical relation for which each element of the domain corresponds to exactly one element of the range. (MW)

Function notation. A notation that describes a function. For a function f, when x is a member of the domain, the symbol $f(x)$ denotes the corresponding member of the range (e.g., $f(x) = x + 3$).

Fundamental Theorem of Algebra. The theorem that establishes that, using complex numbers, all polynomials can be factored. A generalization of the theorem asserts that any polynomial of degree n has exactly n zeros, counting multiplicity. (MW)

Geometric sequence (progression). An ordered list of numbers that has a common ratio between consecutive terms, e.g., 2, 6, 18, 54…. (H)

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[1] Many different methods for computing quartiles are in use. The method defined here is sometimes called the Moore and McCabe method. See Langford, E., "Quartiles in Elementary Statistics," *Journal of Statistics Education* Volume 14, Number 3 (2006).

Histogram. A type of bar graph used to display the distribution of measurement data across a continuous range.

Identity property of 0. See Table 3 in this Glossary.

Imaginary number. Complex numbers with no real terms, such as 5*i*. See Illustration 1 in this Glossary. (M)

Independently combined probability models. Two probability models are said to be combined independently if the probability of each ordered pair in the combined model equals the product of the original probabilities of the two individual outcomes in the ordered pair.

Integer. All positive and negative whole numbers, including zero. (MW)

Interquartile range. A measure of variation in a set of numerical data, the interquartile range is the distance between the first and third quartiles of the data set. Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the interquartile range is 15 – 6 = 9. *See also:* ***first quartile, third quartile***.

Inverse function. A function obtained by expressing the dependent variable of one function as the independent variable of another; that is the inverse of $y = f(x)$ is $x = f^{-1}(y)$. (NCTM)

Irrational number. A number that cannot be expressed as a quotient of two integers, e.g., $\sqrt{2}$. It can be shown that a number is irrational if and only if it cannot be written as a repeating or terminating decimal.

Law of Cosines. An equation relating the cosine of an interior angle and the lengths of the sides of a triangle. (MW)

Law of Sines. Equations relating the sines of the interior angles of a triangle and the corresponding opposite sides. (MW)

Line plot. A method of visually displaying a distribution of data values where each data value is shown as a dot or mark above a number line. Also known as a dot plot. (DPI)

Linear association. Two variables have a linear association if a scatter plot of the data can be well-approximated by a line.

Linear equation. Any equation that can be written in the form $Ax + By + C = 0$ where A and B cannot both be 0. The graph of such an equation is a line.

Linear function. A mathematical function in which the variables appear only in the first degree, are multiplied by constants, and are combined only by addition and subtraction. *For example:* $f(s) = Ax + By + C$. (M)

Logarithm. The exponent that indicates the power to which a base number is raised to produce a given number. *For example, the logarithm of 100 to the base 10 is 2.* (M)

Logarithmic function. Any function in which an independent variable appears in the form of a logarithm; they are the inverse functions of exponential functions.

Matrix (pl. matrices). A rectangular array of numbers or variables.

Mean. A measure of center in a set of numerical data, computed by adding the values in a list and then dividing by the number of values in the list.[2] *Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the mean is 21.*

Mean absolute deviation. A measure of variation in a set of numerical data, computed by adding the distances between each data value and the mean, then dividing by the number of data values. *Example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the mean absolute deviation is 20.*

Measure of variability. A determination of how much the performance of a group deviates from the mean or median, most frequently used measure is standard deviation.

Median. A measure of center in a set of numerical data. The median of a list of values is the value appearing at the center of a sorted version of the list; or the mean of the two central values, if the list contains an even number of values. *Example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 90}, the median is 11.*

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[2] To be more precise, this defines the *arithmetic mean*.

Midline. In the graph of a trigonometric function, the horizontal line halfway between its maximum and minimum values.

Model. A mathematical representation (e.g., number, graph, matrix, equation(s), geometric figure) for real-world or mathematical objects, properties, actions, or relationships. (DPI)

Modulus of a complex number. The distance between a complex number and the origin on the complex plane. The absolute value of $a + bi$ is written $|a + bi|$, and the formula for $|a + bi|$ is $\sqrt{a^2+b^2}$. For a complex number in polar form, $r(\cos\theta + i \sin\theta)$, the modulus is r. (MW)

Multiplication and division within 100. Multiplication or division of two whole numbers with whole number answers, and with product or dividend in the range 0–100. *Example: $72 \div 8 = 9$.*

Multiplicative inverses. Two numbers whose product is 1 are multiplicative inverses of one another. *Example: $3/4$ and $4/3$ are multiplicative inverses of one another because $3/4 \times 4/3 = 4/3 \times 3/4 = 1$.*

Network. a) A figure consisting of vertices and edges that shows how objects are connected, b) A collection of points (vertices), with certain connections (edges) between them.

Non-linear association. The relationship between two variables is nonlinear if a change in one is associated with a change in the other and depends on the value of the first; that is, if the change in the second is not simply proportional to the change in the first, independent of the value of the first variable.

Number line diagram. A diagram of the number line used to represent numbers and support reasoning about them. In a number line diagram for measurement quantities, the interval from 0 to 1 on the diagram represents the unit of measure for the quantity.

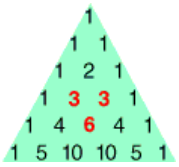
Numeral. A symbol or mark used to represent a number.

Order of Operations. Convention adopted to perform mathematical operations in a consistent order. 1. Perform all operations inside parentheses, brackets, and/or above and below a fraction bar in the order specified in steps 3 and 4; 2. Find the value of any powers or roots; 3. Multiply and divide from left to right; 4. Add and subtract from left to right. (NCTM)

Ordinal number. A number designating the place (as first, second, or third) occupied by an item in an ordered sequence. (M)

Partition. A process of dividing an object into parts.

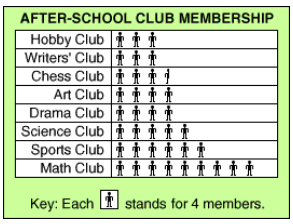
Pascal's triangle. A triangular arrangement of numbers in which each row starts and ends with 1, and each other number is the sum of the two numbers above it. (H)



Percent rate of change. A rate of change expressed as a percent. *Example: if a population grows from 50 to 55 in a year, it grows by $5/50 = 10\%$ per year.*

Periodic phenomena. Naturally recurring events, for example, ocean tides, machine cycles.

Picture graph. A graph that uses pictures to show and compare information.



Polar form. The polar coordinates of a complex number on the complex plane. The polar form of a complex number is written in any of the following forms: $r\cos\theta + r\,i \sin\theta$, $r(\cos\theta + i \sin\theta)$, or $r\text{cis}\,\theta$. In any of these forms, r is called the modulus or absolute value. θ is called the argument. (MW)

Polynomial. The sum or difference of terms which have variables raised to positive integer powers and which have coefficients that may be real or complex. The following are all polynomials: $5x^3 - 2x^2 + x - 13$, $x^2y^3 + xy$, and $(1 + i)a^2 + ib^2$. (MW)

Polynomial function. Any function whose value is the solution of a polynomial.

Postulate. A statement accepted as true without proof.

Prime factorization. A number written as the product of all its prime factors. (H)

Prime number. A whole number greater than 1 whose only factors are 1 and itself.

Probability distribution. The set of possible values of a random variable with a probability assigned to each.

Properties of equality. See Table 4 in this Glossary.

Properties of inequality. See Table 5 in this Glossary.

Properties of operations. See Table 3 in this Glossary.

Probability. A number between 0 and 1 used to quantify likelihood for processes that have uncertain outcomes (such as tossing a coin, selecting a person at random from a group of people, tossing a ball at a target, testing for a medical condition).

Probability model. A probability model is used to assign probabilities to outcomes of a chance process by examining the nature of the process. The set of all outcomes is called the sample space, and their probabilities sum to 1. *See also:* ***uniform probability model***.

Proof. A method of constructing a valid argument, using deductive reasoning.

Proportion. An equation that states that two ratios are equivalent, e.g., $4/8 = ½$ or $4 : 8 = 1 : 2$.

Pythagorean theorem. For any right triangle, the sum of the squares of the measures of the legs equals the square of the measure of the hypotenuse.

Quadratic equation. An equation that includes only second degree polynomials. Some examples are $y = 3x^2 – 5x^2 + 1$, $x^2 + 5xy + y^2 = 1$, and $1.6a^2 + 5.9a – 3.14 = 0$. (MW)

Quadratic expression. An expression that contains the square of the variable, but no higher power of it.

Quadratic function. A function that can be represented by an equation of the form $y = ax^2 + bx + c$, where a, b, and c are arbitrary, but fixed, numbers and a 0. The graph of this function is a parabola. (DPI)

Quadratic polynomial. A polynomial where the highest degree of any of its terms is 2.

Radical. The $\sqrt{}$ symbol, which is used to indicate square roots or nth roots. (MW)

Random sampling. A smaller group of people or objects chosen from a larger group or population by a process giving equal chance of selection to all possible people or objects. (H)

Random variable. An assignment of a numerical value to each outcome in a sample space. (M)

Ratio. A comparison of two numbers or quantities, e.g., 4 to 7 or 4 : 7 or $4/7$.

Rational expression. A quotient of two polynomials with a non-zero denominator.

Rational number. A number expressible in the form a/b or $– a/b$ for some fraction a/b. The rational numbers include the integers. See Illustration 1 in this Glossary.

Real number. A number from the set of numbers consisting of all rational and all irrational numbers. See Illustration 1 in this Glossary.

Rectangular array. An arrangement of mathematical elements into rows and columns.

Rectilinear figure. A polygon all angles of which are right angles.

Recursive pattern or sequence. A pattern or sequence wherein each successive term can be computed from some or all of the preceding terms by an algorithmic procedure.

Reflection. A type of transformation that flips points about a line, called the *line of reflection*. Taken together, the image and the pre-image have the line of reflection as a line of symmetry.

Relative frequency. The empirical counterpart of probability. If an event occurs N' times in N trials, its relative frequency is N'/N. (M)

Remainder Theorem. If $f(x)$ is a polynomial in x then the remainder on dividing $f(x)$ by $x - a$ is $f(a)$. (M)

Repeating decimal. A decimal in which, after a certain point, a particular digit or sequence of digits repeats itself indefinitely; the decimal form of a rational number. (M) *See also:* ***terminating decimal***.

Rigid motion. A transformation of points in space consisting of a sequence of one or more translations, reflections, and/or rotations. Rigid motions are here assumed to preserve distances and angle measures.

Rotation. A type of transformation that turns a figure about a fixed point, called the *center of rotation*.

SAS congruence. (Side-angle-side congruence.) When two triangles have corresponding sides and the angles formed by those sides are congruent, the triangles are congruent. (MW)

SSS congruence. (Side-side-side congruence.) When two triangles have corresponding sides that are congruent, the triangles are congruent. (MW)

Sample space. In a probability model for a random process, a list of the individual outcomes that are to be considered.

Scatter plot. A graph in the coordinate plane representing a set of bivariate data. *For example, the heights and weights of a group of people could be displayed on a scatter plot.* (DPI)

Scientific notation. A widely used floating-point system in which numbers are expressed as products consisting of a number between 1 and 10 multiplied by an appropriate power of 10, e.g., $562 = 5.62 \times 10^2$. (MW)

Sequence, progression. A set of elements ordered so that they can be labeled with consecutive positive integers starting with 1, e.g., 1, 3, 9, 27, 81. In this sequence, 1 is the *first term*, 3 is the *second term*, 9 is the *third term*, and so on.

Significant figures. (digits) A way of describing how precisely a number is written, particularly when the number is a measurement. (MW)

Similarity transformation. A rigid motion followed by a dilation.

Simultaneous equations. Two or more equations containing common variables. (MW)

Sine. The trigonometric function that for an acute angle is the ratio between the leg opposite the angle when the angle is considered part of a right triangle and the hypotenuse. (M)

Tangent. a) Meeting a curve or surface in a single point if a sufficiently small interval is considered. b) The trigonometric function that, for an acute angle, is the ratio between the leg opposite the angle and the leg adjacent to the angle when the angle is considered part of a right triangle. (MW)

Tape diagram. A drawing that looks like a segment of tape, used to illustrate number relationships. Also known as a strip diagram, bar model, fraction strip, or length model.

Terminating decimal. A decimal is called terminating if its repeating digit is 0. A terminating decimal is the decimal form of a rational number. *See also:* ***repeating decimal***.

Third quartile. For a data set with median M, the third quartile is the median of the data values greater than M. *Example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the third quartile is 15. See also:* ***median, first quartile, interquartile range***.

Transformation. A prescription, or rule, that sets up a one-to-one correspondence between the points in a geometric object (the *pre-image*) and the points in another geometric object (the *image*). Reflections, rotations, translations, and dilations are particular examples of transformations.

Transitivity principle for indirect measurement. If the length of object A is greater than the length of object B, and the length of object B is greater than the length of object C, then the length of object A is greater than the length of object C. This principle applies to measurement of other quantities as well.

Translation. A type of transformation that moves every point in a graph or geometric figure by the same distance in the same direction without a change in orientation or size. (MW)

Trigonometric function. A function (as the sine, cosine, tangent, cotangent, secant, or cosecant) of an arc or angle most simply expressed in terms of the ratios of pairs of sides of a right-angled triangle. (M)

Trigonometry. The study of triangles, with emphasis on calculations involving the lengths of sides and the measure of angles. (MW)

Uniform probability model. A probability model which assigns equal probability to all outcomes. *See also:* ***probability model***.

Unit fraction. A fraction with a numerator of 1, such as $1/3$ or $1/5$.

Valid. a) Well-grounded or justifiable; being at once relevant and meaningful, e.g., a *valid* theory; b) Logically correct. (MW)

Variable. A quantity that can change or that may take on different values. Refers to the letter or symbol representing such a quantity in an expression, equation, inequality, or matrix. (MW)

Vector. A quantity with magnitude and direction in the plane or in space, defined by an ordered pair or triple of real numbers.

Visual fraction model. A tape diagram, number line diagram, or area model.

Whole numbers. The numbers 0, 1, 2, 3, … . See Illustration 1 in this Glossary.

TABLE 1. Common addition and subtraction situations.[3]

	Result Unknown	Change Unknown	Start Unknown
Add to	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? 2 + 3 = ?	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? 2 + ? = 5	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? ? + 3 = 5
Take from	Five apples were on the table. I ate two apples. How many apples are on the table now? 5 – 2 = ?	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? 5 – ? = 3	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? ? – 2 = 3

	Total Unknown	Addend Unknown	Both Addends Unknown[4]
Put Together/ Take Apart[5]	Three red apples and two green apples are on the table. How many apples are on the table? 3 + 2 = ?	Five apples are on the table. Three are red and the rest are green. How many apples are green? 3 + ? = 5, 5 – 3 = ?	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? 5 = 0 + 5, 5 = 5 + 0 5 = 1 + 4, 5 = 4 + 1 5 = 2 + 3, 5 = 3 + 2

	Difference Unknown	Bigger Unknown	Smaller Unknown

[3] Adapted from Boxes 2–4 of *Mathematics Learning in Early Childhood*, National Research Council (2009, pp. 32–33).
[4] These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean *makes* or *results in* but always does mean *is the same number as*.
[5] Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

Compare[6]	("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? ("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? 2 + ? = 5, 5 – 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? 2 + 3 = ?, 3 + 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? 5 – 3 = ?, ? + 3 = 5

TABLE 2. Common multiplication and division situations.[7]

	Unknown Product **3 × 6 = ?**	**Group Size Unknown** ("How many in each group?" Division) **3 × ? = 18 and 18 ÷ 3 = ?**	**Number of Groups Unknown** ("How many groups?" Division) **? × 6 = 18 and 18 ÷ 6 = ?**
Equal Groups	There are 3 bags with 6 plums in each bag. How many plums are there in all? *Measurement example.* You need 3 lengths of string, each 6 inches long. How much string will you need altogether?	If 18 plums are shared equally into 3 bags, then how many plums will be in each bag? *Measurement example.* You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?	If 18 plums are to be packed 6 to a bag, then how many bags are needed? *Measurement example.* You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?

[6] For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using *more* for the bigger unknown and using *less* for the smaller unknown). The other versions are more difficult.
[7] The first examples in each cell are examples of discrete things. These are easier for students and should be given before the measurement examples.

Arrays,[8] Area[9]	There are 3 rows of apples with 6 apples in each row. How many apples are there? *Area example.* What is the area of a 3 cm by 6 cm rectangle?	If 18 apples are arranged into 3 equal rows, how many apples will be in each row? *Area example.* A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? *Area example.* A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?
Compare	A blue hat costs $6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost? *Measurement example.* A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?	A red hat costs $18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost? *Measurement example.* A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?	A red hat costs $18 and a blue hat costs $6. How many times as much does the red hat cost as the blue hat? *Measurement example.* A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?
General	$a \times b = ?$	$a \times ? = p$ and $p \div a = ?$	$? \times b = p$ and $p \div b = ?$

[8] The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.

[9] Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.

TABLE 3. The properties of operations.

Here a, b and c stand for arbitrary numbers in a given number system. The properties of operations apply to the rational number system, the real number system, and the complex number system.

Associative property of addition	$(a + b) + c = a + (b + c)$
Commutative property of addition	$a + b = b + a$
Additive identity property of 0	$a + 0 = 0 + a = a$
Existence of additive inverses	For every a there exists $-a$ so that $a + (-a) = (-a) + a = 0$.
Associative property of multiplication	$(a \times b) \times c = a \times (b \times c)$
Commutative property of multiplication	$a \times b = b \times a$
Multiplicative identity property of 1	$a \times 1 = 1 \times a = a$
Existence of multiplicative inverses	For every $a \neq 0$ there exists $\mathbf{1}/\boldsymbol{a}$ so that $a \times \mathbf{1}/\boldsymbol{a} = \mathbf{1}/\boldsymbol{a} \times a = 1$.
Distributive property of multiplication over addition	$a \times (b + c) = a \times b + a \times c$

TABLE 4. The properties of equality.

Here a, b, and c stand for arbitrary numbers in the rational, real, or complex number systems.

Reflexive property of equality	$a = a$
Symmetric property of equality	If $a = b$, then $b = a$.
Transitive property of equality	If $a = b$ and $b = c$, then $a = c$.
Addition property of equality	If $a = b$, then $a + c = b + c$.
Subtraction property of equality	If $a = b$, then $a - c = b - c$.
Multiplication property of equality	If $a = b$, then $a \times c = b \times c$.
Division property of equality	If $a = b$ and $c \neq 0$, then $a \div c = b \div c$.
Substitution property of equality	If $a = b$, then b may be substituted for a in any expression containing a.

TABLE 5. The properties of inequality.

Here a, b, and c stand for arbitrary numbers in the rational or real number systems.

Exactly one of the following is true: $a < b$, $a = b$, $a > b$.

If $a > b$ and $b > c$ then $a > c$.

If $a > b$, then $b < a$.

If $a > b$, then $-a < -b$.

If $a > b$, then $a \pm c > b \pm c$.

If $a > b$ and $c > 0$, then $a \times c > b \times c$.

If $a > b$ and $c < 0$, then $a \times c < b \times c$.

If $a > b$ and $c > 0$, then $a \div c > b \div c$.

If $a > b$ and $c < 0$, then $a \div c < b \div c$.

ILLUSTRATION 1. The Number System.

The Number System is comprised of number sets beginning with the Counting Numbers and culminating in the more complete Complex Numbers. The name of each set is written on the boundary of the set, indicating that each increasing oval encompasses the sets contained within. Note that the Real Number Set is comprised of two parts: Rational Numbers and Irrational Numbers.

APPENDIX A: RECOMMENDED MATHEMATICS COURSES

Suggested Higher Level Mathematics Courses for College and Career Readiness

ADVANCED COURSE: PRECALCULUS

Content Standards

Number and Quantity

The Complex Number System — N-CN

Perform arithmetic operations with complex numbers.

3. Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Represent complex numbers and their operations on the complex plane.

4. 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.
5. Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example,* $\left(-1+\sqrt{3}i\right)^3 = 8$ *because* $\left(-1+\sqrt{3}i\right)$ *has modulus 2 and argument 120°.*
6. 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.

Use complex numbers in polynomial identities and equations.

8. Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x – 2i)$.
9. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Vector and Matrix Quantities — N-VM

Represent and model with vector quantities.

1. Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $|\boldsymbol{v}|$, $||\boldsymbol{v}||$, v).
2. Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
3. Solve problems involving velocity and other quantities that can be represented by vectors.

Perform operations on vectors.

4. Add and subtract vectors.
   a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
   b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

c. Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

5. Multiply a vector by a scalar.
   a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.
   b. Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using $||c\boldsymbol{v}|| = |c|\,\boldsymbol{v}$. Compute the direction of $c\boldsymbol{v}$ knowing that when $|c|\,\boldsymbol{v} \neq 0$, the direction of $c\boldsymbol{v}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$).

Perform operations on matrices and use matrices in applications.

6. Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
7. Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
8. Add, subtract, and multiply matrices of appropriate dimensions.
9. Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
10. 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.
11. 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.
12. Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

Arithmetic with Polynomials and Rational Expressions — A-APR

Use polynomial identities to solve problems.

5. 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.[10]

Rewrite rational expressions.

6. Rewrite simple rational expressions in different forms; write $\boldsymbol{a(x)/b(x)}$ in the form $q(x) + \boldsymbol{r(x)/b(x)}$, 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 inspection, long division, or, for the more complicated examples, a computer algebra system.
7. 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.

[10] The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

indicates standard beyond College and Career Ready.

Reasoning with Equations and Inequalities A-REI

Solve systems of equations.

8. Represent a system of linear equations as a single matrix equation in a vector variable.
9. Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Functions

Interpreting Functions – – – F-IF

Analyze functions using different representations.

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
   d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Building Functions F-BF

Build a function that models a relationship between two quantities.

1. Write a function that describes a relationship between two quantities.
   c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

Build new functions from existing functions.

4. Find inverse functions.
   b. Verify by composition that one function is the inverse of another.
   c. Read values of an inverse function from a graph or a table, given that the function has an inverse.
   d. Produce an invertible function from a non-invertible function by restricting the domain.
5. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle.

3. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
4. Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model periodic phenomena with trigonometric functions.

6. Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

7. 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.

Prove and apply trigonometric identities.

9. Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

Similarity, Right Triangles, and Trigonometry G-SRT

Apply trigonometry to general triangles.

9. Derive the formula $A = \frac{1}{2}ab\sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. Prove the Laws of Sines and Cosines and use them to solve problems.
11. 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).

Circles G-C

Understand and apply theorems about circles.

4. Construct a tangent line from a point outside a given circle to the circle.

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section.

3. 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.
IN.3.a. Use equations and graphs of conic sections to model real-world problems.

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems.

2. Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Visualize relationships between two-dimensional and three-dimensional objects.

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

ADVANCED COURSE: ADVANCED QUANTITATIVE REASONING

Content Standards

Number and Quantity

Vector and Matrix Quantities N-VM

Represent and model with vector quantities.

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2. Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
3. Solve problems involving velocity and other quantities that can be represented by vectors.

Perform operations on matrices and use matrices in applications.

6. Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
7. Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
8. Add, subtract, and multiply matrices of appropriate dimensions.
9. Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
10. 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.
11. 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.
12. Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

Arithmetic with Polynomials and Rational Expressions — A-APR

Use polynomial identities to solve problems.

5. 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.[11]

Reasoning with Equations and Inequalities — A-REI

Solve systems of equations.

8. Represent a system of linear equations as a single matrix equation in a vector variable.
9. Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

[11] The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

NEW COURSE: MATHEMATICAL MODELS WITH APPLICATIONS

Create an additional math class for students who need more time to become proficient with the College and Career Readiness Standards, such as Texas' Mathematical Models with Applications. This course would allow high schools to provide the appropriate course to students as they complete the Core 40 requirements for mathematics with an appropriate sequence for all four years of mathematics. This course would likely be taken after Algebra I.

Mathematical Models with Applications is designed to build on the knowledge and skills for mathematics in Kindergarten-Grade 8 and Algebra I. This mathematics course provides a path for students to succeed in Algebra II and prepares them for various post-secondary choices. Students learn to apply mathematics through experiences in personal finance, science, engineering, fine arts, and social sciences. Students use algebraic, graphical, and geometric reasoning to recognize patterns and structure, model information, solve problems, and communicate solutions. Students will select from tools such as physical objects; manipulatives; technology, including graphing calculators, data collection devices, and computers; and paper and pencil and from methods such as algebraic techniques, geometric reasoning, patterns, and mental math to solve problems. –

In Mathematical Models with Applications, students will use a mathematical modeling cycle to analyze problems, understand problems better, and improve decisions. A basic mathematical modeling cycle is summarized in this paragraph. The student will:

(A) represent:

– – (i) identify the variables in the problem and select those that represent essential features; and

– – (ii) formulate a model by creating and selecting from representations such as geometric, graphical, tabular, algebraic, or statistical that describe the relationships between the variables;

(B) compute: analyze and perform operations on the relationships between the variables to draw conclusions;

(C) interpret: interpret the results of the mathematics in terms of the original problem;

(D) revise: confirm the conclusions by comparing the conclusions with the problem and revising as necessary; and

(E) report: report on the conclusions and the reasoning behind the conclusions

Mathematical Process Standards

MMA.1 – The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
(A) apply mathematics to problems arising in everyday life, society, and the workplace;
(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation,

and number sense as appropriate, to solve problems;
(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
(E) create and use representations to organize, record, and communicate mathematical ideas;
(F) analyze mathematical relationships to connect and communicate mathematical ideas; and
(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Mathematical Modeling in Personal Finance

MMA.2 The student uses mathematical processes with graphical and numerical techniques to study patterns and analyze data related to personal finance. The student is expected to:
MMA.2A use rates and linear functions to solve problems involving personal finance and budgeting, including compensations and deductions;
MMA.2B solve problems involving personal taxes; and
MMA.2C analyze data to make decisions about banking, including options for online banking, checking accounts, overdraft protection, processing fees, and debit card/ATM fees.

MMA.3 The student uses mathematical processes with algebraic formulas, graphs, and amortization modeling to solve problems involving credit. The student is expected to:
MMA.3A use formulas to generate tables to display series of payments for loan amortizations resulting from financed purchases;
MMA.3B analyze personal credit options in retail purchasing and compare relative advantages and disadvantages of each option;
MMA.3C use technology to create amortization models to investigate home financing and compare buying a home to renting a home; and
MMA.3D use technology to create amortization models to investigate automobile financing and compare buying a vehicle to leasing a vehicle.

MMA.4 The student uses mathematical processes with algebraic formulas, numerical techniques, and graphs to solve problems related to financial planning. The student is expected to:
MMA.4A analyze and compare coverage options and rates in insurance;
MMA.4B investigate and compare investment options, including stocks, bonds, annuities, certificates of deposit, and retirement plans; and
MMA.4C analyze types of savings options involving simple and compound interest and compare relative advantages of these options.

Mathematical Modeling in Science and Engineering

MMA.5 The student applies mathematical processes with algebraic techniques to study patterns and analyze data as it applies to science. The student is expected to:
MMA.5A use proportionality and inverse variation to describe physical laws such as Hook's Law, Newton's Second Law of Motion, and Boyle's Law;
MMA.5B use exponential models available through technology to model growth and decay in areas, including radioactive decay; and
MMA.5C use quadratic functions to model motion.

MMA.6 The student applies mathematical processes with algebra and geometry to study patterns and analyze data as it applies to architecture and engineering. The student is expected to:
MMA.6A use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in architecture;
MMA.6B use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields;
MMA.6C use the Pythagorean Theorem and special right-triangle relationships to calculate distances; and
MMA.6D use trigonometric ratios to calculate distances and angle measures as applied to fields.

Mathematical Modeling in Fine Arts

MMA.7A use trigonometric ratios and functions available through technology to model periodic behavior in art and music;
MMA.7B use similarity, geometric transformations, symmetry, and perspective drawings to describe mathematical patterns and structure in art and photography;
MMA.7C use geometric transformations, proportions, and periodic motion to describe mathematical patterns and structure in music; and
MMA.7D use scale factors with two-dimensional and three-dimensional objects to demonstrate proportional and non-proportional changes in surface area and volume as applied to fields.

Mathematical Modeling in Social Sciences

MMA.8 The student applies mathematical processes to determine the number of elements in a finite sample space and compute the probability of an event. The student is expected to:
MMA.8A determine the number of ways an event may occur using combinations, permutations, and the Fundamental Counting Principle;
MMA.8B compare theoretical to empirical probability; and
MMA.8C use experiments to determine the reasonableness of a theoretical model such as binomial or geometric.

MMA.9 The student applies mathematical processes and mathematical models to analyze data as it applies to social sciences. The student is expected to:
MMA.9A interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, dot plots, stem-and-leaf plots, and box and whisker plots, to draw conclusions from the data and determine the strengths and weaknesses of conclusions;
MMA.9B analyze numerical data using measures of central tendency (mean, median, and mode) and variability (range, interquartile range or IQR, and standard deviation) in order to make inferences with normal distributions;
MMA.9C distinguish the purposes and differences among types of research, including surveys, experiments, and observational studies;
MMA.9D use data from a sample to estimate population mean or population proportion;
MMA.9E analyze marketing claims based on graphs and statistics from electronic and print media and justify the validity of stated or implied conclusions; and
MMA.9F use regression methods available through technology to model linear and exponential functions, interpret correlations, and make predictions.

Conduct a Study

MMA.10 The student applies mathematical processes to design a study and use graphical, numerical, and analytical techniques to communicate the results of the study. The student is expected to:
MMA.10A formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions; and
MMA.10B communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project through the use of one or more of the following: a written report, a visual display, an oral report, or a multi-media presentation.

Functions

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle.

3. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
4. Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model periodic phenomena with trigonometric functions.

5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
7. 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.

Prove[12] and apply trigonometric identities.

9. Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

Similarity, Right Triangles, and Trigonometry G-SRT

Apply trigonometry to general triangles.

11. 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).

Circles G-C

Understand and apply theorems about circles.

4. Construct a tangent line from a point outside a given circle to the circle.

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section.

3. 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.
IN.3.a. Use equations and graphs of conic sections to model real-world problems.

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems.

2. Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Visualize relationships between two-dimensional and three-dimensional objects.

[12] Advanced Quantitative Reasoning should accept informal proof and focus on the underlying reasoning, and use the theorems to solve problems.

4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations.

3. 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).

IN.4. Use dimensional analysis for unit conversions to confirm that expressions and equations make sense.

Statistics and Probability

Interpreting Categorical and Quantitative Data – – – S-ID

Interpret linear models.

9. Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions S-IC

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

4. 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.
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
6. Evaluate reports based on data.

Conditional Probability and the Rules of Probability S-CP

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

8. Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.
9. Use permutations and combinations to compute probabilities of compound events and solve problems.

Using Probability to Make Decisions S-MD

Calculate expected values and use them to solve problems.

1. 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.
2. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
3. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
4. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*

Use probability to evaluate outcomes of decisions.

5. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
   a. (+) Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*
   b. (+) Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*
6. Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).[13]

[13] Replacing the hockey goalie with an extra skater.

APPENDIX B: INDIANA'S RECOMMENDED READING LIST

Suggested Authors, Illustrators, and Works

From the Ancient World to About 1970

All Indiana students should acquire knowledge of a range of literary works reflecting a common literary heritage that goes back thousands of years to the ancient world. In addition, all students should become familiar with some of the outstanding works in the rich body of literature that is their particular heritage in the English-speaking world, which includes the first literature in the world created just for children, whose authors viewed childhood as a special period in life.

The suggestions below constitute a core list of those authors, illustrators, or works that comprise the literary and intellectual capital drawn on by those who write in English, whether for novels, poems, nonfiction, newspapers, or public speeches, in this country or elsewhere. The next section of this document contains a second list of suggested contemporary authors and illustrators—including the many excellent writers and illustrators of children's books of recent years—and highlights authors and works from around the world.

In planning a curriculum, it is important to balance depth with breadth. As teachers in schools and districts work with this curriculum framework to develop literature units, they will often combine literary and informational works from the two lists into thematic units. Exemplary curriculum is always evolving—we urge districts to take initiative to create programs meeting the needs of their students.

The lists of suggested authors, illustrators, and works are organized by grade clusters: K–2, 3–4, 5–8, and 9–12. Certain key works or authors are repeated in adjoining grade spans, giving teachers the option to match individual students with the books that suit their interests and developmental levels. The decision to present a grades 9–12 list (as opposed to grades 9–10 and 11–12) stems from the recognition that teachers should be free to choose selections that challenge, but do not overwhelm, their students.

See Appendix B of the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects* for additional suggestions.

Grades K–2

Traditional Literature and Poetry for Reading, Listening, and Viewing

Traditional Literature

Aesop's fables
Rudyard Kipling's *Just So Stories*
Selected Grimm and
Hans Christian Andersen fairy tales
Selected French fairy tales
The Bible as literature: Tales including
Jonah and the whale, Daniel and the lion's den, Noah and the Ark, Moses and the burning bush, the story of Ruth, David and Goliath

Poetry

Mother Goose nursery rhymes
John Ciardi
Rachel Field
David McCord
A.A. Milne
Christina Rossetti

Picture Book Authors and Illustrators

Edward Ardizzone
Ludwig Bemelmans
Margaret Wise Brown
John Burningham
Virginia Lee Burton
Randolph Caldecott
Edgar Parin and Ingri
D'Aulaire Wanda Gág
Theodore Geisel (Dr. Seuss)
Kate Greenaway
Shirley Hughes
Crockett Johnson
Ruth Kraus
Robert Lawson
Munro Leaf
Robert McCloskey
A. A. Milne
Else Holmelund Minarik
William Pène du Bois
Beatrix Potter
Alice and Martin Provensen
H. A. and Margaret Rey
Maurice Sendak

Grades 3–4,
in addition to the grades K–2 selections

Traditional Literature

Greek, Roman, and Norse myths
Stories about King Arthur and Robin Hood
Myths and legends of indigenous peoples of North, Central and South America
American folktales and legends
Asian and African folktales and legends
The Bible as literature:
Tales including Adam and Eve, Cain and Abel, David and Jonathan, the Prodigal Son, the visit of the Magi, well-known psalms (e.g., 23, 24, 46, 92, 121, and 150)

American Authors and Illustrators

Natalie Babbitt
L. Frank Baum
Beverly Cleary
Elizabeth Coatsworth
Mary Mapes Dodge
Elizabeth Enright
Eleanor Estes
Jean Craighead George
Sterling North
Howard Pyle
Carl Sandburg
George Selden
Louis Slobodkin
James Thurber
E. B. White
Laura Ingalls Wilder

British Authors and Illustrators

Michael Bond
Frances Hodgson Burnett
Lewis Carroll
Kenneth Grahame
Dick King-Smith
Edith Nesbit
Mary Norton
Margery Sharp
Robert Louis Stevenson
P. L. Travers

British and American Poets

Stephen Vincent and Rosemarie Carr Benét
Lewis Carroll
John Ciardi
Rachel Field
Robert Frost
Langston Hughes
Edward Lear
Myra Cohn Livingston
David McCord
A.A. Milne
Laura Richards

Grades 5–8,
in addition to the grades K–4 selections

Traditional Literature	American Authors and Illustrators	British Authors and Illustrators	British and American Poets
Grimms' fairy tales	Louisa May Alcott	James Barrie	William Blake
French fairy tales	Lloyd Alexander	Lucy Boston	Lewis Carroll
Tales by Hans Christian Andersen and Rudyard Kipling	Isaac Asimov	Frances Hodgson Burnett	John Ciardi
Aesop's fables	Natalie Babbitt	Lewis Carroll	Rachel Field
Greek, Roman, or Norse myths	L. Frank Baum	Carlo Collodi	Robert Frost
Stories about King Arthur, Robin Hood, Beowulf and Grendel, St. George and the Dragon	Nathaniel Benchley	Daniel Defoe	Langston Hughes
	Ray Bradbury	Charles Dickens	Edward Lear
	Carol Ryrie Brink	Arthur Conan Doyle	Henry Wadsworth Longfellow
	Elizabeth Coatsworth	Leon Garfield	David McCord
Myths and legends of indigenous peoples of North, Central and South America	Esther Forbes	Kenneth Grahame	Ogden Nash
	Paula Fox	Rudyard Kipling	Richard Wilbur
American folktales and legends	Jean Craighead George	C. S. Lewis	
Asian and African folktales and legends	Virginia Hamilton	George MacDonald	
The Bible as literature:	Bret Harte	Edith Nesbit	
Old Testament: Genesis, Ten Commandments, Psalms and Proverbs	O. Henry	Mary Norton	
	Washington Irving	Philippa Pearce	
New Testament: Sermon on the Mount, Parables	Jack London	Arthur Rackham	
	L.M. Montgomery	Anna Sewell	
	Sterling North	William Shakespeare	
	Scott O'Dell	Isaac Bashevis Singer	
	Edgar Allan Poe	Johanna Spyri	
	Howard Pyle	Robert Louis Stevenson	
	Marjorie Kinnan Rawlings	Jonathan Swift	
	Elizabeth Speare	Rosemary Sutcliff	
	Booth Tarkington	J.R.R. Tolkien	
	James Thurber	T.H. White	
	Mark Twain		
	E. B. White		
	N. C. Wyeth		

Grades 9–12,
in addition to the grades 5–8 selections

Traditional Literature

A higher level re-reading of
- Greek mythology

Classical Greek drama:
- Aeschylus
- Sophocles
- Euripides

Substantial selections from epic poetry:
- Homer's *Odyssey* and *Iliad*
- Virgil's *Aeneid*

The Bible as literature:
- *Genesis*
- Ten Commandments
- Selected psalms and proverbs
- *Job*
- Sermon on the Mount
- Selected parables

American Literature:
Historical Documents of
Literary and Philosophical Significance

The Declaration of Independence (1776)
The United States Constitution (1787) and Bill of Rights (1791)
Selected Federalist Papers (1787-1788)
George Washington's Farewell Address (1796)
Selections from Alexis de Tocqueville, *Democracy in America*, volumes I and II (1835, 1839)
The Seneca Falls Declaration of Sentiments and Resolutions (1848)
Frederick Douglass, Independence Day speech (1852)
Abraham Lincoln: "House Divided" speech (1858), Gettysburg Address (1863), Second Inaugural Address (1865)
Theodore Roosevelt, "The New Nationalism" speech (1910)
Woodrow Wilson, "Peace without Victory" speech (1917)
Franklin Delano Roosevelt, "Four Freedoms" Speech (1941)
William Faulkner: Nobel Prize Lecture (1950)
John F. Kennedy's inaugural speech (1961)
Martin Luther King Jr.: "Letter from Birmingham City Jail" (1963), "I Have a Dream" (1963) speech
Lyndon Johnson, speech to Congress on voting rights (1965)

18th and 19th Century: American
Memoirs, Essays, Poetry, and Fiction

Memoirs
Frederick Douglass
Olaudah Equiano
Benjamin Franklin
Harriet Jacobs

Essays
Jonathan Edwards
Ralph Waldo Emerson
Thomas Jefferson
Thomas Paine
Henry David Thoreau
Mark Twain

Poetry
Emily Dickinson
Paul Laurence Dunbar
Henry Wadsworth Longfellow
Edgar Allan Poe
Phillis Wheatley
Walt Whitman

Fiction
James Fenimore Cooper
Stephen Crane
Nathaniel Hawthorne
Henry James
Herman Melville
Edgar Allan Poe

Grades 9–12,
in addition to the grades 5–8 selections

20th century to about 1970:
American Memoirs and Essays, Poetry, Fiction, and Drama

Memoirs and Essays

Henry Adams
James Baldwin
Ambrose Bierce
W. E. B. DuBois
Rachel Carson
John Gunther
John Hershey
Richard Hofstadter
Langston Hughes
Helen Keller
Martin Luther King, Jr.
H. L. Mencken
Eleanor Roosevelt
Franklin D. Roosevelt
Gertrude Stein
Robert Penn Warren
Booker T. Washington
E. B. White
Richard Wright
Malcolm X
Memoirs and other works about the immigrant experience (Abraham Cahan, Younghill Kang, Leo Rosten, Ole Rolvaag, Anzia Yezierska)

Poetry

Elizabeth Bishop
Countee Cullen
Arna Bontemps
E. E. Cummings
Richard Eberhart
Robert Frost
T. S. Eliot
Robinson Jeffers
Amy Lowell
Robert Lowell
Edgar Lee Masters
Edna St. Vincent Millay
Marianne Moore`
Sylvia Plath
Ezra Pound
John Crowe Ransom
Edward Arlington Robinson
Theodore Roethke
Wallace Stevens
Alan Tate
Sara Teasdale
William Carlos Williams

Fiction

James Agee
Ray Bradbury
Truman Capote
Willa Cather
Kate Chopin
Theodore Dreiser
Ralph Ellison
William Faulkner
Jessie Fauset
F. Scott Fitzgerald
Charlotte Gilman
Ernest Hemingway
O. Henry
Zora Neale Hurston
Sarah Orne Jewett
James Weldon Johnson
Harper Lee
Carson McCullers
Flannery O'Connor
Katherine Anne Porter
J. D. Salinger
William Saroyan
John Steinbeck
James Thurber
Jean Toomer
Robert Penn Warren
Edith Wharton
Thomas Wolfe

Drama

Maxwell Anderson
Lorraine Hansberry
Lillian Hellman
Jerome Lawrence and Robert E. Lee
Archibald MacLeish
Carson McCullers
Arthur Miller
Eugene O'Neill
William Saroyan
Robert Sherwood
Orson Welles
Thornton Wilder
Tennessee Williams

Grades 9–12,
in addition to the grades 5–8 selections

British and European Literature:
Essays, Poetry, and Drama

Essays

Joseph Addison
Sir Francis Bacon
Winston Churchill
Charles Darwin
Diderot and other Encyclopédistes
Mahatma Gandhi
Samuel Johnson in "The Rambler"
Arthur Koestler
Charles Lamb
C. S. Lewis
Michel de Montaigne
George Orwell
Jean Jacques Rousseau
John Ruskin
Jonathan Swift
Alexis de Tocqueville
Voltaire
Leonard Woolf
Emile Zola

Poetry

Selections from Chaucer's *Canterbury Tales*
Epic poetry:
Dante, John Milton
Sonnets:
William Shakespeare, John Milton
Edmund Spenser
Metaphysical poetry:
John Donne, George Herbert
Andrew Marvell
Romantic poetry:
William Blake
Lord Byron
Samuel Taylor Coleridge
John Keats
Percy Bysshe Shelley
William Wordsworth
Victorian poetry:
Matthew Arnold
Elizabeth Barrett Browning
Robert Browning
Dante Gabriel Rossetti
Alfred Lord Tennyson

Drama

Samuel Beckett
Robert Bolt
Bertolt Brecht
Calderón
Anton Chekhov
William Congreve
Carlo Goldoni
Henrik Ibsen
Molière
Sean O'Casey
Luigi Pirandello
Racine
Terrence Rattigan
William Shakespeare
Richard Brinsley Sheridan
John Millington Synge
George Bernard Shaw
Oscar Wilde

Grades 9–12,

in addition to the grades 5–8 selections

British and European Literature: Fiction

Selections from an early novel:
- Miguel de Cervantes' *Don Quixote*
- Henry Fielding's *Joseph Andrews*
- Oliver Goldsmith's *The Vicar of Wakefield*

Selections from John Bunyan's allegory, *Pilgrim's Progress*

Satire, or mock epic, verse or prose:
- Lord Byron
- Alexander Pope
- Jonathan Swift

19th Century

Jane Austen
Honoré de Balzac
Emily Bronte
Joseph Conrad
Charles Dickens
Fyodor Dostoevsky
George Eliot
Nikolai Gogol
Thomas Hardy
Victor Hugo
Mary Shelley
Leo Tolstoy
Ivan Turgenev
Emile Zola

20th Century

Albert Camus
Arthur Conan Doyle
André Gide
Graham Greene
James Joyce
Franz Kafka
D. H. Lawrence
W. Somerset Maugham
George Orwell
Marcel Proust
Jean Paul Sartre
Evelyn Waugh
Virginia Woolf

APPENDIX B: Indiana's Recommended Reading List
Suggested Contemporary Authors and Illustrators;
Suggested Authors in World Literature

All Indiana students should be familiar with American authors and illustrators of the present and those who established their reputations after the 1960s, as well as important writers from around the world, both historical and contemporary. Beginning in the last half of the 20th century, the publishing industry in the United States devoted increasing resources to children's and young adult literature created by writers and illustrators from a variety of backgrounds. Many newer anthologies and textbooks offer excellent selections of contemporary and world literature.

As they choose works for class reading or suggest books for independent reading, teachers should ensure that their students are both engaged and appropriately challenged by their selections. The following lists of suggested authors and illustrators are organized by grade clusters (pre-k–2, 3–4, 5–8, and 9–12), but these divisions are far from rigid, particularly for the elementary and middle grades. Many contemporary authors write stories, poetry, and nonfiction for very young children, for students in the middle grades, and for adults as well. As children become independent readers, they often are eager and ready to read authors that may be listed at a higher level.

The lists below are provided as a starting point; they are necessarily incomplete because excellent new writers appear every year. As all English teachers know, some authors have written many works, not all of which are of equally high quality. We expect teachers to use their literary judgment in selecting any particular work. It is hoped that teachers will find here many authors with whose works they are already familiar, and will be introduced to yet others.

Parents and teachers are also encouraged to select books from the following awards lists, past or present:

- The Newbery Medal
- The Caldecott Medal
- The ALA Notable Books
- The Sibert Medal (informational books)
- The Geisel Award (easy readers)
- The Pura Belpre Award (Latino experience)
- The Coretta Scott King Awards (African American experience)
- The Boston Globe-Horn Book Awards
- The Scott O'Dell Award for Historical Fiction (American)

See Appendix B of the *Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects* for additional suggestions.

Grades K–2

Folklore, Fiction, and Poetry

Jon Agee *(fiction, wordplay)*
Edward Ardizzone *(multi-genre, including picture books about Tim)*
Molly Bang *(folklore, easy readers)*
Jan Brett *(fiction: animals)*
Norman Bridwell *(fiction: Clifford)*
Raymond Briggs *(fiction: The Snowman)*
Marcia Brown *(multi-genre, including folklore)*
Anthony Brown *(fiction)*
Marc Brown *(fiction: Arthur)*
Ashley Bryan *(folktales: Africa, poetry)*
John Burningham *(realistic fiction, fantasy)*
Eric Carle *(fiction: animals – Very Hungry Caterpillar)*
Lucille Clifton *(poetry)*
Barbara Cooney *(multi-genre, including folklore: Miss Rumphius)*
Nina Crews *(fiction)*
Doreen Cronin *(fiction: humor)*
Tomie dePaola *(multi-genre, including folklore, family stories)*
Leo and Diane Dillon *(illustrators, folklore)*
Rebecca Kai Dotlich *(poetry)*
Douglas Florian *(poetry)*
Mem Fox *(fiction)*
Marla Frazee *(fiction)*
Don Freeman *(fiction: Corduroy)*
Mordecai Gerstein *(multi-genre)*
Bob Graham *(fiction)*
Eloise Greenfield (*multi-genre, including poetry)*
Mini Grey *(fiction)*
Kevin Henkes *(fiction, including the Lilly books)*
Russell and Lillian Hoban *(fiction: Frances)*
Mary Ann Hoberman *(poetry)*
Shirley Hughes *(realistic fiction: Alfie stories, Tales of Trotter Street)*
Trina Schart Hyman *(folklore, illustrator)*
Rachel Isadora *(folklore)*
G. Brian Karas *(multi-genre, illustrator)*
Ezra Jack Keats *(fiction)*
Holly Keller *(realistic fiction)*
Steven Kellogg *(fiction)*
Betsy Lewin *(fiction)*
Leo Lionni *(fiction: animal)*
Arnold Lobel *(fiction: animal)*
Gerald McDermott *(folklore)*
Patricia McKissack *(multi-genre, including multicultural folktales, realistic stories)*
Kate and Jim McMullan *(fiction; humor)*
James Marshall *(fiction, folktales, easy readers)*
Bill Martin Jr. *(fiction)*
Emily Arnold McCully *(multi-genre, including historical fiction)*
David McPhail *(fiction)*
Susan Meddaugh *(fiction, including Martha Speaks)*
Else Holmelund Minarik *(fiction, easy readers)*
Lynne Rae Perkins *(fiction, family stories)*
Jerry Pinkney *(multi-genre, including multicultural folklore)*
Patricia Polacco *(fiction, multicultural family stories)*
Chris Raschka *(fiction)*
Peggy Rathmann *(fiction: humor)*
Faith Ringgold *(fiction, including multicultural family stories)*
Glen Rounds *(fiction: West)*
Cynthia Rylant *(poetry, fiction, including easy readers: Henry and Mudge)*
Allen Say *(fiction, multicultural historical fiction)*
Alice Schertle *(poetry)*
Amy Schwartz *(fiction)*
Martha Sewall *(multi-genre, fiction)*
David Shannon *(fiction: the David books)*
Marjorie Sharmat *(fiction, easy readers: Nate the Great)*
Uri Shulevitz *(multi-genre, including folklore)*
Judy Sierra *(fiction, poetry, folktales)*
Marilyn Singer *(multi-genre, including poetry)*
Peter Sis *(fiction)*
William Steig *(fiction)*
John Steptoe *(fiction, including multicultural folklore and family stories)*
Tomi Ungerer *(fiction)*
Chris Van Allsburg *(fiction: fantasy)*
Jean van Leeuwen *(fiction, easy readers - Amanda Pig, others)*
Rosemary Wells *(fiction: Max, others)*
David Wiesner *(fiction)*
Mo Willems *(fiction, easy readers)*
Vera Williams *(fiction: realistic)*
Wong Herbert Yee *(fiction, easy readers)*
Jane Yolen *(multi-genre)*
Ed Young *(folktales)*
Paul Zelinsky *(multi-genre, including folklore and tall tales; illustrator)*
Margot and Harve Zemach *(folktales)*
Charlotte Zolotow *(realistic fiction)*

Grades K–2
Multi-Genre and Informational Texts

Aliki *(informational: science and history; concept books)*
Mitsumasa Anno *(multi-genre, including concept books and history)*
Jim Arnosky *(informational: science)*
Molly Bang *(multi-genre)*
Nic Bishop *(informational: science)*
Vicki Cobb *(informational: science)*
Joanna Cole *(informational: science – Magic Schoolbus)*
Floyd Cooper *(multi-genre, illustrator)*
Donald Crews *(multi-genre, including concept books, multicultural family stories)*
Ed Emberly *(multi-genre)*
Michael Emberly *(multi-genre)*
Brian Floca *(informational)*
Gail Gibbons *(informational: science and history)*
Eloise Greenfield *(multi-genre)*
Tana Hoban *(concept books; photography)*
Patricia McKissack *(informational)*
Margaret Miller *(concept books; photography)*
Kadir Nelson *(multi-genre, multicultural history and biography)*
Jerry Pinkney *(informational: Africa)*
James Ransome *(multi-genre, including multicultural history and biography)*
Anne Rockwell (*multi-genre, including concept books)*
Allen Say *(multi-genre)*
Laura Vaccaro Seeger *(concept books)*
Marcia Sewall *(informational: colonial America)*
Peter Sis *(multi-genre, including biography and history)*
Peter Spier *(informational: history)*

See the annual *Horn Book Guide* for ongoing additional selections

Grades 3–4,
in addition to the grades K–2 selections

Folklore, Fiction, and Poetry

Joan Aiken *(fiction: adventure/fantasy)*
Annie Barrows *(chapter books: Ivy and Bean)*
Judy Blume *(fiction: realistic)*
Joseph Bruchac *(fiction: historical)*
Ashley Bryan *(folktales, poetry)*
Betsy Byars *(fiction: realistic)*
Meg Cabot *(fiction: realistic -- Allie Finkle)*
Ann Cameron *(fiction: realistic -- the Julian books)*
Andrew Clements *(fiction:realistic)*
Eleanor Coerr *(fiction: historical)*
Roald Dahl *(fiction)*
Paula Danziger *(fiction: realistic*)
Kate DiCamillo *(fiction: realistic, fantasy, adventure)*
Louise Erdrich *(fiction/folktale)*
Walter Farley *(fiction: horses)*
John Fitzgerald *(fiction: historical - Great Brain)*
Sid Fleischman *(fiction: humor)*
Jean Fritz *(fiction: historical)*
John Reynolds Gardiner *(fiction: realistic)*
Kristine O'Connell George *(poetry)*
Patricia Reilly Giff *(fiction: realistic, historical)*
Paul Goble *(folktales: Native American)*
Stephanie Greene *(chapter books: realistic – Owen Foote, Sophie Hartley)*
Nikki Grimes *(fiction: realistic, multicultural)*
Jesse Haas *(fiction: realistic, horse stories)*
Charise Mericle Harper *(chapter books: Just Grace)*
Marguerite Henry *(fiction: horse stories)*
Betty Hicks *(chapter books: sports – Gym Shorts)*
Jennifer and Matt Holm *(chapter books: graphic novels –Baby Mouse)*
Kimberly Willis Holt *(chapter books: Piper Reed)*
Lee Bennet Hopkins *(poetry)*
Johanna Hurwitz *(multi-genre)*
X. J. Kennedy *(poetry)*
Jessica Scott Kerrin *(chapter books: Martin Bridge)*
Jeff Kinney *(fiction: realistic, cartoon)*
Kate Klise *(fiction: humor)*
Jane Langton *(fiction: fantasy)*
Julius Lester *(multi-genre, including multicultural folklore)*
Grace Lin *(fiction/fantasy: realistic, multicultural)*
Lenore Look (*chapter books, multicultural)*
Patricia MacLachlan *(fiction: historical)*
Ann Martin *(fiction: realistic, fantasy – Doll People)*
Megan McDonald *(chapter books: Judy Moody)*
Claudia Mills *(fiction: realistic, easy readers, chapter books – Gus)*
Barbara O'Connor *(fiction: realistic –Southern humor)*
Sarah Pennypacker *(chapter books: Clementine)*
Daniel Pinkwater *(fiction: humor)*
Jack Prelutsky *(poetry: humor)*
Ken Roberts *(fiction: realistic, humor)*
Louis Sachar *(fiction: humor)*
Alvin Schwartz *(short stories: suspense, horror)*
John Scieszka *(fiction: humor, adventure)*
Brian Selznick *(fiction)*
Barbara Seuling *(chapter books: Robert)*
Joyce Sidman *(poetry)*
Shel Silverstein *(poetry)*
Isaac Bashevis Singer *(fiction/folktale)*
Mildred Taylor *(fiction: historical)*
Carol Boston Weatherford *(fiction: historical, multicultural)*
Gloria Whelan *(fiction: historical)*
Janet Wong *(poetry)*
Lisa Yee *(chapter books)*

Multi-Genre and Informational Texts

Raymond Bial *(informational: historical photo-essays)*
Don Brown *(informational: biography, history)*
Candace Fleming *(biography)*
Jean Fritz *(nonfiction: autobiography)*
Deborah Hopkinson *(informational: history)*
Steve Jenkins *(informational: science)*
Peg Kehret *(multi-genre)*
Barbara Kerley *(informational: biography)*
Kathleen Krull *(informational: biography)*
Patricia Lauber *(informational: science, social studies)*
David Macaulay *(informational: social studies, science)*
Sandra Markle (*informational: science)*
Joyce Sidman *(informational: natural world)*
Seymour Simon *(informational: science))*
Diane Stanley *(informational: history)*

See the annual *Horn Book Guide* for ongoing additional selections

Grades 5–8,
in addition to the grades K–4 selections
Fiction and Poetry

David Almond *(fantasy, fiction: realistic)*
Laurie Halse Anderson *(fiction: historical)*
M. T. Anderson *(fiction: historical, humor)*
Avi *(fiction: historical)*
Joan Bauer *(fiction: realistic)*
Jean P. Birdsall *(fiction: realistic)*
Nancy Bond *(fantasy)*
Bruce Brooks *(fiction: realistic)*
Gennifer Choldenko *(mysteries)*
John Christopher *(science fiction)*
James and Christopher Collier *(fiction: historical)*
Suzanne Collins *(fantasy, science fiction)*
Susan Cooper *(fantasy)*
Eoin Colfer *(fantasy, science fiction)*
Leslie Connor *(fiction: realistic)*
Frank Boyce Cottrell *(fiction: humor)*
Bruce Coville *(fantasy)*
Sharon Creech *(fiction: realistic)*
Christopher Paul Curtis *(fiction: historical)*
Karen Cushman *(fiction: historical)*
Cynthia DeFelice *(fiction: historical, mysteries)*
Frances O'Roark Dowell *(fiction: realistic)*
Jeanne DuPrau *(science fiction)*
Marguerite Engle *(fiction: historical, poetry)*
Louise Erdrich *(fiction: historical)*
Nancy Farmer *(fantasy)*
Louise Fitzhugh *(fiction: realistic)*
Paul Fleischman *(poetry, fiction: realistic)*
Neil Gaiman *(fantasy)*
Jack Gantos *(fiction: humor)*
Bette Greene *(fiction: historical)*
Rosa Guy *(fiction: realistic)*
Mary Downing Hahn *(ghost stories, fiction: historical)*
Shannon Hale *(fantasy, fiction: historical)*
Karen Hesse *(fiction: historical)*
Carl Hiassen *(fiction: humor, mysteries)*
S. E. Hinton *(fiction: realistic)*
Will Hobbs *(fiction: realistic)*
Irene Hunt *(fiction: historical)*
Eva Ibbotson *(fantasy)*
Paul Janeczko *(poetry)*
Angela Johnson *(fiction: realistic)*
Diana Wynne Jones *(fantasy)*
Norton Juster *(fantasy)*
Ellen Klages *(fiction: historical)*
Ron Koertge *(fiction: humor, poetry)*
E.L. Konigsburg *(fiction: realistic)*
Iain Lawrence *(fiction: historical)*
Madeleine L'Engle *(fantasy, fiction: realistic)*
Ursula LeGuin *(fantasy)*
Gail Carson Levine *(fiction: realistic, fantasy)*
Robert Lipsyte *(fiction: realistic)*
Lois Lowry *(fiction: realistic, science fiction)*
Mike Lupica *(mysteries, fiction: sports)*
Hilary McKay *(fiction: humor)*
Robin McKinley *(fantasy)*
Margaret Mahy *(fantasy, fiction: realistic)*
Walter Dean Myers *(fiction: historical, realistic)*
Donna Jo Napoli *(fiction: historical, fantasy)*
Marilyn Nelson *(poetry)*
Naomi Shihab Nye *(poetry)*
Kenneth Oppel *(fantasy, adventure)*
Linda Sue Park *(fiction: historical, realistic)*
Katherine Paterson *(fiction: historical, realistic)*
Sue Patron *(fiction: realistic)*
Gary Paulsen *(fiction: humor, historical, realistic)*
Richard Peck *(fiction: historical, realistic)*
Mitali Perkins *(fiction: realistic)*
Daniel Pinkwater *(fiction: humor)*
Terry Pratchett *(fantasy)*
Philip Pullman (*fantasy)*
Philip Reeve *(fantasy)*
Rick Riordan *(fantasy)*
J. K. Rowling *(fantasy)*
Pam Munoz Ryan *(fiction: historical, realistic)*
Cynthia Rylant *(poetry, fiction: realistic)*
Louis Sachar *(fiction: realistic)*
William Sleator *(ghost stories, science fiction)*
Gary Soto *(fiction: realistic, poetry)*
Suzanne Fisher Staples *(fiction: historical, realistic)*
Rebecca Stead *(science fiction)*
Jonathan Stroud *(fantasy)*
Theodore Taylor *(fiction: historical)*
Kate Thompson *(fantasy)*
Megan Whalen Turner *(fantasy)*
Cynthia Voigt *(fiction: realistic, fantasy)*
Rita Williams-Garcia *(fiction: historical, realistic)*
Jacqueline Wilson *(fiction: realistic)*
Jacqueline Woodson *(fiction: realistic)*
Tim Wynne-Jones *(fiction: realistic)*
Laurence Yep *(fiction: historical, fantasy)*

Grades 5–8,
in addition to the grades pre-k–4 selections

Informational Texts

Susan Campbell Bartoletti *(history)*
Russell Freedman *(biography, history)*
James Cross Giblin *(biography, history)*
Jan Greenberg and Sandra Jordan *(art history)*
Deborah Heiligman *(history)*
Kathryn Lasky *(multi-genre)*
Philp Hoose *(biography, history)*
Albert Marrin *(biography, history)*
Milton Meltzer *(history, biography)*
Jim Murphy *(history)*
Elizabeth Partridge *(biography, history)*
Steve Sheinkin *(biography, history)*
Tanya Lee Stone *(biography, history)*

See the annual *Horn Book Guide* for ongoing additional selections

Grades 9–12,
in addition to the grades 5–8 selections

Fiction

Maya Angelou
Saul Bellow
Pearl Buck
Hortense Calisher
John Cheever
Sandra Cisneros
Michael Chabon
Arthur C. Clarke
Junot Diaz
E. L. Doctorow
Anthony Doerr
Andre Dubus
Louise Erdrich
Richard Ford
Jonathan Franzen
Charles Frazier
Nicholas Gage
Ernest K. Gaines
Alex Haley
Joseph Heller
Oscar Hijuelos
William Hoffman
John Irving
Edward P. Jones
Garrison Keillor
William Kennedy
Ken Kesey
Jamaica Kincaid
Barbara Kingsolver
Maxine Hong Kingston
Jon Krakauer
Jhumpa Lahiri
Cormac McCarthy
Bernard Malamud
Larry McMurtry
Toni Morrison
Joyce Carol Oates
Tim O'Brien
Edwin O'Connor
Cynthia Ozick
Ann Patchet
Chaim Potok
Reynolds Price
E. Annie Proulx
Thomas Pynchon
Marilynne Robinson
Richard Rodriguez
Philip Roth
Richard Russo
May Sarton
Michael Shaara
Jane Smiley
Betty Smith
Wallace Stegner
Amy Tan
John Kennedy Toole
Anne Tyler
John Updike
Kurt Vonnegut, Jr.
Alice Walker
Eudora Welty
Colson Whitehead

Poetry and Drama

Poetry

Claribel Alegria
Sherman Alexie
Julia Alvarez
A. R. Ammons
Maya Angelou
John Ashberry
Jimmy Santiago Baca
Amirai Baraka
Elizabeth Bishop
Robert Bly
Louise Bogan
Arna Bontemps
Gwendolyn Brooks
Hayden Carruth
Marilyn Chin
Billy Collins
J. V. Cunningham
Rita Dove
Alan Dugan
Martin Espada
Allen Ginsberg
Louise Gluck
John Haines
Donald Hall
Robert Hayden
Anthony Hecht
Randall Jarrell
June Jordan
Galway Kinnell
Stanley Kunitz
Audrey Lord
Louis MacNeice
James Merrill
Mary Tall Mountain
Mary Oliver
Sylvia Plath
Anna Quindlen
Ishmael Reed
Adrienne Rich

Drama

Edward Albee
Christopher Durang
John Guare
David Henry Hwang
Tracy Letts
Terrance MacNally
David Mamet
Marsha Norman
Lynn Nottage
Sarah Ruhl
Ntozake Shange
John Patrick Shanley
Sam Shepard
Neil Simon
Anna Deveare Smith
Paula Vogel
August Wilson

Tobias Wolff Philip Levine

Grades 9–12,
in addition to the grades 5–8 selections
Essays and Informational Text

Akhil Reed Amar *(government, history)*
Edward Abbey *(essays, the environment)*
Bernard Bailyn *(history)*
Russell Baker *(journalism, essays)*
Rick Bass *(science)*
Carol Bly *(essays)*
Daniel Boorstin *(history)*
Dee Brown *(history)*
Art Buchwald *(journalism, essays)*
William F. Buckley *(journalism, essays)*
James Carroll *(essays, history, religion in society)*
Margaret Cheney *(biography)*
Robert Coles *(essays, criticism)*
Alistair Cooke *(journalism)*
Stanley Crouch *(journalism, music criticism)*
Jared Diamond *(history)*
Joan Didion *(essays)*
Annie Dillard (*essays, nature)*
Barbara Ehrenreich *(social science, cultural criticism)*
Gretel Ehrlich (science, travel)
Loren Eiseley *(anthropology, nature)*
Joseph Ellis *(history)*
Barbara Fields *(history)*
David Hackett Fischer *(history and economics)*
Frances Fitzgerald *(journalism, history)*
Eric Foner *(history)*
Thomas Friedman *(economics)*
Henry Louis Gates, Jr. *(history)*
Atul Gawande (science)
Malcolm Gladwell *(technology, social change)*
Joy Hakim *(history, history of science)*
David Halberstam *(history)*
Bernd Heinrich *(science, New England)*
Edward Hoagland *(science, travel)*
James O. Horton *(history)*
Sue Hubbell *(science)*
Michael Kammen *(history)*
Tracy Kidder *(social change, travel, New England)*
Elizabeth Kolbert *(science)*
Paul Krugman *(economics)*
Mark Kurlansky *(history)*
Jane Jacobs *(architecture, cities)*
Jill Lepore *(history)*
William Least Heat-Moon *(travel)*
Barry Lopez *(science)*
J. Anthony Lukas *(journalism, history)*
Matthys Levy *(science)*
Pauline Maier *(history)*
Norman Mailer *(essays, journalism)*
William Manchester *(history)*
Howard Mansfield *(history, preservation, New England)*
Mary McCarthy *(essays, criticism)*
Edward McClanahan *(essays)*
David McCullough *(history, biography)*
John McPhee *(science)*
John Hanson Mitchell *(nature, history, New England)*
N. Scott Momaday *(memoir)*
Samuel Eliot Morison *(history)*
Lance Morrow *(journalism, essays)*
Bill Moyers *(journalism, essays)*
Anna Quindlen *(journalism, essays)*
Chet Raymo *(science)*
Matt Ridley *(science)*
Richard Rodriguez *(essays, memoir)*
Oliver Sacks *(science)*
Carl Sagan *(science)*
Simon Schama *(history)*
William Shirer *(history)*
Dava Sobel *(science)*
Shelby Steele *(history)*
Alan Taylor *(history)*
Studs Terkel *(journalism, sociology)*
Paul Theroux *(travel)*
Lewis Thomas *(science)*
Hunter S. Thompson *(cultural criticism)*
James Trefil *(science)*
Barbara Tuchman *(history)*
Laurel Thatcher Ulrich *(history)*
Jonathan Weiner *(science)*
Cornell West *(cultural criticism)*
Walter Muir Whitehill *(history)*
Gary Wills *(history)*
E. O. Wilson *(science)*
Tom Wolfe (essays)
Gordon Wood *(history)*
James Wood *(literary criticism)*
Malcolm X *(essays, cultural criticism)*
Barry Zimmerman & David Zimmerman *(science)*
Howard Zinn *(history)*

Jane Goodall *(science)*
Doris Kearns Goodwin *(history)*
Adam Gopnik *(essays, criticiam, travel, art)*
Stephen Jay Gould *(science)*
Stephen Greenblatt *(literary criticism)*

Mary Beth Norton *(history)*
Henry Petroski *(science and technical subjects)*
Nathaniel Philbrick *(history)*
Michael Pollan *(science)*
Stephen Pinker *(science)*

Yearly compilations of science and nature writings:
Best American Science Writing
American Science and Nature Writing

Grades 9–12,
in addition to the grades 5–8 selections
Contemporary and Historical World Literature
Fiction

Chinua Achebe
S. Y. Agnon
Ilse Aichinger
Isabel Allende
Kingsley Amis
Jerzy Andrzejewski
Nadeem Aslam
Margaret Atwood
Isaac Babel
John Banville
Julian Barnes
James Berry
Heinrich Boll
Jorge Luis Borges
Mikhail Bulgakov
Dino Buzzati
A. S. Byatt
Italo Calvino
Karl Capek
Peter Carey
Carlo Cassola
Camillo Jose Cela
J.M. Coetzee
Julio Cortazar
Anita Desai
Isak Dinesen
Roddy Doyle
Margaret Drabble
E. M. Forster
Gabriel Garcia Marquez
William Golding
Nadine Gordimer
Robert Graves
Hermann Hesse
Wolfgang Hildesheimer
Aldous Huxley
Kazuo Ishiguro
Ha Jin
Yuri Kazakov
Thomas Kenneally
Milan Kundera
Chang-Rae Lee
Stanislaw Lem
Primo Levi
Jacov Lind
Clarice Lispector
Ian McEwan
Naguib Mahfouz
Thomas Mann
Jan Martel
Alberto Moravia
John Mortimer
Alice Munro
Iris Murdoch
Vladimir Nabokov
V. S. Naipaul
Ben Okri
Michael Ondaatje
Alan Paton
Orhan Pamuk
Cesar Pavese
Santha Rama Rau
Mordechai Richler
Rainer Maria Rilke
Arundhati Roy
Salman Rushdie
Jose Saramago
Ignazio Silone
Isaac Bashevis Singer
Alexander Solshenitsyn
Graham Swift
Niccolo Tucci
Mario Vargas-Llosa
Elie Wiesel

Grades 9–12,
in addition to the grades 5–8 selections

Contemporary and Historical World Literature

Poetry

Bella Akhmadulina
Anna Akhmatova
Rafael Alberti
Josif Brodsky
Constantine Cavafis
Odysseus Elytis
Federico García Lorca
Seamus Heaney
Ted Hughes
Czeslaw Milosz
Gabriela Mistral
Pablo Neruda
Octavio Paz
Jacques Prévert
Alexander Pushkin
Salvatore Quasimodo
Juan Ramon Ramirez
Arthur Rimbaud
Pierre de Ronsard
George Seferis
Léopold Sédar Senghor
Wole Soyinka
Marina Tsvetaeva
Paul Verlaine
Andrei Voznesensky
Derek Walcott
Yevgeny Yevtushenko

Drama

Alan Ayckbourn
Jean Anouilh
Fernando Arrabal
Jean Cocteau
Brian Friel
Athol Fugard
Jean Giraudoux
Eugene Ionesco
John Mortimer
John Osborne
Harold Pinter
Jean Paul Sartre
Peter Shaffer
Tom Stoppard

Essays/Nonfiction

Julian Bell *(art history)*
E. H. Gombrich *(art history)*
Steven Hawking *(science)*
Margaret Laurence *(essays)*
Shiva Naipaul *(essays)*
Octavio Paz *(essays)*
Rebecca West *(essays)*
Simon Winchester *(science, history)*
Marguerite Yourcenar *(essays)*

Texts from World Religions

Analects of Confucius
Bhagavad-Gita
The Bible
The Koran
Book of the Hopi
Tao Te Ching
Buddhist texts
Zen Buddhist parables

Common Core State Standards Initiative. http://www.corestandards.org/the-standards

Indiana Documents

Indiana Academic Standards for English Language Arts (2006,2008). Indianapolis, IN: Indiana Department of Education: Author.

Indiana Academic Standards for Mathematics (2000, 2008, 2009). Indianapolis, IN: Indiana Department of Education: Author.

Massachusetts Documents

Massachusetts English Arts Curriculum Framework (2011). Malden, MA: Massachusetts Department of Elementary and Secondary Education: Author.

Massachusetts Mathematics Curriculum Framework (2011). Malden, MA: Massachusetts Department of Elementary and Secondary Education: Author.

Texas Documents

Texas Administrative Code (TAC), Title 19, Part II, Chapter 110. Texas Essential Knowledge and Skills for English Language Arts and Reading (2009). Austin, TX: Texas Education Agency: Author.

Texas Administrative Code (TAC), Title 19, Part II, Chapter 111. Texas Essential Knowledge and Skills for Mathematics (2012). Austin, TX: Texas Education Agency: Author.

Virginia Documents

English Standards of Learning Framework (2010). Richmond, VA: Virginia Department of Education: Author.

Mathematics Standards of Learning Framework (2010). Richmond, VA: Virginia Department of Education: Author.

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Review of Indiana Draft English Language Arts Standards
February 27, 2014
Kathleen Porter-Magee

On February 18, the Indiana Department of Education released the first public draft of a set of new K–12 expectations for English Language Arts and math. The proposed changes take place against the backdrop of a rollercoaster debate about the Common Core State Standards (CCSS) that has seen numerous ups and downs since the state first adopted the CCSS back in August 2010. This contentious debate culminated in passage of legislation in April 2013 that paused CCSS implementation and charged the state Board of Education with adopting new college- and career-readiness standards.

State officials hope these new standards will accomplish two things: build on the best of both the Common Core and of the state's previous (highly regarded) ELA and math standards and put to rest the heated and polarizing debate over the Common Core.

It's perfectly fine, and has been since the outset, for states to adapt, modify, and add to the Common Core in order to address singular interests, needs, or enthusiasms of their residents, leaders, and educators. The test is whether such changes yield improvements on the one hand without diluting the very considerable gains that the Common Core itself made over the status quo across most of the U.S.

In this post, I take a close look at the proposed ELA to understand how they stack up against the Common Core and the Indiana standards that came before them.

The short answer: not well at all. Both the previous Indiana standards for English language arts and the Common Core literacy standards were among the best in the nation. Both were clear, and both provided explicit guidance about what students should know and be able to do, as well as the kinds of texts they should read at each grade level to build vocabulary and knowledge from grade to grade. In principle, it should be possible to build on the manifest strengths of both documents and develop a set of K–12 expectations that are second to none. Unfortunately, the recently released public draft reveals ELA standards that are less specific, less coherent, and harder to navigate than either Indiana's previous standards or the Common Core. The public draft fails even to address some of most vocal criticisms of the CCSS literacy standards. Cursive writing is still missing from the latest draft, for instance. And nowhere does the Board of Education emphasize the importance of focusing on literature and literary texts in English classrooms.

If drafting an exemplary set of college- and career-ready standards for literacy was the goal, the Indiana Department of Education has fallen well short of its mark.

Overview

The public draft is presented straightforwardly and follows roughly the same format as the Common Core. The standards are presented for each grade level, Kindergarten through grade 12, and organized by strand (reading, literature, information, writing, etc.).

The biggest difference in organization between the CCSS and the Indiana draft standards is that the former outlines ten college- and career-ready "anchor standards" for each strand (ten for reading literature, ten for informational reading, ten for writing, and on). These describe what a college- and career-ready student would know and be able to do upon graduation from high school. Then, for each grade, there are ten grade-specific standards provided for each strand. (So there are ten first grade writing standards, ten second grade writing standards, and on.) The grade-specific standards build logically from grade to grade, showing how knowledge and skills build over time towards the college- and career-ready anchor standard.

For instance, the college- and career-ready "anchor" standard 9 asks students to

> Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. *(Common Core, Reading Standards for Literature, Anchor Standard 9).*

The grade-specific standards that build towards this college- and career-ready goal for grades 3, 6, and 9 ask students to

> Compare and contrast the themes, settings, and plots of stories written by the same author about the same or similar characters. (e.g., in books from a series) *(Common Core, Reading Standards for Literature, Standard 9, grade 3)*
>
> Compare and contrast texts 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. *(Common Core, Reading Standards for Literature, Standard 9, Grade 6)*
>
> Analyze how an author draws on and transforms source material in a specific work (e.g., how Shakespeare treats a theme or topic from Ovid or the Bible or how a later author draws on a play by Shakespeare). *(Common Core, Reading Standards for Literature, Standard 9, Grades 9–10)*

The alignment between the anchor standards and the grade-specific expectations in the CCSS make the document easy to read and navigate, particularly for teachers looking to track how knowledge and skills build over time.

The Indiana public draft has abandoned this structure completely. There are no college- and career-ready "anchor standards," and there is no consistency in how expectations are organized and presented from grade to grade within each strand.

Worse, the Indiana draft standards have eliminated all of the introductory and supporting material that was provided in the Common Core. These omissions are a significant loss, because it was the introduction that made clear, for instance, that literature, rather than informational texts, should dominate study in English class (page 5). And it was the introduction that called specifically for a "content-rich curriculum" (page 6). Also missing is the guidance from page 33 of the CCSS, which emphasized the importance of text selection and the coherent sequencing of texts to build knowledge and vocabulary within and across grades. Absent these linkages,

Indiana schools risk a continued narrowing of the curriculum, away from important subjects like science, history, and art in favor of literacy blocks that focus near-exclusively on skills, a tacit but enormously consequential emphasis shift that could—and in many places does—lead to English classes that rely on "manufactured texts" rather than great literature and seminal documents.

Diminished clarity and specificity

Many of the grade-specific literacy expectations were copied verbatim—or near verbatim—from the CCSS to the Indiana draft ELA standards. Occasionally, however, expectations have been modified or changed, sometimes in ways that compromise the clarity and specificity—and perhaps even the rigor—of the standard. Take, for example, the following fourth-grade Common Core standard:

> Determine the meaning of words and phrases as they are used in a text, including those that allude to significant characters found in mythology (e.g., Herculean). (*Common Core, Literature, grade 4)*

In Indiana, the standard has been edited and merely asks students to

> Determine the meaning of words and phrases as they are used in a text. (*Indiana, grade 4)*

With this change, a skill that may look the same loses the content link that would help students become truly literate, in this case by knowing something about significant figures from classical mythology.

In writing, the CCSS asks second graders to

> Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). *(Common Core, Writing Standards, Grade 2)*

Indiana has dropped the parenthetical and merely asks students to "participate in shared research and writing projects." In such examples, it seems clear that in striving to avoid being overly prescriptive, the authors have lost an opportunity to provide useful—and wholly optional—guidance to teachers and curriculum developers.

Similar examples can be found throughout. The consequence is a series of expectations that are less specific than either the CCSS or the Indiana standards that preceded them.

College- and career-readiness at risk

While no standards are perfect, two critical elements of the Common Core literacy standards make them game changers.

First, the standards recognize that *what* students read is as important as what they do with what they read. And to that end, they put a clear emphasis on the quality and complexity of the literary and nonliterary texts that students will read in class. Second, the Common Core make explicit the link between building content knowledge and vocabulary and improving reading comprehension.

The Indiana draft ELA standards have eliminated both of these fundamentals and, in so doing so, have seriously compromised the college- and career-readiness of the standards articulated in the document.

Text quality and complexity

While the Indiana draft standards retain an occasional reference to the importance of text quality and complexity, they have removed the clear and specific text-selection guidance included in the CCSS. This rejection of the centrality of text selection to literacy instruction is evident in three ways.

First, the expectation that students read grade-appropriate literary and nonliterary texts is often vague. In grades 2 and 3, for instance, students are asked to read "appropriately complex" literary and informational texts—a vague and insufficient reference to the importance of reading texts that are appropriately complex *for the grade*. By contrast, in grades 4 and 5, students are asked only to engage with "increasingly complex" texts—a distinction that suggests that as long as students are progressing and reading more difficult books over the course of the year, it matters little whether those texts are considered "grade-level" texts.

Then, in grades 6 through 12, the language shifts again, and students are asked read literary and nonliterary texts that fall within the appropriate "complexity band," a phrase borrowed directly from the CCSS.

Unfortunately, at no level does Indiana provide any guidance about what it means to select texts that are "appropriately complex," and nowhere do the standards help teachers determine which texts fall within the grade-level "complexity band." In short, by borrowing the phrase without the related guidance about how to judge the quality and complexity of literary and informational texts, the standards meant to guide text selection are rendered virtually meaningless.

The absence of any guidance about what texts might meet the content and rigor demands of the standards is curious considering that, even before the CCSS, Indiana provided explicit text-selection guidance. The Common Core includes both a list of exemplar texts *and* explicit guidance about how to judge text complexity, and the previous Hoosier state ELA standards included a list of exemplar texts that was even more comprehensive than the CCSS exemplar-text list. Given the importance of giving students regular practice with suitably challenging literary and nonliterary texts across all grades, this omission seriously compromises the college- and career-readiness of the Indiana expectations, as well as graduates' readiness to participate in full in the nation's public life and culture.

Worse still, the Indiana draft standards go on to remove *any* required reading from the expectations. The Common Core explicitly requires students to read a Shakespearean play, the

Declaration of Independence, the Bill of Rights, the Preamble to the Constitution, and Lincoln's Second Inaugural Address. These are essential foundational works in American history and literature that have been stripped from the Indiana draft ELA standard—a sad thing indeed.

Content knowledge and comprehension

In August 2010, at the same time the Indiana Board of Education was considering adopting the Common Core, one of the most respected educators and thinkers of our time, E.D. Hirsch, penned a letter urging Common Core adoption. Hirsch explained,

> I support [the Common Core] because more than merely unifying the current patchwork of expectations among the states the Common Core Standards represent new approaches to language arts based on the deepest results of research in cognitive science. The new standards recognize that verbal achievement is based on general knowledge, and that instruction in language arts must cover all key academic domains, and be integrated with a content-rich curriculum.

Two years later, Robert Pondiscio, then–Vice President of the Core Knowledge Foundation, argued in a debate at the Pioneer Institute that the Common Core included the "57 most important words in education reform. Ever." They are as follows:

> "By reading texts in history/social studies, science, and other disciplines, students build a foundation of knowledge in these fields that will also give them the background to be better readers in all content areas. Students can only gain this foundation when the curriculum is intentionally and coherently structured to develop rich content knowledge within and across grades."

Pondiscio went on to say,

> Every teacher in elementary school in the land must understand that without imparting a coherent, knowledge-rich, language-rich ELA curriculum…most of our children will not meet any meaningful standard….I will not give up these 57 words. The foundation on which American education rests must be intentional and coherent. It must be not just literature rich but knowledge rich and language rich.

Unfortunately, like the references to Shakespeare and America's Founding Documents, these 57 words have been stripped from the Indiana draft ELA standards. So has the explicit call for a content-rich curriculum, as well as the guidance about how teachers can build knowledge and vocabulary through curriculum and thoughtful text sequencing. In short, the heart of the Common Core literacy standards—the elements that earned the support of education leaders like Hirsch—have been gutted from the latest Indiana draft.

Because of Indiana's long history of setting clear and rigorous standards for English language arts, arguably no state was better positioned to customize the CCSS in a way that made the expectations even stronger than the Core. And yet—remarkably and inexplicably—Indiana state

officials have managed to do the opposite: draft ELA standards that are worse than either of the documents they hope to replace.