This Teacher Resource Guide has been developed to provide supporting materials to help educators successfully implement the Indiana Academic Standards for Eighth Grade Mathematics – Adopted April 2014. These resources are provided to help you in your work to ensure all students meet the rigorous learning expectations set by the Academic Standards. Use of these resources is optional – teachers should decide which resource will work best in their school for their students.

This resource document is a living document and will be frequently updated. Please send any suggested links and report broken links to:

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The examples in this document are for illustrative purposes only, to promote a base of clarity and common understanding. Each example illustrates a standard but please note that examples are not intended to limit interpretation or classroom applications of the standards.

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GOOD WEBSITES FOR MATHEMATICS:

http://nlvm.usu.edu/en/nav/vlibrary.html
http://www.math.hope.edu/swanson/methods/applets.html
http://learnzillion.com
http://illuminations.nctm.org
https://teacher.desmos.com
http://illustrativemathematics.org
http://www.insidemathematics.org
https://www.khanacademy.org/
https://www.teachingchannel.org/
http://map.mathshell.org/materials/index.php
https://www.istemnetwork.org/index.cfm
http://www.azed.gov/azccrs/mathstandards/

	Indiana Academic Standard for Eighth Grade Mathematics – Adopted April 2014	Highlighted Vocabulary Words from the Standard Defined	Specific Eighth Grade Example for the Standard	Specific Eighth Grade Electronic Resource for the Standard
Number Sense				
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.	**Rational number** - a real number that can be written as a ratio of two integers with a non-zero denominator. **Irrational number** - a real number that cannot be expressed as a ratio of two integers.	a) Give two examples of rational numbers and two examples of irrational numbers. Describe how to determine whether a number is rational or irrational. b) Convert $0.\overline{23}$ to a fraction.	http://www.softschools.com/math/classifying_numbers/ https://www.illustrativemathematics.org/illustrations/334 https://www.illustrativemathematics.org/illustrations/335
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.		a) Plot $-1.4, \sqrt{2}, \sqrt{7}$, and $2.\overline{2}$ on a number line. b) Estimate the value of $-2\pi^2$.	http://jsdalgebra.wikispaces.com/1.+Real+No.Sense+CT https://www.illustrativemathematics.org/illustrations/337 https://www.illustrativemathematics.org/illustrations/336

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.		Which expressions are equivalent to $4^{-2} \times 4^{5}$? a) 16^{3} b) $\frac{1}{4^{3}}$ c) 64 d) 4^{3} e) 4^{-10}	http://www.learnalberta.ca/content/mejhm/index.html?l=0&ID1=AB.MATH.JR.NUMB&ID2=AB.MATH.JR.NUMB.EXPO&lesson=html/object_interactives/exponent_laws/use_it.html
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.		The area of a square is 90 square feet. What is the length, in feet, of the side of the square? a) 22.5 b) 45 c) $\sqrt{45}$ d) $\sqrt{90}$	https://learnzillion.com/lessonsets/351

Computation				
MA.8.C.1:	Solve real-world problems with rational numbers by using multiple operations.		Veda earned $150 last week. Jay earned $130 last week. They combined their money and decided to donate ¼ of their total amount to a charity. Then, they spent 40% of the remaining amount at an amusement park. Jay claims that they only have 35% of their original combined total left. Is Jay's claim correct? Justify your answer.	https://www.illustrativemathematics.org/illustrations/108
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.		Object A weighs 1.25×10^8 milligrams. Object B weighs 6.55×10^{11} milligrams. How many times heavier is object B than object A? How much heavier, in milligrams, is object B than object A. Write your answers in scientific notation.	http://www.xpmath.com/forums/arcade.php?do=play&gameid=20

Algebra and Functions				
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.	**Coefficient** – the numerical factor of a term that contains a variable. **Fluently** – efficient and accurate	a) Two fifths of the sum of a number and 4, plus -7 is -16. Write an equation that can be used to determine the number and then determine the number. b) A local gym has two pricing options. • Option A: $5.75 for each visit • Option B: yearly membership for $99, plus $0.50 for each visit Write an inequality that can be used to determine the minimum number of times a person would need to visit the gym in a year in order for option B to be less expensive than option A. Then solve the inequality and interpret the solution. c) Solve: $\frac{3}{4}(2x-7)+\frac{1}{2}x=-9$	http://learnzillion.com/lessons/1010-solve-linear-equations-by-using-the-distributive-property-of-equality http://www.math-play.com/equation-games.html

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, or a = b results (where a and b are different numbers).		Determine whether each equation has one solution, infinitely many solutions, or no solutions. a) 5x-5 =5x-10 b) ½ (10x-20) = 5x-10 c) 10x – 23 = 29 – 3x d) 1.45x = 0 Give other examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. In words, describe how you know whether a linear equation in one variable has one solution, infinitely many solutions, or no solutions.	http://learnzillion.com/lessonsets/124-find-examples-of-linear-equations-in-one-variable-with-one-none-or-many-solutions

<table>
<tr>
<td>MA.8.AF.3:</td>
<td>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).</td>
<td></td>
<td>Determine whether each relation represents a function. Describe why or why not.

a) {(-3.4, 9), (-5, -5), (9, -3.4)}

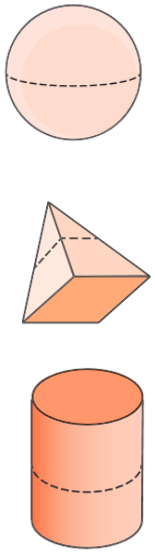
b) Consider a relation such that the independent variable represents the people in a classroom and the dependent variable represents the month in which they were born. Does this relation represent a function? Vice-versa, consider a relation such that the independent variable represents the months of the year and the dependent variable represents the people associated to the month in which they were born. Does this relation represent a function?

c)
<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>-6</td><td>-1</td></tr>
<tr><td>2.5</td><td>½</td></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>-6</td><td>1</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

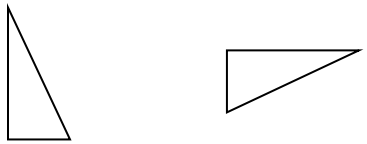
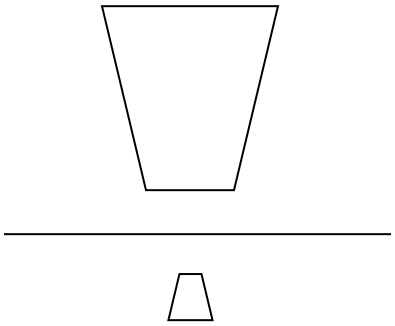
MA.8.AF.4:	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.	**Qualitative** – descriptive information not based on numbers**.**	Pat and Kim are both at the library. Pat walks away from the library at a constant rate. Kim leaves shortly after Pat and walks in the same direction as Pat and at the same constant rate. Sketch a graph to represent Pat and Kim's distance from the library as a function of time.	https://www.illustrativemathematics.org/illustrations/632 https://www.illustrativemathematics.org/illustrations/633 https://www.illustrativemathematics.org/illustrations/674
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.		a) Graph each equation below. • $y = 3x - 3$ • $y = \frac{2}{3}x$ • $y = -2x + 1$ • $y = -\frac{4}{3}x + 2$ b) Create a table of values for each equation. Then graph each equation on the same coordinate plane. Describe similarities and differences among the graphs of the equations. • $y = 2x$ • $y = x^2$ • $y = 2^x$	

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.	**Slope** - the ratio of the vertical change to the horizontal change. **y-intercept** - the y-coordinate of the point where the graph crosses the y-axis.	Rebecca wants to buy a new MP3 player. She has already saved $10 and will earn the rest by selling necklaces for $4 each. Write an equation that represents the amount of money Rebecca has saved given the number of necklaces sold. Be sure to define your variables. Then, explain what the y-intercept and slope represents in the context of the problem. Then, determine the number of necklaces Rebecca must sell before she is able to purchase an MP3 player that costs $167 after tax.	

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 moving objects has greater speed).		Samantha starts with $20 on a gift card to an ice cream shop. She plans to spend $3.50 of the gift card each week. Joe also has a gift card to an ice cream shop and plans to spend his money in a similar way as Samantha. The amount he has remaining on his gift card, *y*, after *x* weeks can be found using the equation below. $y = 50 - 7x$ Assuming that Joe and Samantha spend their gift cards as described, who spends at a faster rate? Explain your answer. Who starts with more money on their gift card? Explain your answer. Who will spend their entire gift card more quickly? Justify your answer.	https://www.illustrativemathematics.org/illustrations/641
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.		Graph the system of equations below. How can you approximate the solution of the system by looking at the graph? How can you justify the solution? If possible, justify the solution to the system of equations. $y = -2x - 1$ $y = \frac{1}{2}x - 6$	

Geometry and Measurement				
MA.8.GM.1:	Identify, define and describe attributes of three-dimensional 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.	**Rectangular Prism** - a solid figure where all sides are rectangles and all sides meet perpendicular. **Cylinder** - solid object with: * two identical flat ends that are circular * and one curved side. It has the same cross-section from one end to the other **Cone** - a solid or hollow object that tapers from a circular or roughly circular base to a point. **Sphere** - a round solid figure, or its surface, with every point on its surface equidistant from its center **Pyramid** - a solid figure where the base is a polygon and the sides are triangles which meet at the top (the apex).	a) Create a table that defines and describes attributes of right rectangular prisms, cylinders, cones, spheres, and pyramids. b) The dotted lines below represent the slicing of the sphere, square pyramid, and cylinder. Describe the two-dimensional shapes that result from each slice. Describe other ways to slice these figures and the resulting two-dimensional shapes. 	https://learnzillion.com/lessons/1134-describe-2dimensional-cross-sections-of-right-rectangular-prisms http://www.pbslearningmedia.org/resource/muen-math-g-slicing-3d-figures/slicing-three-dimensional-figures/ http://www.learner.org/courses/learningmath/geometry/session9/part_c/index.html http://www.opusmath.com/common-core-standards/7.g.3-describe-the-two-dimensional-figures-that-result-from-slicing

MA.8.GM.2:	Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.	**Volume** - the amount of 3-dimensional space an object occupies; capacity. **Surface area** - the total area of the surface of a 3-dimensional object.	Sue builds a sandcastle using two plastic molds. One of the molds is in the shape of a square pyramid that is 5 inches tall and the edge of the base measures 3.5 inches. The other mold is in the shape of a cone that is 7 inches tall and the diameter of the base is 9 inches. How much sand, in cubic inches, can fit in each plastic mold?	
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.	**Rotation** - a transformation that turns a figure about a fixed point. **Reflection** - a transformation in which the figure is the mirror image of the other. **Translation** - a transformation in which a figure is moved (slid) without changing its shape, size, or orientation.	[Provide multiple opportunities for students to explore the transformation of figures so that they can appreciate that points stay the same distance apart and lines stay at the same angle after they have been rotated, reflected, and/or translated.]	https://learnzillion.com/lessonsets/422-verify-the-properties-of-rotations-reflections-and-translations

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.	**Congruent** - congruent figures have the same size and shape.	The triangles below are congruent. Describe a sequence of transformations that would show that the triangles are congruent. 	http://learnzillion.com/lessons/3156-demonstrate-congruence-using-a-transformation-sequence https://www.illustrativemathematics.org/illustrations/1228
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.	**Dilation** - a similarity transformation that results from the reduction or enlargement of a figure **Similar** - similar figures have the same shape but not necessarily the same size.	The figures below are similar. Describe a sequence of transformations that would show that the figures are similar. 	https://learnzillion.com/courses/45?collection_id=658#collection_658

MA.8.GM.6:	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.		The vertices of a figure are (-1, 1), (-1, -3), (2, 1), and (2, -3). The figure is translated two units to the right and then reflected over the *x*-axis. What are the vertices of the image?	https://www.illustrativemathematics.org/illustrations/1243 https://www.illustrativemathematics.org/illustrations/1232
MA.8.GM.7:	Use inductive reasoning to explain the Pythagorean relationship.	**Inductive reasoning** - reasoning from detailed facts to general principles. **Pythagorean relationship** - referring to the Pythagorean Theorem in a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.		http://nlvm.usu.edu/en/nav/frames_asid_164_g_3_t_3.html?open=instructions&from=topic_t_3.html http://www.nctm.org/standards/content.aspx?id=26776 http://illuminations.nctm.org/activity.aspx?id=4211
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.		The height of a house is 30 feet. The base of 31-foot ladder is located 15 feet away from the base of the house and is leaning up against the side of the house. How far up the side of the house does the top of the ladder reach?	http://www.pbs.org/wgbh/nova/proof/puzzle/use.html https://www.illustrativemathematics.org/illustrations/60

MA.8.GM.9:	Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.		Tom is looking at a map of a theme park. The map is laid out in a coordinate system. Tom is located at (2, 3). The roller coaster is located at (7, 8) and the water ride is located at (9, 1). Is Tom closer to the roller coaster or the water ride? Justify your answer.	http://www.pbslearningmedia.org/resource/mgbh.math.g.pythag/calculating-distance-using-the-pythagorean-theorem

<table>
<tr><th colspan="5">Data Analysis, Statistics and Probability</th></tr>
<tr>
<td>MA.8.DSP.1:</td>
<td>Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.</td>
<td>Bivariate - a set of data that has two variables.
Clustering - when data seems to be "gathered" around a particular value.
Outlier - a value that lies “outside" (is much smaller or larger than) most of the other values in a set of data.
Positive association - as one variable increases, the other variable increases.
Negative association - as one variable decreases, the other variable decreases.</td>
<td>Data for 10 students’ Math and Science scores are provided in the table. Construct a scatter plot for this data and describe the association between the Math and Science scores.
<table>
<tr><th>Student</th><th>Math</th><th>Science</th></tr>
<tr><td>A</td><td>85</td><td>83</td></tr>
<tr><td>B</td><td>50</td><td>70</td></tr>
<tr><td>C</td><td>64</td><td>68</td></tr>
<tr><td>D</td><td>42</td><td>40</td></tr>
<tr><td>E</td><td>56</td><td>60</td></tr>
<tr><td>F</td><td>93</td><td>96</td></tr>
<tr><td>G</td><td>34</td><td>33</td></tr>
<tr><td>H</td><td>24</td><td>27</td></tr>
<tr><td>I</td><td>63</td><td>63</td></tr>
<tr><td>J</td><td>72</td><td>74</td></tr>
</table>
</td>
<td>https://www.illustrativemathematics.org/illustrations/975

https://www.illustrativemathematics.org/illustrations/1097</td>
</tr>
</table>

<table>
<tr>
<td>MA.8.DSP.2:</td>
<td>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.</td>
<td></td>
<td>The fuel tank in Ellen's car has a capacity of 13.5 gallons. Before a trip, she fills her car completely with gasoline. The table shows the total amount of gasoline used and the distance Ellen traveled. Construct a scatter plot for this data such that the distance traveled is the dependent variable and the gasoline used is the independent variable. Describe the relationship between the variables. If the data is linear, sketch a line to fit the data. Do you think the line represents a good fit for the data set? Why or why not? [Example continued in next standard.]
<table>
<tr><th>Total Gallons of Gasoline Used</th><th>Miles Traveled</th></tr>
<tr><td>1.8</td><td>45</td></tr>
<tr><td>2.4</td><td>60</td></tr>
<tr><td>3.8</td><td>100</td></tr>
<tr><td>5.5</td><td>150</td></tr>
<tr><td>7.3</td><td>200</td></tr>
<tr><td>8.2</td><td>225</td></tr>
</table>
</td>
<td>http://illuminations.nctm.org/Activity.aspx?id=4186

https://www.illustrativemathematics.org/illustrations/41

https://www.illustrativemathematics.org/illustrations/1520

https://www.illustrativemathematics.org/illustrations/1558</td>
</tr>
</table>

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.	**Extrapolation** - an estimation of a value based on extending a known sequence of values or facts beyond the area that is certainly known **Interpolation** - an estimation of a value within two known values in a sequence of values	[Example continued from previous standard.] Write a linear equation to model the data. What does the slope and y-intercept represent in terms of the context? Do they seem reasonable? Use your equation to predict the number of miles Ellen could travel before her fuel tank is empty.	http://illuminations.nctm.org/Activity.aspx?id=4186 https://www.illustrativemathematics.org/illustrations/41 https://www.illustrativemathematics.org/illustrations/1520 https://www.illustrativemathematics.org/illustrations/1558

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.	**Simple event**- an event that consists of a single outcome. **Compound event** – consists of two or more simple events. **Outcome** - a possible result of a probability experiment. **Sample space** - the set of all possible outcomes of an experiment. **Independent events** - two events, A and B, are independent if the fact that A occurs does not affect the probability of B occurring. **Dependent events** - two events are dependent if the outcome or occurrence of the first affects the outcome or occurrence of the second so that the probability is changed. **Complementary events** - all outcomes that are NOT the event; If the event is Monday or Tuesday, the complement would be the days Wednesday through Sunday. **Mutually exclusive events** - two events are mutually exclusive if they cannot occur at the same time (i.e., they have no outcomes in common).	a) Mary has two bags of coins. Bag A contains 5 pennies and 3 dimes. Bag B contains 10 pennies and 4 dimes. Mary will randomly choose one coin from Bag A and then one coin from Bag B. Are these dependent or independent events? Explain your answer. b) Jason has one bag with 50 quarters and 9 pennies. He will randomly choose one coin and not put that coin back in the bag. He will then randomly choose another coin. Are these dependent or independent events? Explain your answer.	http://www.actuarialfoundation.org/probabilitychallenge/

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.		a) Ray flips a coin and then rolls a standard six-sided die. List all of the possible outcomes. Then, find the probability of the coin landing on heads and rolling an even number. b) A bag contains 5 marbles. There is one red marble, two blue marbles, and two purple marbles. Sal randomly chooses one marble without replacement and then randomly chooses another. What is the sample space for these events? What is the probability of choosing one blue marble followed by another blue marble?	https://www.illustrativemathematics.org/illustrations/885
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.	**Multiplication counting principle** - If an event occurs in *m* ways and another event occurs independently in *n* ways, then the two events can occur in *m*×*n* ways.	Mel is creating a login password. His password will consist of three numbers using the digits 0-9 followed by three letters. The letters may be upper case or lower case and the letters and digits may be repeated. How many different passwords are possible?	http://www.aaamath.com/sta-basic-cntg.htm#section2