KPBSD 2018-2019 Eighth Grade Mathematics Pacing Guide

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Yellow indicates the committee identified this standard as a Priority Standard and it is included on the District Benchmark Assessment.

KPBSD MATH CURRICULUM
8^{TH} GRADE
UNIT 1 – INTEGER EXPONENTS AND THE SCIENTIFIC NOTATION

Desired Results

Priority Standards

8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both standard notation and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.

Supporting Standards

8.EE.1. Apply the properties (product, quotient, power, zero, negative exponents, and rational exponents) of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

8.EE.3. 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. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.*

Transfer

Students will be able to independently use their learning to…
Make sense of, compare, generate and evaluate large numbers in real-world settings.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- If the exponent increases by 1, the value increases by 10.
- The laws of exponents and the basic knowledge of positive integer exponents.
- Scientific notation and its uses to perform operations.

ESSENTIAL QUESTIONS

Students will keep considering…

- How can I use the properties of integer exponents to make equivalent numerical expressions?
- How are zero and negative exponents defined and used?
- How are the laws of exponents applied and used to estimate and compare very large and very small numbers?
- How can scientific notation be used to express very large and very small quantities?
- In what ways can scientific notation be used to perform operations?
- How can very large and very small real-world quantities be expressed and compared using exponents?

	Acquisition	
	Students will know… • Operations using numbers expressed in scientific notations. • Scientific notation to express very large and very small quantities. • The properties of integer exponents to generate equivalent numerical expressions. • Properties of integer exponents to produce equivalent numerical expressions. • Expressing numbers as a single-digit times an integer power of 10. • Scientific notation is used to estimate very large and/or very small quantities.	Students will be skilled at… • I can interpret scientific notation that has been generated by technology. • I can choose appropriate units of measure when using scientific notation. • I can compare quantities to express how much larger one is compared to the other.

Evidence

Evaluative Criteria	**Assessment Evidence**

	PERFORMANCE TASK(S):
	• 100 People
	  ○ Students use ratios and scientific notation to calculate and express different aspects of the world population.
	• A Million Dollars
	  ○ Students multiply and divide using scientific notation and integers.
	• Giant Burgers
	  ○ Students analyze a situation and multiply numbers in scientific notation.
	• Multiple Solutions
	  ○ Students use the properties of integer exponents.

Learning Plan

EngageNY Module 1

KPBSD MATH CURRICULUM
8^{TH} GRADE
UNIT 1 – INTEGER EXPONENTS AND THE SCIENTIFIC NOTATION

Math Practices and Vocabulary

MP.2. Reason abstractly and quantitatively. Students use concrete numbers to explore the properties of numbers in exponential form and then prove that the properties are true for all positive bases and all integer exponents using symbolic representations for bases and exponents. As lessons progress, students use symbols to represent integer exponents and make sense of those quantities in problem situations. Students refer to symbolic notation in order to contextualize the requirements and limitations of given statements (e.g., letting *m,n* represent positive integers, letting *a,b* represent all integers, both with respect to the properties of exponents).

MP.3. Construct viable arguments and critique the reasoning of others. Students reason through the acceptability of definitions and proofs (e.g., the definitions of x0 and x-b for all integers b and positive integers x). New definitions, as well as proofs, require students to analyze situations and break them into cases. Further, students examine the implications of these definitions and proofs on existing properties of integer exponents. Students keep the goal of a logical argument in mind while attending to details that develop during the reasoning process.

MP.6. Attend to precision. Beginning with the first lesson on exponential notation, students are required to attend to the definitions provided throughout the lessons and the limitations of symbolic statements, making sure to express what they mean clearly. Students are provided a hypothesis, such as x<y, for positive integers x, y, and then are asked to evaluate whether a statement, like -2 < 5, contradicts this hypothesis.

MP.7. Look for and make use of structure. Students understand and make analogies to the distributive law as they develop properties of exponents.

MP.8. Look for and express regularity in repeated reasoning. While evaluating the cases developed for the proofs of laws of exponents, students identify when a statement must be proved or if it has already been proven. Students see the use of the laws of exponents in application problems and notice the patterns that are developed in problems.

Vocabulary

- Exponents
- Factor
- Integer exponent
- Proportion
- Proportional relationship
- Pythagorean Theorem
- Scientific notation

KPBSD MATH CURRICULUM
8^{TH} GRADE
UNIT 2 – THE CONCEPT OF CONGRUENCE

Desired Results

Priority Standards

8.G.5. Justify using informal arguments to establish facts about

- the angle sum of triangles (sum of the interior angles of a triangle is 180º),
- measures of exterior angles of triangles,
- angles created when parallel lines are cut by a transversal (e.g., alternate interior angles), and
- angle-angle criterion for similarity of triangles.

8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Supporting Standards

8.G.1. Through experimentation, verify the properties of rotations, reflections, and translations (transformations) to figures on a coordinate plane).

a. Lines are taken to lines, and line segments to line segments of the same length.
b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.

8.G.2. Demonstrate understanding of congruence by applying a sequence of translations, reflections, and rotations on two-dimensional figures. Given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.6. Explain the Pythagorean Theorem and its converse.

Transfer

Students will be able to independently use their learning to…
Apply previous learning to developing their understanding of the concept of congruence.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Congruence can be defined through a series of translations, reflections, and rotations in the plane.
- The definitions and properties of basic rigid motions can be verified experimentally and by reasoning.
- The basic properties of individual rigid motions can be sequenced in various combinations.
- Congruence is a sequence of basic rigid motions.
- The Pythagorean Theorem can be used to solve basic problems.

ESSENTIAL QUESTIONS

Students will keep considering…

- What are the properties of congruence?
- Which theorems or properties can be used with various figures?
- Which rigid motions can be sequenced to produce a congruent figure?
- How can the Pythagorean Theorem be used to solve problems?

	Acquisition	
	Students will know… • The definition of similar triangles. • The definition and ways to identify transversals. • Strategies to recognize transformed geometric figures on the coordinate plane as the product of reflections, rotations, and translations. • Angles are created when a parallel line is cut by a transversal. • When and why geometric figures that have been transformed on the coordinate plane are congruent or similar. • Ways to identify the relationships among pairs of alternate interior, alternate exterior, and corresponding angles formed by two parallel lines cut by a transversal. • Methods to solve authentic problems based on geometric transformations; on parallel lines cut by a transversal. • Pythagorean Theorem and Converse. • Parts of a right triangle. • Symbols and definition for Congruency.	Students will be skilled at… • I can justify that the sum of interior angles equals 180. • I can justify that the exterior angle of a triangle is equal to the sum of the two remote interior angles. • I can use Angle-Angle Criterion to prove similarity among triangles. • I can solve basic mathematical Pythagorean Theorem problems and it converse to find missing lengths of sides of triangles in two- and three-dimensions. • I can apply Pythagorean Theorem in solving real-world problems dealing with two- and three-dimensional shapes. • I can use physical models, transparencies, or geometry software to verify the properties of rotations, reflections, and translations (i.e., Lines are taken to lines and line segments to line segments of the same length, angles are taken to angles of the same measure, & parallel lines are taken to parallel lines). • I can apply the concept of congruency to write congruent statements. • I can reason that a 2-deminsional figure is congruent to another if the second can be obtained by a sequence of rotations, reflections, translation. • I can describe the sequence of rotations, reflections, translations that exhibits the congruence between 2-deminsional figures using words.

Evidence	
Evaluative Criteria	**Assessment Evidence**
	PERFORMANCE TASK(S): • Patterns in Prauge ○ Students calculate the area and perimeter of a complex shape using the Pythagorean Theorem.

Learning Plan

EngageNY Module 2

Math Practices and Vocabulary

MP.2. Reason abstractly and quantitatively. This module is rich with notation that requires students to decontextualize and contextualize throughout. Students work with figures and their transformed images using symbolic representations and need to attend to the meaning of the symbolic notation to contextualize problems. Students use facts learned about rigid motions in order to make sense of problems involving congruence.

MP.3. Construct viable arguments and critique the reasoning of others. Throughout this module, students construct arguments around the properties of rigid motions. Students make assumptions about parallel and perpendicular lines and use properties of rigid motions to directly or indirectly prove their assumptions. Students use definitions to describe a sequence of rigid motions to prove or disprove congruence. Students build a logical progression of statements to show relationships between angles of parallel lines cut by a transversal, the angle sum of triangles, and properties of polygons like rectangles and parallelograms.

MP.5. Use appropriate tools strategically. This module relies on students' fundamental understanding of rigid motions. As a means to this end, students use a variety of tools but none as important as an overhead transparency. Students verify experimentally the properties of rigid motions using physical models and transparencies. Students use transparencies when learning about translation, rotation, reflection, and congruence in general. Students determine when they need to use the transparency as a tool to justify conjectures or when critiquing the reasoning of others.

MP.6. Attend to precision. This module begins with precise definitions related to transformations and statements about transformations being distance- and angle-preserving. Students are expected to attend to the precision of these definitions and statements consistently and appropriately as they communicate with others. Students describe sequences of motions precisely and carefully label diagrams so that there is clarity about figures and their transformed images. Students attend to precision in their verbal and written descriptions of rays, segments, points, angles, and transformations in general.

Vocabulary

- Adjacent angles
- Alternate exterior angles
- Alternate interior angles
- Vertical angles
- Complementary angles
- Congruent
- Pythagorean Theorem
- Reflection
- Right triangle
- Rotation
- Supplementary angles
- Translation
- Transversal

KPBSD MATH CURRICULUM
8th GRADE
UNIT 3 –SIMILARITY

Desired Results

Priority Standards

8.G.4. Demonstrate understanding of similarity, by applying a sequence of translations, reflections, rotations, and dilations on two-dimensional figures. Describe a sequence that exhibits the similarity between them.

8.G.5. Justify using informal arguments to establish facts about

- the angle sum of triangles (sum of the interior angles of a triangle is 180º),
- measures of exterior angles of triangles,
- angles created when parallel lines are cut by a transversal (e.g., alternate interior angles), and
- angle-angle criterion for similarity of triangles.

8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Supporting Standards

8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.6. Explain the Pythagorean Theorem and its converse.

Transfer

Students will be able to independently use their learning to…
Construct a more complex definition of similarity that can be applied to more advanced situations.

Meaning

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
Students will understand that… • Concepts of similarity and dilation can be used to prove the Pythagorean Theorem. • An expanded definition of similarity can be applied to geometric shapes that are not polygons, such as ellipses and circles.	Students will keep considering… • How can information arguments be used to establish facts? • How can the Pythagorean Theorem be used to determine unknown quantities? • What is similarity? • How can I determine if triangles are similar?

Acquisition

Students will know… • Similar figures as corresponding angles are congruent and corresponding sides are proportional. • The symbol and definition for similar triangles. • Define and identify transversals. • Angles are created when a parallel line is cut by transversal. • The Pythagorean Theorem and its converse.	Students will be skilled at… • I can apply the concept of similarity to write similarity statements. • I can reason that a two-dimensional figure is similar to another if the second can be obtained by a sequence of rotations, reflections, translation, or dilation. • I can describe the sequence of rotations, reflections, translations, or dilations that exhibits the similarity between two-dimensional figures using words and/or symbols. • I can solve basic mathematical Pythagorean Theorem problems and it converse to find missing lengths of sides of triangles in two- and three-dimensions. • I can apply Pythagorean Theorem in solving real-world problems dealing with two- and three-dimensional shapes.

Evidence

Evaluative Criteria	Assessment Evidence
	PERFORMANCE TASK(S): • Aaron's Designs ○ Students use rigid transformations to move a figure on a coordinate plane.

Learning Plan

EngageNY Module 3

Math Practices and Vocabulary

MP.3. Construct viable arguments and critique the reasoning of others. Many times in this module, students are exposed to the reasoned logic of proofs. Students are called on to make conjectures about the effect of dilations on angles, rays, lines, and segments, and then they must evaluate the validity of their claims based on evidence. Students also make conjectures about the effect of dilation on circles, ellipses, and other figures. Students are encouraged to participate in discussions and evaluate the claims of others.

MP.4. Model with mathematics. This module provides an opportunity for students to apply their knowledge of dilation and similarity in real-world applications. Students use shadow lengths and a known height to find the height of trees, the distance across a lake, and the height of a flagpole.

Vocabulary

- Dilation
- Scale drawing
- SImilar
- SImilarity transformation

KPBSD MATH CURRICULUM
8^{th} GRADE
UNIT 4 – LINEAR EQUATIONS

Desired Results

Priority Standards

8.EE.5. Graph linear equations such as *y=mx+b*, interpreting *m* as the slope or rate of change of the graph and *b* as the *y*-intercept or starting value. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

8.EE.8. Analyze and solve systems of linear equations.

a. Show that the solution to a system of two linear equations in two variables is the intersection of the graphs of those equations because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables and estimate solutions by graphing the equations. Simple cases may be done by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*

c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For 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.*

Supporting Standards

Transfer

Students will be able to independently use their learning to…

Draw connections between proportional relationships, lines, and linear equations.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Their knowledge of proportional relationships can be extended to lines and linear equations.
- Equations in one and two variables can be transcribed and solved with symbolic notation and properties of equality.

ESSENTIAL QUESTIONS

Students will keep considering…

- How can I represent proportional relationships using graphs, equations, and words?
- How can I use graphs to solve systems of two equations?
- How can I predict if a system of two equations has one, none, or infinite solutions?

Acquisition

Students will know…

- The unit rate or the slope can be represented in a graph, table of equation.
- The solution to an equation is the value(s) of the variable which makes the equation true.
- With one solution the variable do not cancel out and only one value makes the equation true.
- With no solution the variables cancel out and constants are not equal, no real numbers makes the equation true.
- With infinite solutions, the variable cancel and constants are equal and any real number makes the equation true.
- Systems of equations.

Students will be skilled at…

- I can compare two different proportional relationships represented in different ways.
- I can interprete the unit rate of proportional relationships as the slope of the graph.
- I can estimate the point(s) of intersection for a system of two equations in two unknowns by graphing the equations.
- I can solve simple cases of systems of two linear equations in two variables by inspection.
- I can describe the point(s) of intersection between two lines as points that satisfy both equations simultaneously.

8.EE.6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*. **8.EE.7.** Solve linear equations in one variable. a. 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 successively transforming the 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). b. Solve linear equations with rational coefficients, including equations whose solutions require expanding expressions using the distributive property and combining like terms.		

Evidence

Evaluative Criteria	Assessment Evidence

	PERFORMANCE TASK(S):
	• Bike Ride
	  ○ Students interpret a graph to identify the highest rate of change, maximums, and other features.
	• Journey
	  ○ Students create a graph based on a situation and identify important features.
	• Shelves
	  ○ Students identify linear equations by graph, equation, and situation.
	• Buying Chips and Candy
	  ○ Students use a system of linear equations to solve for variables.
	• Hot Under the Collar

	○ Students analyze two linear equations and the difference between them. • Picking Apples ○ Students use a linear equation to compare values against a graph.

Learning Plan

EngageNY Module 4

Math Practices and Vocabulary

MP.1. Make sense of problems and persevere in solving them. Students analyze given constraints to make conjectures about the form and meaning of a solution to a given situation in one-variable and two-variable linear equations, as well as in simultaneous linear equations. Students are systematically guided to understand the meaning of a linear equation in one variable, the natural occurrence of linear equations in two variables with respect to proportional relationships, and the natural emergence of a system of two linear equations when looking at related, continuous proportional relationships.

MP.2. Reason abstractly and quantitatively. Students de-contextualize and contextualize throughout the module as they represent situations symbolically and make sense of solutions within a context. Students use facts learned about rational numbers in previous grade levels to solve linear equations and systems of linear equations.

MP.3. Construct viable arguments and critique the reasoning of others. Students use assumptions, definitions, and previously established facts throughout the module as they solve linear equations. Students make conjectures about the graph of a linear equation being a line and then proceed to prove this claim. While solving linear equations, they learn that they must first assume that a solution exists and then proceed to solve the equation using properties of equality based on the assumption. Once a solution is found, students justify that it is in fact a solution to the given equation, thereby verifying their initial assumption. This process is repeated for systems of linear equations.

MP.4. Model with mathematics. Throughout the module, students represent real-world situations symbolically. Students identify important quantities from a context and represent the relationship in the form of an equation, a table, and a graph. Students analyze the various representations and draw conclusions and/or make predictions. Once a solution or prediction has been made, students reflect on whether the solution makes sense in the context presented. One example of this is when students determine how many buses are needed for a field trip. Students must interpret their fractional solution and make sense of it as it applies to the real-world.

MP.7. Look for and make use of structure. Students use the structure of an equation to make sense of the information in the equation. *For example, students write equations that represent the constant rate of motion for a person walking. In doing so, they interpret an equation such as $y = 3/5\,x$ as the total distance a person walks, y, in x amount of time, at a rate of 3/5 . Students look for patterns or structure in tables and show that a rate is constant.*

Vocabulary

- Average speed
- Constant speed
- Horizontal line
- Linear equation (description)
- Point-slope equation of a line
- Slope of a line in a cartesian plane
- Slope-intercept equation of a line
- Solution to a system of linear equations (description)
- Standard form of a linear equation
- System of linear equations
- Vertical line
- X-intercept
- Y-intercept
- Coefficient
- Equation
- Like terms
- Linear expression
- Solution
- Term
- Unit rate
- Variable

KPBSD MATH CURRICULUM
8^{th} GRADE
UNIT 5 – EXAMPLES OF FUNCTIONS FROM GEOMETRY

Desired Results

Priority Standards

8.F.2. Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For 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.*

Supporting Standards

8.F.1. Understand that a function is a rule that assigns to each input (the domain) exactly one output (the range). The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. *For example, use the vertical line test to determine functions and non-functions*.

8.F.3. 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. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

8.G.9. Identify and apply the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Transfer

Students will be able to independently use their learning to…
Apply their knowledge of functions to solve real-world problems.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- A function is necessary for describing geometric concepts and occurrences in everyday life.
- Knowledge of linear equations can apply to linear functions.
- Rate of change is the slope of the graph of a line.
- Linear functions and nonlinear functions can be identified by a graph.
- Previous knowledge of volume can be extended to volume formulas for cones, cylinders, and spheres.

ESSENTIAL QUESTIONS

Students will keep considering…

- How can two functions be represented in a variety of ways?
- What is the slope of a line?
- How can the equation y=mx+b be used?
- How are linear and nonlinear functions similar and different?
- How can I apply previous knowledge to extend to volume for cones, cylinders, and spheres?

Acquisition

Students will know…

- Functions algebraically including slope and y-intercept.
- Functions using graphs, tables, and verbal descriptions.
- Definition of "inspection".
- Cases in which a system of two equations in two unknowns has no solution.
- Formulas for volume of cones, cylinders, and spheres.
- There are fundamental differences between discrete and continuous rates.

Students will be skilled at…

- I can compare and contrasting two functions with different representations.
- I can draw conclusions based on different representations of functions.
- I can compare the characteristics of linear and nonlinear functions using various representations.
- I can identify cases in which a system of two equations in two unknowns has an infinite number of solutions.
- I can solve a system of two equations (linear) in two unknowns algebraically.

	• The equation y=mx+b is the defining linear function.	• I can solve simple cases of systems of two linear equations in two variables by inspection. • I can recognize that a linear function is graphed as a straight line. • I can recognize the equation y=mx+b is the equation of a function whose graph is a straight line where m is the slope and b is the y-intercept. • I can provide examples of nonlinear functions using multiple representations. • I can identify and define vocabulary: cone, cylinder, sphere, radius, diameter, circumference, area, volume, pi, base, height. • I can compare the volume of cones, cylinders, and spheres. • I can determine and apply appropriate volume formulas in order to solve mathematical and real-world problems for the given shape. • I can find the radii, height, or approximate for π. Given the volume of a cone, cylinder, or sphere.

Evidence

Evaluative Criteria	**Assessment Evidence**

	PERFORMANCE TASK(S):
	• Linear Graphs
	  ○ Students identify, graph, and match linear equations to situations.
	• Baseball Jersey
	  ○ Students use linear equations to solve a system.
	• Meal Out
	  ○ Students use linear equations to solve a system.
	• Party
	  ○ Students define, use, and identify linear equations from a situation and graph.

Learning Plan

EngageNY Module 5

Math Practices and Vocabulary

MP.2. Reason abstractly or quantitatively. Students examine, interpret, and represent functions symbolically. They make sense of quantities and their relationships in problem situations. For example, students make sense of values as they relate to the total cost of items purchased or a phone bill based on usage in a particular time interval. Students use what they know about rate of change to distinguish between linear and nonlinear functions. Further, students contextualize information gained from the comparison of two functions.

MP.6. Attend to precision. Students use notation related to functions, in general, as well as notation related to volume formulas. Students are expected to clearly state the meaning of the symbols used in order to communicate effectively and precisely to others. Students attend to precision when they interpret data generated by functions. They know when claims are false; for example, calculating the height of an object after it falls for -2 seconds. Students also understand that a table of values is an incomplete representation of a continuous function, as an infinite number of values can be found for a function.

MP.8. Look for and express regularity in repeated reasoning. Students use repeated computations to determine equations from graphs or tables. While focused on the details of a specific pair of numbers related to the input and output of a function, students maintain oversight of the process. As students develop equations from graphs or tables, they evaluate the reasonableness of their equation as they ensure that the desired output is a function of the given input.

Vocabulary

- Area
- Linear equation
- Nonlinear equation
- Rate of change
- Solids
- Volume
- Cone
- Cylinder
- Function
- Lateral edge
- Linear function
- Solid sphere

KPBSD MATH CURRICULUM
8^{th} GRADE
UNIT 6 – LINEAR FUNCTIONS

Desired Results

Priority Standards

8.F.4. 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 (x, y) 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.

8.SP.2. Explain why 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 informally assess the model fit by judging the closeness of the data points to the line.

8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept. *For 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.*

Supporting Standards

8.F.5. Given a verbal description between two quantities, sketch a graph. Conversely, given a graph, describe a possible real-world example. *For example, graph the position of an accelerating car or tossing a ball in the air.*

8.SP.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

Transfer

Students will be able to independently use their learning to…
Understand and use bivariate data in preparation for Algebra I work.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…
- A function assigns exactly one value to each input.
- The relationships of bivariate data can be modeled through using functions.

ESSENTIAL QUESTIONS

Students will keep considering…
- What is a function?
- How can bivariate data be modeled?
- What relationships can be modeled using functions?

Acquisition

Students will know…
- Slope is determined by the constant rate of change.
- The y-intercept is the initial value where x=0.
- Straight lines are used to model relationships between two quantitative variables.
- A linear equation can be used to model situations.
- The equation of a linear model, slope, and intercept in the context of bivariate measurement data.
- A straight line can represent a scatter plot with linear association.

Students will be skilled at…
- I can construct a function to model a linear relationship between two quantities.
- I can relate the rate of change and initial value to real world quantities in a linear function in terms of the situation modeled and in terms of its graph or a table of values.
- I can informally assess the model fit by judging the closeness of the data points to the line.
- I can fit a straight line within the plotted area.
- I can interpret the meaning of the slope and intercept of a linear equation in terms of the situation. *For 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.*

association, linear association, and nonlinear association. **8.SP.4.** Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects and use relative frequencies to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*		• I can interpret the relationship between x and y values by analyzing a graph. • I can interpret scatter plots for bivariate (two different variables such as distance and time) measurement data to investigate patterns of association between two quantities. • I can interpret the data in the two-way table to recognize patterns. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* • I can use relative frequencies of the data to describe relationships (positive, negative, or no correlation).

Evidence

Evaluative Criteria	**Assessment Evidence**

	PERFORMANCE TASK(S):
	• Birds Eggs
	  o Students analyze a scatter plot to identify key features.
	• Scatter Diagram
	  o Students interpret a scatter plot, add points, and create a trend line.
	• Sugar Prices
	  o Students analyze a scatter plot to identify key features.
	• House Prices
	  o Students analyze a scatter plot to identify key features and predict new values.
	• Vincent's Graphs
	  o Students interpret and draw graphs based on given situations.

KPBSD MATH CURRICULUM
8th GRADE
UNIT 6 – LINEAR FUNCTIONS

Learning Plan

EngageNY Module 6

Math Practices and Vocabulary

MP.2. Reason abstractly and quantitatively. Students reason quantitatively by symbolically representing the verbal description of a relationship between two bivariate variables. They attend to the meaning of data based on the context of problems and the possible linear or nonlinear functions that explain the relationships of the variables.

MP.4. Model with mathematics. Students model relationships between variables using linear and nonlinear functions. They interpret models in the context of the data and reflect on whether or not the models make sense based on slopes, initial values, or the fit to the data.

MP.6. Attend to precision. Students evaluate functions to model a relationship between numerical variables. They evaluate the function by assessing the closeness of the data points to the line. They use care in interpreting the slope and the y-intercept in linear functions.

MP.7. Look for and make use of structure. Students identify pattern or structure in scatter plots. They fit lines to data displayed in a scatter plot and determine the equations of lines based on points or the slope and initial value.

Vocabulary

- Categorical variable
- Intercept or initial value
- Numerical variable
- Slope
- Variable
- Two-way frequency table
- Scatter plot
- Relative frequency
- Bivariate data set
- Association

KPBSD MATH CURRICULUM
8th GRADE
UNIT 7 – INTRODUCTION TO IRRATIONAL NUMBERS USING GEOMETRY

Desired Results

Priority Standards

8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.9. Identify and apply the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.

Supporting Standards

8.NS.1. Classify real numbers as either rational (the ratio of two integers, a terminating decimal number, or a repeating decimal number) or irrational.

8.NS.2. Order real numbers, using approximations of irrational numbers, locating them on a number line. *For example, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

8.G.6. Explain the Pythagorean Theorem and its converse.

8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Transfer

Students will be able to independently use their learning to…
Explore the concept of irrational numbers by expanding their use of the Pythagorean Theorem.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Irrational numbers are numbers that can be placed in their approximate position on a number line.
- Irrational numbers exist and are different from rational numbers.
- Positive square roots and cube roots of expressions can be found.
- The Pythagorean Theorem can be expanded to solve real-world problems.

ESSENTIAL QUESTIONS

Students will keep considering…

- What are irrational numbers?
- How can I solve positive square roots and cube roots?
- How can I find a rational approximation of an irrational number?
- How can I apply the Pythagorean Theorem on the coordinate plane and in real-world situations?
- How can I use formulas to solve for volumes of cones, cylinders, and spheres in both real-world and mathematical problems?

Acquisition

Students will know…

- The Pythagorean Theorem and its converse.
- The square root of 2 is irrational.
- The decimal expansion of rational numbers repeats eventually.
- Every number has a decimal expansion.
- The value of expressions involving irrational numbers using rational approximations. *For example, by truncating the decimal expansion of 2, show that 2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Students will be skilled at…

- I can solve basic mathematical Pythagorean Theorem problems and it converse to find missing lengths of sides of triangles in two and three dimensions.
- I can apply Pythagorean Theorem in solving real-world problems dealing with two and three-dimensional shapes.
- I can compare the volume of cones, cylinders, and spheres.
- I can use square root and cube root symbols to represent solutions to equations of the form

	• The difference between rational and irrational numbers. • Formulas for volumes, cone, cylinder, and sphere.	x^2= p and x^3= p, where p is a positive rational number. • I can determine and apply appropriate volume formulas in order to solve mathematical and real-world problems for the given shape. • I can approximate for π, given the volume of a cone, cylinder, or sphere. • I can compare the size of irrational numbers using rational approximations. • I can determine how to create a right triangle from two points on a coordinate graph. • I can use the Pythagorean Theorem to solve for the distance between the two points. • I can evaluate cube roots of small perfect cubes. • I can evaluate square roots of small perfect squares. • I can convert a decimal expansion which repeats eventually into a rational number. • I can approximate irrational numbers as rational numbers. • I can approximately locate irrational numbers on a number line.

Evidence

Evaluative Criteria	Assessment Evidence

	PERFORMANCE TASK(S):
	• Short Tasks - The Number System
	  ○ Students uses their understanding of the number system to solve various problems.
	• Proofs of the Pythagorean Theorem
	  ○ Students are presented with multiple proofs of the Pythagorean Theorem and are asked to anyalze them.
	• Janes TV
	  ○ Students learn how the PythagoreanTheorem applies to classification of a TV and its diagonal and how much area it will take up.
	• Temple Geometry
	  ○ Students explore a Japanese Circle Puzzle and solve using triangle properties.
	• Pythagorean Triples
	  ○ Students investigate the concept of Pythagorean Triples.
	• Circles and Squares
	  ○ Students explore the ratios of circles inscribed in squares.
	• Matchsticks
	  ○ Students determine how many match sticks could fit into a log based on volume.
	• Glasses
	  ○ Students investigate the difference in volume of three different types of glasses.
	• Rugs
	  ○ The task challenges a student to demonstrate understanding of the concepts of irrational numbers, the Pythagorean Theorem and use it to calculate perimeter/circumference.

Learning Plan

EngageNY Module 7

Math Practices and Vocabulary

MP.6. Attend to precision. Students begin attending to precision by recognizing and identifying numbers as rational or irrational. Students know the definition of an irrational number and can represent the number in different ways (e.g., as a root, as a non-repeating decimal block, or as a symbol such as π). Students will attend to precision when clarifying the difference between an exact value of an irrational number compared to the decimal approximation of the irrational number. Students use appropriate symbols and definitions when they work through proofs of the Pythagorean Theorem and its converse. Students know and apply formulas related to volume of cones and truncated cones.

MP.7. Look for and make use of structure. Students learn that a radicand can be re-written as a product and that sometimes one or more of the factors of the product can be simplified to a rational number. Students look for structure in repeating decimals, recognize repeating blocks, and know that every fraction is equal to a repeating decimal. Additionally, students learn to see composite solids as made up of simpler solids. Students interpret numerical expressions as representations of volumes of complex figures.

MP.8. Look for and express regularity in repeated reasoning. While using the long division algorithm to convert fractions to decimals, students recognize that when a sequence of remainders repeats, the decimal form of the number will contain a repeat block. Students recognize that when the decimal expansion of a number does not repeat or terminate, the number is irrational and can be represented with a method of rational approximation using a sequence of rational numbers to get closer and closer to the given number.

Vocabulary

- Cube root
- Perfect square
- Irrational number
- Real number
- Square root
- Rational approximation
- Decimal expansion
- Finite decimals
- Number line
- Rate of change
- Rational number
- Volume