This Teacher Resource Guide, revised in July 2018, provides supporting materials to help educators successfully implement the Indiana Academic Standards for Eighth Grade. This resource guide is provided to help ensure all students meet the rigorous learning expectations set by the academic standards. Use of this guide and the resources on the web page is optional – teachers should decide which resources will work best for their students. However, all guidance contained in this document and on the website has been chosen to best support effective teaching practices and promote the Mathematics Process Standards.

With an increased emphasis on content area literacy, academic vocabulary has been noted. Additionally, necessary vocabulary that should be prior knowledge has also been listed. Best practices should be utilized when teaching students academic vocabulary. Please see the Literacy Framework for examples of best practices.

Examples have been removed from the document as they tend to limit interpretation and classroom application. Rather, success criteria, in the form of "I can" statements, have been included. According to Hattie (2017), success criteria is specific, concrete and measurable, describing what success looks like when a learning goal is reached. Additionally, success criteria contributes to teacher clarity, which has a 0.75 effect size! An effect size of 0.40 reportedly indicates one year of growth. Utilizing success criteria in the classroom allows students to monitor their own learning and increases motivation (Hattie, p. 57). **It is important to note that the success criteria provided here are not intended to be limiting. Teachers may have additional success criteria for their students.**

Guidance around vertical articulation has been provided in the last two columns. Knowing what was expected of students at previous grade levels will help teachers connect new learning to prior knowledge. Additionally, understanding what a student will be expected to learn in the future provides the teacher a context for the current learning. This information is not exhaustive; rather it is provided to give teachers a quick understanding of how the work builds from previous grade levels into subsequent courses. The Indiana Department of Education (IDOE) math team recommends teachers further study this vertical articulation to situate their course objectives in the broader math context.

If you have any questions, please do not hesitate to reach out to the IDOE math team. Contact information for the Elementary and Secondary Math Specialists can be found on the website: https://www.doe.in.gov/standards/mathematics. If you have suggested resources for the website, please share those as well.

Hattie, J., Fisher, D., Frey, N., Gojak, L. M., Moore, S. D., & Mellman, W. (2017). *Visible learning for mathematics: What works best to optimize student learning, grades K-12*. Thousand Oaks, CA: Corwin Mathematics.

Number Sense					
Grade 8 Mathematics Standards		**Success Criteria**	**Academic Vocabulary**	**Looking Back**	**Looking Ahead**
MA.8.NS.1:	Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal expansion; for rational numbers, show that the decimal expansion repeats eventually, and convert a decimal expansion that repeats into a rational number.	I can classify rational and irrational numbers. I can show that every number has a decimal expansion. I can show that the decimal expansion eventually repeats for rational numbers. I can change every repeating decimal into a rational number.	Rational number Irrational number	Understand that positive and negative numbers are used to describe quantities having opposite directions or values. (MA.6.NS.1) Compare and order rational numbers and plot them on a number line. (MA.6.NS.3) Know there are rational and irrational numbers. (MA.7.NS.3)	Understand the hierarchy and relationships of numbers within the real number system. (MA.AI.RNE.1)
MA.8.NS.2:	Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers.	I can estimate irrational numbers with rational approximations. I can use estimate values to compare two or more irrational numbers. I can plot irrational numbers on a number line using rational approximations.	Rational number Irrational number	Compare and order rational numbers and plot them on a number line. (MA.6.NS.3) Find square roots of perfect squares. (MA.7.NS.2) Know there are rational and irrational numbers. (MA.7.NS.3)	Give examples of rational and irrational numbers. (MA.8.NS.1) Understand the relationships of numbers and sets of numbers within the real number system. (MA.AI.RNE.1)

		I can estimate the value of expressions that use irrational numbers.			
MA.8.NS.3:	Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions.	I can apply the product of powers property to simplify expressions with integer exponents. I can apply the power of a product property to simplify expressions with integer exponents. I can apply the power to a power rule to simplify expressions with integer exponents. I can apply the quotient of powers to simplify expressions with integer exponents. I can apply the negative exponent rule to simplify expressions with integer exponents. I can apply the zero-exponent rule to simplify expressions with integer exponents. I can use the properties of integer exponents to simplify expressions.	Rational number Integer Properties of exponents Equivalent expressions	Identify and explain prime and composite numbers. (MA.6.NS.6) Find the prime factorization of whole numbers and write the results using exponents. (MA.7.NS.1)	Rewrite and evaluate numeric expressions with positive rational exponents using the properties of exponents. (MA.AI.RNE.3) Simplify algebraic rational expressions, with numerators and denominators containing monomial bases with integer exponents. (MA.AI.RNE.5)

		I can identify equivalent expressions. I can generate equivalent expressions using the properties of exponents.			
MA.8.NS.4:	Use square root symbols to represent solutions to equations of the form x^2 = p, where p is a positive rational number.	I can use square root symbols to represent the solutions to quadratic equations. I can evaluate the square root of a perfect square. I can estimate the square root of non-perfect squares.	Square root Rational number	Understand the inverse relationship between squaring and finding the square root of a perfect square integer. (MA.7.NS.2)	Solve quadratic equations in one variable by finding square roots. (MA.AI.QE.4)

Computation					
Grade 8 Mathematics Standards		**Success Criteria**	**Academic Vocabulary**	**Looking Back**	**Looking Ahead**
MA.8.C.1:	Solve real-world problems with rational numbers by using multiple operations.	I can solve real-world problems by adding, subtracting, multiplying, and dividing rational numbers.	Rational numbers	Solve real world problems with positive fractions and decimals by using one or two operations. (MA.6.C.3)	**Students are expected to build upon and continue applying concepts learned previously.**

				Use proportional relationships to solve ratio and percent problems with multiple operations. (MA.7.C.6) Solve real-world problems with rational numbers by using one or two operations. (MA.7.C.8)	
MA.8.C.2:	Solve real-world and other mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as a scientific calculator, graphing calculator, or excel spreadsheet.	I can write an estimation of a large quantity by expressing it as the product of a single-digit number and a positive power of ten. I can write an estimation of a very small quantity by expressing it as the product of a single-digit number and a negative power of ten. I can compare quantities written in scientific notation. I can compute with two numbers expressed in scientific notation. I can interpret scientific notation that has been generated by technology.	Scientific notation	Evaluate positive rational number with whole number exponents. (MA.6.C.5) Apply the order of operations and properties of operations to evaluate numerical expressions with nonnegative rational numbers. (MA.6.C.6)	Rewrite numeric expressions with positive rational exponents. (MA.AI.RNE.3)

Algebra and Functions					
Grade 8	**Mathematics Standards**	**Success Criteria**	**Academic Vocabulary**	**Looking Back**	**Looking Ahead**
MA.8.AF.1:	Solve linear equations with rational number coefficients fluently, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems.	I can solve linear equations in one variable. I can solve a linear equation by using the distributive property and combining like terms. I can write and solve equations and inequalities in one variable to represent real-world problems.	Linear equation Rational number Coefficient Distributive property Collecting (combining) like terms Linear inequality	Solve equations of the form x + p = q, x – p = q, px = q and x/p = q fluently. (MA.6.AF.5) Solve equations of the form px + q = r and p(x + q) = r fluently, where p, q, and r are specific rational numbers. Represent real-world problems using equations of these forms and solve such problems. (MA.7.AF.2)	Solve fluently linear equations and inequalities in one variable; explain and justify each step; justify the choice of solution method. (MA.AI.L.1) Represent real-world problems using linear equations and inequalities in one variable. (MA.AI.L.2)
MA.8.AF.2:	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by transforming a given equation into simpler forms, until an equivalent equation of the form x = a, a = a,	I can simplify a linear equation to determine whether it has one solution, no solutions, or infinitely many solutions. I can give examples of linear equations with one solution, no solutions, or infinitely many solutions.	Linear equation Infinitely many solutions Equivalent equation	Understand that solving an equation or inequality is the process of answering: Which values make the equation or inequality true? (MA.6.AF.4)	Represent real-world problems using linear equations and inequalities in one variable and solve such problems. (MA.AI.L.2)

	or a = b results (where a and b are different numbers).				
MA.8.AF.3:	Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y).	I can define a function as a rule, where for each input there is exactly one output. I can identify the independent and dependent variables. Given a graph or table, I can determine whether the relation is a function. I can show the relationship between inputs and outputs of a function by graphing them as ordered pairs on a coordinate grid.	Function Relation Independent variable Dependent variable Ordered pair	Graph points with whole number coordinates on a coordinate plane. (MA.5.AT.6) Represent real world problems and equations by graphing ordered pairs in the first quadrant. (MA.5.AT.7) Graph points with rational number coordinates. (MA.6.AF.7) Graph two quantities on a coordinate plane to determine whether the graph is a straight line. (MA.7.AF.6)	Understand that if f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. (MA.AI.F.1) Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations. (MA.AI.F.3)

MA.8.AF.4:	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.	I can identify where a graph is increasing or decreasing. I can classify a graph as linear or nonlinear. I can locate maximum and minimum values on a graph, when present. I can match the graph of a function to a given situation. I can sketch a graph that exhibits the qualitative features of a function that has been described verbally.	Qualitative Linear Nonlinear Increasing Decreasing Maximum value Minimum value	Graph ordered pairs in the first quadrant of the coordinate plane and interpret the coordinate values in the context of a situation. (MA.5.AT.7) Identify real-world and other mathematical situations that involve proportional relationships. (MA.7.AF.9)	Describe qualitatively the functional relationship between two quantities by analyzing a graph; make predictions about the relationship. (MA.AI.F.2)
MA.8.AF.5:	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations.	I can explain that an equation in the form of y = mx + b represents the graph of a linear relationship. I can give examples of relationships and create a table of values that can be defined as non-linear. I can compare and contrast linear and nonlinear functions from	Linear function Nonlinear function	Recognize that a constant rate of change describes a linear function. Identify and describe situations with constant or varying rates of change. (MA.7.AF.4)	Represent linear functions as graphs from equations, equations from graphs, and equations from tables. (MA.AI.L.4) Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables. (MA.AI.L.5)

		tables, graphs, equations, and verbal descriptions.			
MA.8.AF.6:	Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.	I can write a linear equation given a table of values. I can write a linear equation given a graph. I can write a linear equation given a verbal description. I can explain why the equation y = mx + b represents a linear function. I can find the slope and y-intercept in a linear function. Given an equation in slope-intercept form, I can interpret the slope and y-intercept in context.	Linear relationship Slope Rate of change y-intercept	Use variables to represent two quantities in a proportional relationship. (MA.6.AF.10) Write equations to represent proportional relationships; recognize that these are described by the linear function y = mx. (MA.7.AF.9)	Represent linear functions as graphs from equations, equations from graphs, and equations from tables and other given information. (MA.AI.L.4) Represent real-world problems that can be modeled with a linear function. (MA.AI.L.5)
MA.8.AF.7:	Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two	I can compare the properties of two linear functions that are represented differently (as equations, tables, graphs, or verbal).	Linear functions Distance-time graph	Use variables to represent two quantities in a proportional relationship. (MA.6.AF.10) Identify real-world and other	Translate among equivalent forms of equations for linear functions. Recognize that different forms reveal more or less information about a

	moving objects has greater speed).	I can interpret and analyze distance-time graphs and equations.		mathematical situations that involve proportional relationships. (MA.7.AF.9)	given situation. (MA.AI.L.6)
MA.8.AF.8:	Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation.	I can explain the solution to a system of two linear equations in two variables as the point of intersection of their graph. I can describe the point of intersection between two lines as the point that satisfies both equations at the same time. I can estimate the solution to a system of linear equations and assess the reasonableness of my approximation.	System of two linear equations Point of intersection Simultaneous	Evaluate expressions for specific values of their variables. (MA.6.AF.1) Graph a line given a point and its slope. (MA.7.AF.5)	Solve a pair of linear equations by graphing. (MA.AI.SEI.1) Solve pairs of linear equations using substitution or elimination. (MA.AI.SEI.2) Write a system of two linear equations that represents a real-world problem and solve. (MA.AI.SEI.3)

Geometry					
Grade 8	**Mathematics Standards**	**Success Criteria**	**Academic Vocabulary**	**Looking Back**	**Looking Ahead**
MA.8.GM.1:	Identify, define and describe attributes of three-dimensional	I can identify three-dimensional figures	Right Rectangular Prism Cylinder	Construct right rectangular prisms from nets and use	Solve real-world and other mathematical problems involving

	geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results.	based on specific attributes. I can define three-dimensional figures based on specific attributes. I can describe three-dimensional figures based on specific attributes. I can make predictions regarding the two-dimensional figure formed when slicing a three-dimensional solid.	Cone Sphere Pyramid	the nets to compute surface area of prisms. (MA.6.GM.6) Construct nets for right rectangular prisms and cylinders and use the nets to compute surface area. (MA.7.GM.7)	volume of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions. (MA.G.TS.5)
MA.8.GM.2:	Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.	I can state and apply the formulas for the volumes of cones, spheres and pyramids. I can state and apply the formula for surface area of a sphere. I can solve real-world problems involving the volume of cones, spheres, and pyramids.	Volume Surface area Cone Sphere Pyramid	Find the volume of a right rectangular prism with fraction edge lengths using unit cubes. (MA.6.GM.5) Solve real-world and other mathematical problems involving volume of cylinders and three-dimensional objects composed of right rectangular prisms. (MA.7.GM.6)	Solve real-world and other mathematical problems involving surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve algebraic expressions. (MA.G.TS.5)

MA.8.GM.3:	Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.	I can verify the properties of rotated, reflected or translated geometric figures by measuring and comparing lengths of segments and measures of angles. I can prove that lines and line segments remain the same length following a rotation, reflection, or translation. I can confirm that angles have the same measure following a rotation, reflection, or translation. I can verify that parallel lines remain parallel following a rotation, reflection, or translation.	Rotation Reflection Translation Mapped Parallel lines		Use geometric descriptions of rigid motions to transform figures and predict the results of translations, rotations and reflections. (MA.G.TR.1)
MA.8.GM.4:	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. Describe a sequence that exhibits the congruence between two given congruent figures.	I can explain that a two-dimensional figure is congruent to another after performing a series of rotations, reflections and translations. I can describe a sequence of transformations that shows the congruence between two figures.	Two-dimensional figure Congruent Rotation Reflection Translation		Explain how the criteria for triangle congruence follow from the definition of congruence in terms of rigid motion. (MA.G.T.2) Describe a motion or series of motions that will show two shapes are

					congruent. (MA.G.TR.1)
MA.8.GM.5:	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Describe a sequence that exhibits the similarity between two given similar figures.	I can explain how transformations can be used to prove that two figures are similar. I can describe a sequence of transformations that either prove or disprove that two figures are similar. I can describe attributes of similar figures.	Two-dimensional figure Rotation Reflection Translation Dilation Similar	Identify and describe similarity relationships of polygons and solve problems involving similarity. (MA.7.GM.2)	Given two triangles, use the definition of similarity in terms of similarity transformations to decide if they are similar. (MA.G.T.4) Understand that by similarity, side rations are properties of the angles in the triangle, leading to definitions of trigonometric ratios. (MA.G.T.9) Verify experimentally the properties of dilations given by a center and a scale factor. (MA.G.TR.2)
MA.8.GM.6:	Describe the effect of dilations, translations,	I can describe the changes to the size and	Dilation	Draw polygons in the coordinate plane;	Prove that given quadrilaterals are

	rotations, and reflections on two-dimensional figures using coordinates.	shape of a figure after a dilation in the coordinate plane. I can describe the effect of translations on coordinates. I can use coordinate notation to describe a translation. I can use vector notation to describe a translation. I can describe the effect of a reflection across the x-axis, y-axis or the lines y = x or y = -x on coordinates. I can describe the effect of a rotation about the origin on coordinates.	Translation Rotation Reflection Two-dimensional figure Coordinate Coordinate notation Vector notation	use coordinates to find the length of a side joining points. (MA.6.GM.3)	parallelograms, rhombuses, rectangles, squares, or trapezoids using coordinate proof. (MA.G.qp.2)
MA.8.GM.7:	Use inductive reasoning to explain the Pythagorean relationship.	I can understand how to use inductive reasoning to make conjectures. I can use inductive reasoning to explain the Pythagorean Theorem.	Inductive reasoning Pythagorean relationship	Apply the area formula for a rectangle. (MA.4.M.4) Apply the area formula for a triangle. (MA.5.M.3) Find the area of complex shapes	Develop the distance formula using the Pythagorean Theorem. (MA.G.T.8)

				composed of polygons by decomposing into simple shapes. (MA.6.GM.4)	
MA.8.GM.8:	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.	I can draw a diagram and use the Pythagorean Theorem to solve real world problems involving right triangles. I can apply the Pythagorean Theorem to find an unknown side length of a right triangle.	Pythagorean Theorem Right triangle	Draw triangles with given conditions from three measures of angles or sides. (MA.7.GM.1)	Use trigonometric ratios and the Pythagorean Theorem to solve real-world and mathematical problems. (MA.G.T.10)
MA.8.GM.9:	Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.	I can create a right triangle given two points on a coordinate grid. I can apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	Pythagorean Theorem	Draw triangles with given conditions from three measures of angles or sides. (MA.7.GM.1)	Develop the distance formula using the Pythagorean Theorem. (MA.G.T.8)

Data Analysis, Statistics, and Probability					
Grade 8 Mathematics Standards		**Success Criteria**	**Academic Vocabulary**	**Looking Back**	**Looking Ahead**
MA.8.DSP.1:	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of	I can plot ordered pairs on a coordinate grid representing the	Scatter plot Bivariate	Select, create, and interpret graphical representations of	Graph bivariate data on a scatter plot and describe the

	association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	relationship between two data sets. I can identify an appropriate scale for each measurement data when constructing scatter plots. I can accurately label the axes when constructing a scatter plot. I can describe patterns such as clustering, positive or negative association and linear or nonlinear association. I can identify outliers.	Clustering Outlier Positive association Negative association	numerical data. (MA.6.DS.2)	relationship. (MA.AI.DS.2) Distinguish between correlation and causation. (MA.AI.DS.4)
MA.8.DSP.2:	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line.	I can recognize if the data plotted on a scatter plot has a linear association or a nonlinear association. I can draw a straight line to approximate the linear relationship between the plotted points of two data sets. I can describe the fit of my line by evaluating the	Scatter plot Linear association		Use technology to find a linear function that models the relationship for a bivariate data set. (MA.AI.DS.3)

		closeness of the data points to the line.			
MA.8.DSP.3:	Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data; interpret the slope and y-intercept.	I can determine the equation of a trend line that approximates the linear relationships between the plotted points of two data sets. I can interpret the y-intercept and slope of an equation based on collected data. I can use the equation of a trend line to make predictions about additional data points.	Linear relationship Extrapolation Interpolation Bivariate	Evaluate expression for specific values of their variables. (MA.6. AF.1) Construct a function to model a linear relationship. (MA.8.AF.6)	Use technology to find a linear function that models the relationship for a bivariate data set to make predictions; interpret the slope and y-intercept. (MA.AI.DS.3) Use technology to find a linear, quadratic, or exponential function that models a relationship for a bivariate data set. (MA.AII.DSP.2)
MA.8.DSP.4:	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.	I can find the sample space for a compound event. I can find the probability of a compound event. I can describe events as independent or dependent. I can identify events as mutually exclusive.	Simple event Compound event Outcome Sample space Independent events Dependent events Complementary events Mutually exclusive events	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. (MA.7.DSP.5)	Understand dependent and independent events and conditional probability. (MA.AII.DSP.5)

		I can identify the complement of an event.			
MA.8.DSP.5:	Represent sample spaces and find probabilities of compound events (independent and dependent) using methods, such as organized lists, tables, and tree diagrams.	I can represent the sample space of independent and dependent events. I can create a tree diagram to show the sample space of a compound event. I can find the probability of a compound event using an organized list. I can find the probability of a compound event using a table. I can find the probability of a compound event using a tree diagram.	Sample space Compound event Independent event Dependent event Tree diagram	Approximate the probability of a chance event by collecting data on the chance process that produces it. (MA.7.DSP.6)	Record multiple observations of random events and construct empirical models of probability distributions. (MA.AII.DSP.4)

MA.8.DSP.6:	For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes.	I can apply the multiplication counting principle to situations with a large number of outcomes. I can develop the multiplication counting principle through exploration.	Multiplication counting principle	Develop probability models that include the sample space and probabilities of outcomes to represent simple events with equally likely outcomes. (MA.7.DSP.7)	Understand the multiplication counting principle, permutations and combinations. (MA.AII.DSP.6)