

Math 8

Course Description: In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Math 8 builds on what students have learned about proportional and geometric relationships in Math 7 to develop several key concepts in algebra and geometry. Students start the year with rigid transformations and congruence in Unit 1, which sets them up to learn about similarity and dilations in Unit 2. Students use what they know about similar triangles to explore slope as they study linear relationships in Unit 3. This work with linear relationships builds toward solving linear equations with variables on both sides of the equal sign, and systems of linear equations in Unit 4.

Unit 5 invites students to consider functions, specifically what makes a relationship a function. Unit 5 also explores the volumes of cylinders, cones, and spheres. Unit 6 returns to linear relationships as students explore bivariate data. Unit 7 builds on the exponent work from Math 6 to explore properties of exponents and scientific notation as a tool for representing very large and very small quantities. Math 8 ends with the Pythagorean theorem as students encounter square roots, cube roots, and irrational numbers for the first time.

As students encounter challenging problems, and practice asking for help and a willingness to learn from others, they build the social emotional learning competencies of self-management, self awareness, relationship skills, and social awareness.

Grades: 8

Course Resources & Materials: DESMOS

Course Essential Questions (5-10):

- How is mathematics used to measure, model and calculate change?
- How can we use graphing and algebra to find the solution to a system of equations?
- What does a solution represent?

- Why is it important to know which variable is the independent variable?
- How do you use patterns to understand data?
- How can I represent very small and large numbers using integer exponents and scientific notation?
- How can the Pythagorean Theorem be used to solve problems?

Course Priority Standards (5-10):

- **8.EE1.B.6b:** Understand the connections between proportional relationships, lines and linear equations. Apply concepts of slope and y-intercept to graphs, equations and proportional relationships: b. 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.EE1.A.1:** Work with radicals and integer exponents. Know and apply the properties of integer exponents to generate equivalent expressions.
- **8.EE1.C.7a:** Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Solve linear equations and inequalities in one variable: a. Create and identify linear equations with one solution, infinitely many solutions or no solutions.
- **8.EE1.C.8d:** Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Analyze and solve systems of linear equations: d. Solve systems of two linear equations.
- **8.GM.B.6:** Understand and apply the Pythagorean Theorem. Use models to demonstrate a proof of the Pythagorean Theorem and its converse.
- **8.F.A.1b:** Define, evaluate and compare function: Explore the concept of functions. (The use of function notation is not required.): b. Determine if a relation is a function.
- **8.F.B.4a:** Use functions to model relationships between quantities. Use functions to model linear relationships between quantities: a. Explain the parameters of a linear function based on the context of a problem.
- **8.DSP.A.3:** Investigate patterns of association in bivariate data. Interpret the parameters of a linear model of bivariate measurement data to solve problems.

Course Enduring Understandings, Goals, & Objectives (5-10):

- There is often more than one-way to write an equation.
- The rate of change in a linear relationship is represented by the slope of the line representing the relationship.
- Geometry occurs in many situations, from architecture to floor patterns.
- Functions can model relationships between quantities.
- Patterns of data can be used to inform decision making.
- Right triangles have a special relationship among the side lengths which can be represented by a model and a formula.

- Scientific notation is used to represent very large or very small numbers.

Course Essential Vocabulary: reflection, rotation, translation, clockwise, counterclockwise, image, sequence of transformations, transformation, corresponding, congruent, rigid transformation, transversal, vertical angles, dilation, center of a dilation, scale factor, similar, slope, rate of change, linear relationship, vertical intercept, solution to an equation with two variables, term, constant term, system of equations, scatter plot, outlier, positive association, negative association, two-way table, segmented bar graph, relative frequency, exponent, base (of an exponent), power of ten, scientific notation, cube root, hypotenuse, irrational number, legs, Pythagorean theorem, rational number, square root

Unit 1	Rigid Transformations (Approximately 20 Days)
Unit 1 Big Ideas <i>(Understandings)</i>	• Geometry occurs in many situations, from architecture to floor patterns. • Similar objects are a combination of rigid motions and dilation. • Rigid motions create images that are congruent to the original.
Unit 1 Guiding & Essential Questions	• When using transformations, how are the angles, lengths, or figures changing or staying the same? • How can I determine if two figures are identical? • How do I complete a transformation in the coordinate plane? • How do I know if two figures are similar? • How do I know if angles are congruent?
Unit 1 Student Learning Goal(s)	• Students will describe and perform translations, rotations, and reflections on a grid. • Students will determine whether two figures are congruent using rigid transformations. • Students will use transformations to determine missing angle measurements and discover new angle relationships. • Students will identify and describe sequences of transformations that take one figure to another in the context. • Students will use the terms translation, rotation, and reflection to describe and draw transformations on a grid. • Students will use coordinates to describe figures and their images under transformations in the coordinate plane. • Students will communicate precisely about transformations of polygons on a coordinate grid.

	• Students will see that parallel lines are taken to parallel lines under any rigid transformations. • Students will justify that pairs of vertical angles and alternate interior angles on parallel lines are congruent. • Students will observe that the sum of the interior angles of any triangle is always 180 degrees. • Students will apply what they've learned about angle relationships to informally establish the triangle sum theorem. • Students will examine and create different patterns of shapes, including tessellations and complex designs that exhibit rotational symmetry.
Unit 1 Vocabulary	reflection, rotation, translation, clockwise, counterclockwise, image, sequence of transformations, transformation, corresponding, congruent, rigid transformation, transversal, vertical angles
Unit 1 Missouri Learning Standards	8.GM.A.1a: Understand congruence and similarity using physical models, transparencies or geometry software. Verify experimentally the congruence properties of rigid transformations: a. Verify that angle measure, betweenness, collinearity and distance are preserved under rigid transformations. 8.GM.A.1b: Understand congruence and similarity using physical models, transparencies or geometry software. Verify experimentally the congruence properties of rigid transformations: b. Investigate if orientation is preserved under rigid transformations. 8.GM.A.2a: Understand congruence and similarity using physical models, transparencies or geometry software. Understand that two-dimensional figures are congruent if a series of rigid transformations can be performed to map the pre-image to the image: a. Describe a possible sequence of rigid transformations between two congruent figures. 8.GM.A.3: Understand congruence and similarity using physical models, transparencies or geometry software. Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. 8.GM.A.5a: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: a. Derive the sum of the interior angles of a triangle. 8.GM.A.5b: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: b. Explore the relationship between the interior and exterior angles of a triangle. 8.GM.A.5c: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: c. Construct and explore the angles created when parallel lines are cut by a transversal.

	8.GM.A.5d: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: d. Use the properties of similar figures to solve problems.
Unit 1 Common Core State Standards	CCSS.MATH.CONTENT.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:
	CCSS.MATH.CONTENT.8.G.A.1.A Lines are taken to lines, and line segments to line segments of the same length.
	CCSS.MATH.CONTENT.8.G.A.1.B Angles are taken to angles of the same measure.
	CCSS.MATH.CONTENT.8.G.A.1.C Parallel lines are taken to parallel lines.
	CCSS.MATH.CONTENT.8.G.A.2 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; given two congruent figures, describe a sequence that exhibits the congruence between them.
	CCSS.MATH.CONTENT.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	CCSS.MATH.CONTENT.8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i>
Unit 1 Assessments <i>(Minimum 1 Summative, 1 Formative)</i>	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 1	DESMOS

Unit 2	Dilations, Similarity, and Introducing Slope (Approximately 20 days)
Unit 2 Big Ideas	• Dilations create similar figures. • The slope of a line is a measure of its steepness.
Unit 2 Guiding & Essential Questions	• How does similarity connect to proportional reasoning? • How can I use angle relationships to find missing measurements? • How do I recognize similar polygons and solve proportions based on their relationships? • Why does the slope of a line remain constant?
Unit 2 Student Learning Goal(s)	• Students will describe dilations precisely in terms of their center of dilation and scale factor. • Students will apply dilations to figures on and off of a coordinate grid. • Students will identify similar figures and properties of similar figures using transformations. • Students will explain slope in terms of similar triangles on the same line and determine the slopes of lines. • Students will perform dilations, moving from informal to formal ways of measuring to determine the distances between the center, pre-image, and image in any dilation. • Students will discover that dilations map line segments to line segments, and polygons to polygons. • Students will identify and describe sequences of transformations, including dilations, that take one figure to another. • Students will examine the side lengths and angle measurements of polygons in order to understand similarity. • Students will examine angle measurements in triangles to determine whether or not two triangles are similar. • Students will discover that the quotient of two side lengths in one triangle is equal to the quotient of the corresponding side lengths in a similar triangle. • Students will use slope to help determine if points lie on a particular line.
Unit 2 Vocabulary	dilation, center of a dilation, scale factor, similar, slope
Unit 2 Missouri Learning Standards	8.GM.A.3: Understand congruence and similarity using physical models, transparencies or geometry software. Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.

	8.GM.A.4a: Understand congruence and similarity using physical models, transparencies or geometry software. Understand that two-dimensional figures are similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image: a.Describe a possible sequence of transformations between two similar figures.
	8.GM.A.5a: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: a.Derive the sum of the interior angles of a triangle.
	8.GM.A.5b: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: b.Explore the relationship between the interior and exterior angles of a triangle.
	8.GM.A.5c: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: c.Construct and explore the angles created when parallel lines are cut by a transversal.
	8.GM.A.5d: Understand congruence and similarity using physical models, transparencies or geometry software. Explore angle relationships and establish informal arguments: d.Use the properties of similar figures to solve problems.
	8.EEI.B.6a: Understand the connections between proportional relationships, lines and linear equations. Apply concepts of slope and y-intercept to graphs, equations and proportional relationships: a.Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane.
	8.EEI.B.6b: Understand the connections between proportional relationships, lines and linear equations. Apply concepts of slope and y-intercept to graphs, equations and proportional relationships: b.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.
Unit 2 Common Core State Standards	CCSS.MATH.CONTENT.8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	CCSS.MATH.CONTENT.8.G.A.4 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; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

	CCSS.MATH.CONTENT.8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.
	CCSS.MATH.CONTENT.8.EE.B.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.
Unit 2 Assessments (Minimum 1 Summative, 1 Formative)	To be written in implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 2	DESMOS

Unit 3	Proportional and Linear Relationships (Approximately 20 Days)
Unit 3 Big Ideas	- Two variables are in a linear relationship if one variable is changing by a constant amount when the other variable changes by increments of 1 unit. - The rate of change in a linear relationship is represented by the slope of the line representing the relationship.
Unit 3 Guiding & Essential Questions	- How is mathematics used to measure, model and calculate change? - How are the characteristics of a linear relationship relevant in a real world situation?
Unit 3 Student Learning Goal(s)	- Students will compare proportional relationships using their equations, tables, and graphs. - Students will interpret the intercept and slope of the graph or equation of a linear relationship.

	• Students will use the concept that a graph represents all solutions of an equation to solve problems. • Students will scale axes in multiple ways in order to graph proportional relationships • Students will compare two different proportional relationships given different representations on them. • Students will write and interpret equations of lines by considering the slope and vertical intercept. • Students will write equations of lines using the idea that any line in a plane is a vertical translation of a line through the origin. • Students will develop a method for calculating the slope of any line given the coordinates of two points on the line. • Students will write equations of horizontal and vertical lines in addition to lines with positive and negative slopes. • Students will interpret multiple representations of non-proportional linear relationships in context, including slopes, intercepts, and solutions.
Unit 3 Vocabulary	rate of change, linear relationship, vertical intercept, solution to an equation with two variables
Unit 3 Missouri Learning Standards	8.EE1.B.5a: Understand the connections between proportional relationships, lines and linear equations. Graph proportional relationships: a. Interpret the unit rate as the slope of the graph.
	8.EE1.B.5b: Understand the connections between proportional relationships, lines and linear equations. Graph proportional relationships: b. Compare two different proportional relationships.
	8.EE1.B.6a: Understand the connections between proportional relationships, lines and linear equations. Apply concepts of slope and y-intercept to graphs, equations and proportional relationships: a. Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane.
	8.EE1.B.6b: Understand the connections between proportional relationships, lines and linear equations: Apply concepts of slope and y-intercept to graphs, equations and proportional relationships: b. 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.EE1.C.7a: Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Solve linear equations and inequalities in one variable: a. Create and identify linear equations with one solution, infinitely many solutions or no solutions.
	8.EE1.C.7b: Analyze and solve linear equations and inequalities and pairs of simultaneous linear

	equations. Solve linear equations and inequalities in one variable: b.Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms.
Unit 3 Common Core State Standards	CCSS.MATH.CONTENT.8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. 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.
	CCSS.MATH.CONTENT.8.EE.B.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.
	CCSS.MATH.CONTENT.8.EE.C.7 Solve linear equations in one variable.
	CCSS.MATH.CONTENT.8.EE.C.7.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).
	CCSS.MATH.CONTENT.8.EE.C.7.B Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
Unit 3 Assessments <i>(Minimum 1 Summative, 1 Formative)</i>	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 3	DESMOS

Unit 4	Linear Equations and Linear Systems (Approximately 20 Days)
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Unit 4 Big Ideas	• The solution to a system of linear equations can be found graphically or algebraically. • Analyzing the equations and the situation can help you to determine which strategy is most appropriate to apply. • The strategies for solving linear equations, linear inequalities, and systems of linear equations can be extended to solving systems of linear inequalities using the properties of inequality.
Unit 4 Guiding & Essential Questions	• How can we use graphing and algebra to find the solution to a system of equations? • What does a solution represent? • If given two pairs of points, will they intersect? • When will a system not have a solution?
Unit 4 Student Learning Goal(s)	• Students will write and solve equations with multiple occurrences of one variable. • Students will use graphs and algebraic methods to solve systems of linear equations with two variables. • Students will create and solve number puzzles that can be represented by linear equations in one variable. • Students will use hanger diagrams to calculate unknown weights of objects by adding and removing equal items from each side. • Students will categorize linear equations in one variable based on their structure, and solve equations from each category. • Students will determine what it means to set two expressions equal to each other and solve for the unknown variable. • Students will interpret points that lie on one, both, or neither line on a graph of two simultaneous equations in context. • Students will create and interpret a graph of two lines in context. • Students will understand that solving a system of equations means finding values of the variables that make both equations true. • Students will solve a system of equations using algebraic methods. • Students will identify, describe, and employ strategies for solving linear systems of equations with different features or structures.
Unit 4 Vocabulary	term, constant term, system of equations
Unit 4 Missouri	8.EE1.C.7a: Analyze and solve linear equations and inequalities and pairs of simultaneous linear

Learning Standards	equations. Solve linear equations and inequalities in one variable: a.Create and identify linear equations with one solution, infinitely many solutions or no solutions.
	8.EEI.C.7b: Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Solve linear equations and inequalities in one variable: b.Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms.
	8.EEI.C.8a: Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Analyze and solve systems of linear equations: a.Graph systems of linear equations and recognize the intersection as the solution to the system.
	8.EEI.C.8b: Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Analyze and solve systems of linear equations: b.Explain why solution(s) to a system of two linear equations in two variables correspond to point(s) of intersection of the graphs.
	8.EEI.C.8c: Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations. Analyze and solve systems of linear equations: c.Explain why systems of linear equations can have one solution, no solution or infinitely many solutions.
Unit 4 Common Core State Standards	CCSS.MATH.CONTENT.8.EE.C.7 Solve linear equations in one variable.
	CCSS.MATH.CONTENT.8.EE.C.7.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).
	CCSS.MATH.CONTENT.8.EE.C.7.B Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
	CCSS.MATH.CONTENT.8.EE.C.8 Analyze and solve pairs of simultaneous linear equations.
	CCSS.MATH.CONTENT.8.EE.C.8.A Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

	CCSS.MATH.CONTENT.8.EE.C.8.B Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
	CCSS.MATH.CONTENT.8.EE.C.8.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.
Unit 4 Assessments <i>(Minimum 1 Summative, 1 Formative)</i>	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 4	DESMOS

Unit 5	Functions and Volume (Approximately 20 Days)
Unit 5 Big Ideas	• Functions can model relationships between quantities. • Functions can be used to describe how changing one variable can affect another variable. • A function is a specific type of relationship in which each input has a unique output.
Unit 5 Guiding & Essential Questions	• How would you interpret the features (e.g. rate of change, initial value, increasing/decreasing) of a function, in a real world context? • How do you determine if relations are functions? • How is a function different from a relation? • Why is it important to know which variable is the independent variable? • How can a function be recognized in any form? • What is the best way to represent a function?
Unit 5 Student Learning Goal(s)	• Students will determine whether or not graphs, tables, or rules represent functions. • Students will create and interpret graphs of functions that represent stories.

	• Students will calculate and compare the volumes of cylinders, cones, and spheres. • Students will use the relationships between height, radius, and volume to calculate missing dimensions. • Students will write rules based on input-output pairs represented in tables. • Students will determine whether or not a graph represents a function and explain their reasoning. • Students will explore the relationship between equations and functions, and understand that an equation may look different depending on how the independent and dependent variables are defined. • Students will interpret qualitative features of a function and specific points in context. • Students will draw the graph of a function that represents a real world situation. • Students will use data points to model a linear function and decide when it is reasonable to model the relationship with a linear function. • Students will use piecewise functions to model real-world data sets presented as graphs. • Students will estimate the volume of cylinders, cones, cubes, and spheres. • Students will explore and use a strategy to calculate the volume of a cylinder. • Students will use functions to explore how changing a cylinder's radius or height impacts its volume. • Students will recognize that the volume of a cone is $\frac{1}{3}$ the volume of a cylinder with the same radius and the same height. • Students will calculate missing dimensions of cylinders and cones given their volume and another dimension. • Students will develop and use a formula for the volume of a sphere.
Unit 5 Vocabulary	function, dependent variable, independent variable, cone, cylinder, radius, sphere, volume
Unit 5 Missouri Learning Standards	8.F.A.1a: Define, evaluate and compare functions. Explore the concept of functions. (The use of function notation is not required.): a. Understand that a function assigns to each input exactly one output. 8.F.A.1b: Define, evaluate and compare functions. Explore the concept of functions. (The use of function notation is not required.): b. Determine if a relation is a function. 8.F.A.1c: Define, evaluate and compare functions. Explore the concept of functions. (The use of function notation is not required.): c. Graph a function. 8.F.A.2: Define, evaluate and compare functions. Compare characteristics of two functions each represented in a different way.

	8.F.A.3a: Define, evaluate and compare functions. Investigate the differences between linear and nonlinear functions: a. Interpret the equation $y = mx + b$ as defining a linear function, whose parameters are the slope (m) and the y-intercept (b).
	8.F.A.3b: Define, evaluate and compare functions. Investigate the differences between linear and nonlinear functions: b. Recognize that the graph of a linear function has a constant rate of change.
	8.F.A.3c: Define, evaluate and compare functions. Investigate the differences between linear and nonlinear functions: c. Give examples of nonlinear functions.
	8.F.B.4a: Use functions to model relationships between quantities. Use functions to model linear relationships between quantities: a. Explain the parameters of a linear function based on the context of a problem.
	8.F.B.4b: Use functions to model relationships between quantities. Use functions to model linear relationships between quantities: b. Determine the parameters of a linear function.
	8.F.B.4c: Use functions to model relationships between quantities. Use functions to model linear relationships between quantities: c. Determine the x-intercept of a linear function.
	8.F.B.5: Use functions to model relationships between quantities. Describe the functional relationship between two quantities from a graph or a verbal description.
	8.GM.C.9a: Solve problems involving volume of cones, pyramids and spheres. Solve problems involving surface area and volume: a. Understand the concept of surface area and find surface area of pyramids.
	8.GM.C.9b: Solve problems involving volume of cones, pyramids and spheres. Solve problems involving surface area and volume: b. Understand the concepts of volume and find the volume of pyramids, cones and spheres.
Unit 5 Common Core State Standards	CCSS.MATH.CONTENT.8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.1
	CCSS.MATH.CONTENT.8.F.A.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.
	CCSS.MATH.CONTENT.8.F.A.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. <i>For example, the function $A = s^2$ giving the area of a square as</i>

	<i>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.</i>
	CCSS.MATH.CONTENT.8.F.B.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.
	CCSS.MATH.CONTENT.8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
	CCSS.MATH.CONTENT.8.G.C.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
Unit 5 Assessments (Minimum 1 Summative, 1 Formative)	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 5	DESMOS

Unit 6	Associations in Data (Approximately 20 Days)
Unit 6 Big Ideas	• Patterns of data can be used to inform decision making. • There are different types of graphs that are dependent upon the data gathered.
Unit 6 Guiding & Essential Questions	• How do you use patterns to understand data? • What's the impact of including outliers? • Why is it important to have solid data?
Unit 6 Student Learning Goal(s)	• Students will examine different ways to organize bivariate data, including scatter plots.

	• Students will use scatter plots and fitted lines to analyze numerical data and identify associations. • Students will use two-way tables and bar graphs to identify associations in categorical data. • Students will compare and contrast the same data represented by a dot plot and by a scatter plot • Students will interpret points on a scatter plot in terms of a context and add points to a scatter plot given information about an individual in the population. • Students will practice creating linear models that match the association of sets of data. • Students will interpret the slope of a line of fit in context. • Students will visualize clustering and associations in data. • Students will analyze and interpret bivariate data in context. • Students will study categorical data displayed in two-way tables and in bar graphs. • Students will use relative frequencies displayed in tables and in segmented bar graphs to identify possible associations between variables in data.
Unit 6 Vocabulary	scatter plot, outlier, positive association, negative association, two-way table, segmented bar graph, relative frequency
Unit 6 Missouri Learning Standards	8.DSP.A.1: Investigate patterns of association in bivariate data. Construct and interpret scatter plots of bivariate measurement data to investigate patterns of association between two quantities. 8.DSP.A.2: Investigate patterns of association in bivariate data. Generate and use a trend line for bivariate data, and informally assess the fit of the line. 8.DSP.A.3: Investigate patterns of association in bivariate data. Interpret the parameters of a linear model of bivariate measurement data to solve problems. 8.DSP.A.4a: Investigate patterns of association in bivariate data. Understand the patterns of association in bivariate categorical data displayed in a two-way table: a. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. 8.DSP.A.4b: Investigate patterns of association in bivariate data. Understand the patterns of association in bivariate categorical data displayed in a two-way table: b. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
Unit 6 Common Core State Standards	CCSS.MATH.CONTENT.8.SP.A.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 association, linear association, and nonlinear association.

	CCSS.MATH.CONTENT.8.SP.A.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
	CCSS.MATH.CONTENT.8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and 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.
	CCSS.MATH.CONTENT.8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. 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 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?
Unit 6 Assessments (Minimum 1 Summative, 1 Formative)	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 6	DESMOS

Unit 7	Exponents and Scientific Notation (Approximately 20 Days)
Unit 7 Big Ideas	• Tables and graphs can provide more information about an exponential function and help solve problems. • There is often more than one-way to write an equation. The ability to rewrite an equation as an equivalent expression can be helpful when solving problems involving exponential functions and relationships.

	• There are rules for working with exponential expressions. These properties of exponents are useful in writing equivalent expressions and particularly when working with values written in scientific notation. • Exponential Notation is a way to express repeated products of the same number. • All real numbers, rational and irrational, can be plotted on a number line. • Rational approximations of irrationals can be used to compare sizes, estimate locations on a number line and estimate values of expressions. • Scientific notation is used to represent very large or very small numbers.
Unit 7 Guiding & Essential Questions	• How can we use exponential laws to do calculations in Scientific Notation? • What are exponents? • How can we simplify exponential expressions? • How can I represent very small and large numbers using integer exponents and scientific notation? • How can I perform operations with numbers expressed in scientific notation? • What are some applications of scientific notation?
Unit 7 Student Learning Goal(s)	• Students will identify and create equivalent expressions involving positive, negative, and zero exponents. • Students will express and perform operations with very large or very small quantities using powers of 10 and scientific notation. • Students will discover ways to write equivalent exponential expressions involving the product of powers and powers of powers. • Students will look for and make use of structure to identify equivalent exponent expressions that use powers of powers and products of powers. • Students will rewrite products of powers, quotients of powers, and powers of powers as single powers. • Students will develop an understanding of the meaning of zero and negative exponents. • Students will write rules for simplifying exponential expressions. • Students will represent large and small numbers using multiples of powers of 10 • Students will apply powers of 10 and exponent rules to solve problems in context.

	- Students will multiply and divide numbers expressed in scientific notation, and express how many times as much one quantity is as the other. - Students will add and subtract numbers expressed in scientific notation and express the resulting sums and differences in scientific notation. - Students will use scientific notation as a tool for comparing, combining, and operating.
Unit 7 Vocabulary	exponent, base (of an exponent), power of ten, scientific notation
Unit 7 Missouri Learning Standards	8.EE.I.A.1: Work with radicals and integer exponents. Know and apply the properties of integer exponents to generate equivalent expressions.
	8.EE.I.A.3: Work with radicals and integer exponents. Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other.
	8.EE.I.A.4a: Work with radicals and integer exponents. Use scientific notation to solve problems: a.Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.
	8.EE.I.A.4b: Work with radicals and integer exponents. Use scientific notation to solve problems: b.Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.
Unit 7 Common Core State Standards	CCSS.MATH.CONTENT.8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $32 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
	CCSS.MATH.CONTENT.8.EE.A.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 times 10^8 and the population of the world as 7 times 10^9 , and determine that the world population is more than 20 times larger.
	CCSS.MATH.CONTENT.8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology
Unit 7 Assessments (Minimum 1 Summative, 1 Formative)	To be written in Implementation, Year 1 (2023-24)

Curricular Resources Utilized in Unit 7	DESMOS
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Unit 8	The Pythagorean Theorem and Irrational Numbers (Approximately 20 Days)
Unit 8 Big Ideas	• The Pythagorean Theorem can be used both algebraically and geometrically to solve problems involving right triangles. • Right triangles have a special relationship among the side lengths which can be represented by a model and a formula.
Unit 8 Guiding & Essential Questions	• What is the length of the side of a square of a certain area? • What is the relationship among the lengths of the sides of a right triangle? • How can the Pythagorean Theorem be used to solve problems? • How do I know that I have a convincing argument to informally prove Pythagorean Theorem? • What is Pythagorean Theorem and when does it apply?
Unit 8 Student Learning Goal(s)	• Students will understand that square roots and cube roots represent the edge length of squares and cubes, and approximate their values. • Students will use the Pythagorean theorem and its converse to reason about right triangles and find unknown measurements. • Students will determine fractions and decimal approximations for rational and irrational numbers. • Students will estimate side lengths of squares with known areas and review strategies for calculating areas. • Students will develop an understanding of square roots and square root notation. • Students will approximate the value of square roots by determining the two integer values it lies between and by drawing a square. • Students will explore the relationship between the edge length and the volume of a cube. • Students will identify patterns in the relationship between the squares of side lengths of triangles and learn that the relationship between the side lengths of a right triangle is that Pythagorean theorem.

	• Students will use the Pythagorean theorem to calculate side lengths of right triangles. • Students will develop and apply their understanding of the converse of the Pythagorean theorem. • Students will use the Pythagorean theorem as a tool to solve problems involving diagonal distances. • Students will apply the pythagorean theorem to find distances between points in the coordinate plane. • Students will explore connections between unit fractions and their decimal representations using long division to convert fractions to decimals. • Students will develop a strategy for rewriting repeating decimals as fractions.
Unit 8 Vocabulary	cube root, hypotenuse, irrational number, legs, Pythagorean theorem, rational number, square root
Unit 8 Missouri Learning Standards	8.NS.A.1a: Know that there are numbers that are not rational, and approximate them by rational numbers. Explore the real number system: a. Know the differences between rational and irrational numbers. 8.NS.A.1b: Know that there are numbers that are not rational, and approximate them by rational numbers. Explore the real number system: b. Understand that all rational numbers have a decimal expansion that terminates or repeats. 8.NS.A.1c: Know that there are numbers that are not rational, and approximate them by rational numbers. Explore the real number system: c. Convert decimals which repeat into fractions and fractions into repeating decimals. 8.NS.A.1d: Know that there are numbers that are not rational, and approximate them by rational numbers. Explore the real number system: d. Generate equivalent representations of rational numbers. 8.NS.A.2: Know that there are numbers that are not rational, and approximate them by rational numbers. Estimate the value and compare the size of irrational numbers and approximate their locations on a number line. 8.EE1.A.2a: Work with radicals and integer exponents. Investigate concepts of square and cube roots: a. Solve equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. 8.EE1.A.2b: Work with radicals and integer exponents. Investigate concepts of square and cube roots: b. Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000. 8.EE1.A.2c: Work with radicals and integer exponents. Investigate concepts of square and cube roots: c. Recognize that square roots of non-perfect squares are irrational. 8.GM.B.6: Understand and apply the Pythagorean Theorem. Use models to demonstrate a proof of the Pythagorean Theorem and its converse. 8.GM.B.7: Understand and apply the Pythagorean Theorem. Use the Pythagorean Theorem to determine unknown side lengths in right triangles in problems in two- and three-dimensional contexts.

	8.GM.B.8: Understand and apply the Pythagorean Theorem. Use the Pythagorean Theorem to find the distance between points in a Cartesian coordinate system.
Unit 8 Common Core State Standards	CCSS.MATH.CONTENT.8.EE.A.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 $\sqrt{2}$ is irrational.
	CCSS.MATH.CONTENT.8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
	CCSS.MATH.CONTENT.8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
	CCSS.MATH.CONTENT.8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse.
	CCSS.MATH.CONTENT.8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
	CCSS.MATH.CONTENT.8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
Unit 2 Assessments <i>(Minimum 1 Summative, 1 Formative)</i>	To be written in Implementation, Year 1 (2023-24)
Curricular Resources Utilized in Unit 2	DESMOS

