

8th Grade Math Unit and Lesson Plans, rev. 2019  
DHH Lengel Middle School  
Pottsville, PA

Block Length: 75 minutes  
Blocks per cycle: 5  
Length of Course: One Year  
Developed by: Nathan Kraft, lead teacher

The Grade 8 curriculum is based on the newly adopted Pearson enVision 2.0 program. It begins with a review of real numbers (rational and irrational) as well as exponent laws and scientific notation. Students then explore the concepts of linear equations, functions, bivariate data, systems of linear equations, congruence and similarity, Pythagorean Theorem, and surface area and volume.

Resources: Pearson enVision 2.0,  
Online Resources Include: Pearson Realize, Desmos, Khan Academy, Get More Math

Marking Period	Units	Standards and Eligible Content	Assessments	Lessons	Objectives	Vocabulary
1	1 Real Numbers	<p>CC.2.1.8.E.1 Distinguish between rational and irrational numbers using their properties.</p> <p>CC.2.1.8.E.4 Estimate irrational numbers by comparing them to rational numbers.</p> <p>CC.2.2.8.B.1 Apply concepts of radicals and integer exponents to generate equivalent expression.</p> <p>M08.A-N.1.1.1 Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths).</p> <p>M08.A-N.1.1.2 Convert a terminating or repeating decimal to a rational number (limit repeating decimals to thousandths).</p> <p>M08.A-N.1.1.3 Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144). Example: <math>\sqrt{5}</math> is between 2 and 3 but closer to 2.</p> <p>M08.A-N.1.1.4 Use rational approximations of irrational numbers to compare and order irrational numbers.</p> <p>M08.A-N.1.1.5 Locate/identify rational and irrational numbers at their approximate locations on a number line.</p> <p>M08.B-E.1.1.1 Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents). Properties will be provided. Example: <math>3^{12} \times 3^{-15} = 3^{-3} = 1/(3^3)</math></p> <p>M08.B-E.1.1.2 Use square root and cube root symbols to represent solutions to equations of the form <math>x^2 = p</math> and <math>x^3 = p</math>, where <math>p</math> is a positive rational number. Evaluate square roots of perfect squares (up to and including <math>12^2</math>) and cube roots of perfect cubes (up to and including <math>5^3</math>) without a calculator. Example: If <math>x^2 = 25</math> then <math>x = \pm\sqrt{25}</math>.</p> <p>M08.B-E.1.1.3 Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10 and express how many times larger or smaller one number is than another. Example: Estimate the population of the United States as <math>3 \times 10^8</math> and the population of the world as <math>7 \times 10^9</math> and determine that the world population is more than 20 times larger than the United States' population.</p> <p>M08.B-E.1.1.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	<p>1-1 Rational Numbers as Decimals</p> <p>1-2 Understand Irrational Numbers</p> <p>1-3 Compare and Order Real Numbers</p> <p>1-4 Evaluate Square Roots and Cube Roots</p> <p>1-5 Solve Equations Using Square Roots and Cube Roots</p> <p>1-6 Use Properties of Integer Exponents</p> <p>1-7 More Properties of Exponents</p> <p>1-8 Use Powers of 10 to Estimate Quantities</p>	<p>Locate repeating decimals on a number line. Write repeating decimals as fractions.</p> <p>Classify a number as rational or irrational. Understand the concepts of square roots and perfect squares.</p> <p>Approximate square roots by using perfect squares. Compare and order rational and irrational numbers.</p> <p>Evaluate square roots and cube roots to solve problems. Evaluate perfect squares and perfect cubes.</p> <p>Solve equations involving perfect squares or cubes. Solve equations involving imperfect squares or cubes.</p> <p>Multiply and divide expressions with integers exponents. Find the power of a power.</p> <p>Simplify exponential expressions using the Zero Exponent Property and Negative Exponent Property.</p> <p>Estimate and compare very large and very small quantities using powers of 10.</p>	<p>irrational number, perfect square, square root</p> <p>cube root, perfect cube</p> <p>Power of Products Property, Product of Powers, Quotient of Powers Property</p> <p>Negative Exponent Property, Zero Exponent Property</p>

		millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology (e.g., interpret 4.7EE9 displayed on a calculator as $4.7 \times 10^9$ ).		1-9 Understand Scientific Notation	Write very large and very small numbers in scientific notation. Convert scientific notation to standard form.	scientific notation
				1-10 Operations with Numbers in Scientific Notation	Add, subtract, multiply, and divide numbers in scientific notation.	
1&2	2 Analyze and Solve Linear Equations	<p>CC.2.2.8.B.2 Understand the connections between proportional relationships, lines, and linear equations.</p> <p>CC.2.2.8.B.3 Analyze and solve linear equations and pairs of simultaneous linear equations.</p> <p>M08.B-E.2.1.1 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</p> <p>M08.B-E.2.1.2 Use similar right triangles to show and explain why the slope <math>m</math> is the same between any two distinct points on a non-vertical line in the coordinate plane.</p> <p>M08.B-E.2.1.3 Derive the equation <math>y = mx</math> for a line through the origin and the equation <math>y = mx + b</math> for a line intercepting the vertical axis at <math>b</math>.</p> <p>M08.B-E.3.1.1 Write and identify linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms until an equivalent equation of the form <math>x = a</math>, <math>a = a</math>, or <math>a = b</math> results (where <math>a</math> and <math>b</math> are different numbers).</p> <p>M08.B-E.3.1.2 Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	2-1 Combine Like Terms to Solve Equations	Combine like terms. Solve equations with like terms on one side of the equation. Make sense of scenarios and represent them with equations.	
				2-2 Solve Equations with Variables on Both Sides	Solve equations with like terms on both sides of the equation. Make sense of scenarios and represent them with equations.	
				2-3 Solve Multi-step Equations	Plan multiple solution pathways and choose one to find the solution.	
				2-4 Equations with No Solutions or Infinitely Many Solutions	Determine the number of solutions to an equation.	
				2-5 Compare Proportional Relationships	Analyze equations, linear graphs, and tables to find unit rates and compare proportional relationships.	
				2-6 Connect Proportional Relationships and Slope	Find the slope of a line using different strategies. Interpret a slope in context and relate it to steepness on a graph.	

				2-7 Analyze Linear Equations: $y = mx$	Understand how the constant of proportionality and the slope relate in a linear equation. Write a linear equation in the form $y = mx$ when the slope is given. Graph a linear equation in the form $y = mx$ .	
				2-8 Understand the y-intercept of a Line	Interpret and extend the table or graph of a linear relationship to find its y-intercept. Analyze graphs in context to determine and explain the meaning of the y-intercept.	y-intercept
				2-9 Analyze Linear Equations: $y = mx + b$	Graph a line from an equation in the form $y = mx + b$ . Write an equation that represents the given graph of a line.	slope-intercept form
2	3 Use Functions to Model Relationships	<p>CC.2.2.8.C.1 Define, evaluate, and compare functions.</p> <p>CC.2.2.8.C.2 Use concepts of functions to model relationships between quantities.</p> <p>M08.B-F.1.1.1 Determine whether a relation is a function.</p> <p>M08.B-F.1.1.2 Compare properties of two functions, each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions). Example: Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.</p> <p>M08.B-F.1.1.3 Interpret the equation <math>y = mx + b</math> as defining a linear function whose graph is a straight line; give examples of functions that are not linear.</p> <p>M08.B-F.2.1.1 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two <math>(x, y)</math> values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values.</p> <p>M08.B-F.2.1.2 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	3-1 Understand Relations and Functions	Identify whether a relation is a function. Interpret a function.	relation, function
				3-2 Connect Representations of Functions	Identify functions in different representations: equations, tables, and graphs. Identify linear and nonlinear functions in different representations.	constant rate of change, initial value, linear function, nonlinear function
				3-3 Compare Linear and Nonlinear Functions	Compare properties of linear functions in different representations. Compare properties of linear and nonlinear functions in different representations.	
				3-4 Construct Functions to Model Linear Relationships	Construct a linear function to model a relationship using an equation in the form $y = mx + b$ .	

		graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.		3-5 Intervals of Increase and Decrease	Describe qualitatively the behavior of a function by analyzing its graph. Describe the graph of a function at each interval.	interval
				3-6 Sketch Functions From Verbal Descriptions	Draw a qualitative graph of a function based on a verbal description. Analyze and interpret the sketch of a graph of a function.	
2	4 Investigate Bivariate Data	<p>CC.2.4.8.B.1 Analyze and/or interpret bivariate data displayed in multiple representations.</p> <p>CC.2.4.8.B.2 Understand that patterns of association can be seen in bivariate data utilizing frequencies.</p> <p>M08.D-S.1.1.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative correlation, linear association, and nonlinear association.</p> <p>M08.D-S.1.1.2 For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line.</p> <p>M08.D-S.1.1.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. Example: In a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</p> <p>M08.D-S.1.2.1 Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible associations between the two variables. Example: Given data on whether students have a curfew on school nights and whether they have assigned chores at home, is there evidence that those who have a curfew also tend to have chores?</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	4-1 Construct and Interpret Scatter Plots	Construct a scatter plot graph to model paired data. Utilize a scatter plot to identify and interpret the relationship between paired data.	cluster, gap, measurement, data, negative association, outlier, positive association, scatter plot
				4-2 Analyze Linear Associations	Recognize whether the paired data has a linear association, a nonlinear association, or no association. Draw a trend line to determine whether a linear association is positive or negative and strong or weak.	trend line
				4-3 Use Linear Models to Make Predictions	Use the slope and y-intercept of a trend line to make a prediction. Make a prediction when no equation is given by drawing trend lines and writing the equation of the linear model.	

				4-4 Interpret Two-Way Frequency Tables	Organize paired categorical data into a two-way frequency table. Compare and make conjectures about data displayed in a two-way frequency table.	categorical data
				4-5 Interpret Two-Way Relative Frequency Tables	Construct two-way frequency tables and two-way relative frequency tables. Compare and make conjectures about data displayed in a two-way relative frequency table.	relative frequency table
2&3	5 Analyze and Solve Systems of Linear Equations	<p>CC.2.2.8.B.3 Analyze and solve linear equations and pairs of simultaneous linear equations.</p> <p>M08.B-E.3.1.3 Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs because points of intersection satisfy both equations simultaneously.</p> <p>M08.B-E.3.1.4 Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations. Solve simple cases by inspection. Example: <math>3x + 2y = 5</math> and <math>3x + 2y = 6</math> have no solution because <math>3x + 2y</math> cannot simultaneously be 5 and 6.</p> <p>M08.B-E.3.1.5 Solve real-world and mathematical problems leading to two linear equations in two variables. Example: Given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	5-1 Estimate Solutions by Inspection	Examine graphs of linear systems of equations to determine the number of solutions, based on number of intersection points. Compare the equations in a linear system to look for a relationship between the number of solutions and the slopes and y-intercepts of the equations.	system of linear equations, solution of a system of linear equations
				5-2 Solve Systems by Graphing	Create and examine graphs of linear systems of equations to determine the solution.	
				5-3 Solve Systems by Substitution	Understand how substitution can be used to solve a linear system of equations. Apply this understanding to solve a system of linear equations with one solution, no solutions, or infinitely many solutions.	

				5-4 Solve Systems by Elimination	Understand how the process of elimination can be used to solve a system of linear equations with no solution, one solution, or infinitely many solutions. Apply this understanding to solve mathematical and real-world problems.	
3	6 Congruence and Similarity	<p>CC.2.3.8.A.2 Understand and apply congruence, similarity, and geometric transformations using various tools.</p> <p>M08.C-G.1.1.1 Identify and apply properties of rotations, reflections, and translations. Example: Angle measures are preserved in rotations, reflections, and translations.</p> <p>M08.C-G.1.1.2 Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them.</p> <p>M08.C-G.1.1.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.</p> <p>M08.C-G.1.1.4 Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them.</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	6-1 Analyze Translations	Understand translations. Translate a figure on a coordinate plane. Describe a translation.	transformation, translation, image
				6-2 Analyze Reflections	Understand and describe a reflection. Reflect two-dimensional figures.	reflection, line of reflection
				6-3 Analyze Rotations	Identify and perform a rotation. Determine how a rotation affects a two-dimensional figure.	rotation, angle of rotation, center of rotation
				6-4 Compose Transformations	Understand a sequence of transformations. Describe and perform a sequence of transformations.	
				6-5 Understand Congruent Figures	Understand congruence of figures using a series of transformations. Identify congruent figures.	congruent
				6-6 Describe Dilations	Understand dilations. Dilate to enlarge or reduce a figure in a coordinate plane.	dilation, scale factor, enlargement, reduction
				6-7 Understand Similar Figures	Understand similarity. Complete a similarity transformation. Identify similar figures.	similar

				6-8 Angles, Lines, and Transversals	Understand the relationships of angles formed by parallel lines and a transversal. Find unknown angle measures.	transversal, corresponding angles, alternate interior angles, same-side interior angles
				6-9 Interior and Exterior Angles of Triangles	Understand the relationship of the interior angles of a triangle. Find unknown angle measures.	remote interior angles, exterior angle of a triangle
				6-10 Angle-Angle Triangle Similarity	Determine whether triangles are similar. Solve problems involving similar triangles.	
3&4	7 Understand and Apply the Pythagorean Theorem	CC.2.3.8.A.3 Understand and apply the Pythagorean Theorem to solve problems. M08.C-G.2.1.1 Apply the converse of the Pythagorean theorem to show a triangle is a right triangle. M08.C-G.2.1.2 Apply the Pythagorean theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (Figures provided for problems in three dimensions will be consistent with Eligible Content in grade 8 and below.) M08.C-G.2.1.3 Apply the Pythagorean theorem to find the distance between two points in a coordinate system.	Quizzes, Test, Open-Ended Questions, Khan Academy	7-1 Understand the Pythagorean Theorem	Understand the Pythagorean Theorem. Given two side lengths of a right triangle, use the Pythagorean Theorem to find the length of the third side.	hypotenuse, leg, Pythagorean Theorem, proof
				7-2 Understand the Converse of the Pythagorean Theorem	Understand why the Converse of the Pythagorean Theorem is true. Apply the Converse of the Pythagorean Theorem to identify right triangles. Use the Converse of the Pythagorean Theorem to analyze two-dimensional shapes.	
				7-3 Apply the Pythagorean Theorem to Solve Problems	Apply the Pythagorean Theorem and its converse to solve real-world problems. Apply the Pythagorean Theorem to solve problems that involve three dimensions.	



				7-4 Find Distance in the Coordinate Plane	Apply the Pythagorean Theorem to find the distance between two points on a map or coordinate plane. Find the perimeter of a figure on a coordinate plane. Identify the coordinates of the third vertex of a triangle on the coordinate plane.	
4	8 Solve Problems Involving Surface Area and Volume	<p>CC.2.3.8.A.1 Apply the concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems.</p> <p>M08.C-G.3.1.1 Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems. Formulas will be provided.</p>	Quizzes, Test, Open-Ended Questions, Khan Academy	8-1 Find Surface Area of Three-Dimensional Figures	Find the surface areas of cylinders, cones, and spheres.	cone, cylinder, sphere
				8-2 Find Volume of Cylinders	Recognize the relationship between the volume of a rectangular prism and the volume of a cylinder. Solve real-world problems involving the volume of a cylinder. Use the formula for the volume of a cylinder to find an unknown measure.	
				8-3 Find Volume of Cones	Recognize the relationship between the volume of a cylinder and the volume of a cone. Use the Pythagorean Theorem when solving volume problems. Find the volume of a cone. Given the circumference of the base, find the volume of a cone.	

				8-4 Find Volume of Spheres	<p>Recognize the relationship between the volume of a cone and the volume of a sphere.</p> <p>Find the volume of a sphere. Given the surface area, find the volume of a sphere.</p> <p>Find the volume of a composite figure.</p>	composite figure
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