

Curriculum Map: 8th Grade Algebra 2024

Course: 8 Algebra Sub-topic: Algebra

Grade(s): 8

Course Description: Algebra I is an exploration of variables, function patterns, graphs, and equations. Students are expected to describe and translate graphic, algebraic, numeric, and verbal representations of relations and use those representations to solve problems. Students are introduced to rational numbers, systems of equations and inequalities, exponential functions, factoring, and quadratic equations and functions. Algebra I provides a solid foundation for further study in mathematics by helping students develop computational, procedural, and problem solving skills.

In addition 8th grade Algebra students will focus on the three critical areas required for regular 8th grade math curriculum: (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.

Essential Questions: How are relationships represented mathematically? How can expressions, equations, and inequalities be used to quantify, solve, model and/or analyze mathematical situations? What does it mean to estimate or analyze numerical quantities? When is it appropriate to estimate versus calculate? What makes a tool and/or strategy appropriate for a given task? How does the type of data influence the choice of display? How can probability and data analysis be used to make predictions? How are spatial relationships, including shape and dimension, used to draw, construct, model, and represent real situations or solve problems? How can the application of the attributes of geometric shapes support mathematical reasoning and problem solving? How can geometric properties and theorems be used to describe, model, and analyze situations? How can data be organized and represented to provide insight into the relationship between quantities? How is mathematics used to quantify, compare, represent, and model numbers? How can mathematics support effective communication? Why does “what” we measure influence “how” we measure? In what ways are the mathematical attributes of objects or processes measured, calculated, and/or interpreted? How precise do measurements and calculations need to be? How can patterns be used to describe relationships in mathematical situations? How can recognizing repetition or regularity assist in solving problems more efficiently?

Course Textbooks, Workbooks, Materials Citations: Maneuvering the Middle Online Curriculum
Prentice Hall Algebra 1 textbook
Digital resources, online text and ancillary materials
CDT Testing for Benchmarking
Khan Academy
Study Island
Moby Max
Various websites and print resources

Course Notes: Basic math facts, computation, and word problems are integrated into each module.
Vocabulary Acquisition: Integrated into each module as dedicated by student need.

Unit: Module 1: Operations and Linear Equations & Linear Inequalities
Timeline: 18 Weeks

Unit Assignments:

Concept	Unit Goals/ Standards	Objectives	Assessments
Rational Numbers	Distinguish between rational and irrational numbers using their properties. CC.2.1.8.E.1 Estimate irrational numbers by comparing them to rational numbers. CC.2.1.8.E.4 Apply properties of rational and irrational numbers to solve real-world or mathematical problems. CC.2.1.HS.F.2	Make sense of problems and persevere in solving them.	Assessments: Summative Assessments Informal Assessments Formal Assessments Practice May Include: Test Quizzes Exit Ticket Practice Exercises Conference with the teacher
		Reason abstractly and quantitatively.	
		Construct viable arguments and critique reasoning of others.	
		Model with mathematics.	
		Use appropriate tools strategically.	
		Attend to precision.	
		Look for and make use of structure.	
		Look for and express regularity in repeated reasoning.	

Equations	Apply inverse operations to solve equations or formulas for a given variable. CC.2.2.HS.D.8 Apply concepts of radicals and integer exponents to generate equivalent expressions. CC.2.2.8.B.1 Apply and extend the properties of exponents to solve problems with rational exponents. CC.2.1.HS.F.1 Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations. CC.2.2.7.B.3 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.9	Translate verbal quantitative situations into algebraic expressions and vice versa. Model real-world situations with algebraic expressions. Evaluate algebraic expressions for a given replacement set to include rational numbers. Solve a literal equation (formula) for a specified variable. Simplify expressions and solve equations, using the field properties of the real numbers and properties of equality to justify simplification and solution. Simplify equations using the distributive property, combining like terms, and inverse operations. Solve multi-step linear equations with rational number coefficients. Solve multi-step equations. Add, subtract, multiply, and divide rational numbers. Use and/or identify an algebraic property to justify any step in an equation solving process. Interpret solutions to problems in the context of the problem situation. Check the solution to an equation. Use estimation to solve problems. Evaluate expressions that contain absolute value, square roots and cube roots. Simplify square roots. Evaluate expressions involving exponents to solve problems. Evaluate expressions involving absolute value to solve problems.
Exponents and Scientific Notation	Apply concepts of radicals and integer exponents to generate equivalent expressions. CC.2.2.8.B.1 Apply and extend the properties of exponents to solve problems with rational exponents. CC.2.1.HS.F.1 Apply properties of rational and irrational numbers to solve real-world or mathematical problems. CC.2.1.HS.F.2	Divide the numerical expressions with integer exponents with like bases by subtracting the exponents. Evaluate numerical expressions with integer exponents. Write a numerical expression with a negative exponent as an equivalent numerical expression with a positive exponent Multiply numerical expressions with integer exponents with like bases by adding the exponents Add and subtract and divide numerical expressions with integer exponents. Calculate the solution to $x^2=p$, where p is a positive rational number by taking the square root of both sides. Calculate the solution to $x^3=p$, where p is a positive rational number by taking the cube root of both sides. Evaluate a square root of a perfect square. Name numbers that are perfect squares and non-perfect squares. Evaluate a cube root of a perfect cube. Name numbers that are perfect cubes and non-perfect cubes. Identify that non-perfect squares and non-perfect cubes are irrational numbers (focus on 2). Compare the magnitude (size) of 2 or more numbers written in scientific notation. Rewrite numbers in standard form in scientific notation. Expand numbers written in scientific notation into standard form. Divide numbers in scientific notation to compare their sizes. Add, subtract, multiply, and divide numbers written in scientific notation, applying laws of exponents Find appropriate units for very large and small quantities. Demonstrate on the calculator and identify that E on the calculator means $\times 10^a$. Explain a proof of Pythagorean theorem. (If a triangle is a right triangle, then $a^2 + b^2 = c^2$). Explain a proof of the converse of Pythagorean theorem(If $a^2 + b^2 = c^2$, then a triangle is a right triangle) Identify the legs and hypotenuse of a right triangle. Calculate the length of a leg of a right triangle using Pythagorean theorem. Calculate the length of the hypotenuse of a right triangle using Pythagorean theorem. Calculate the diagonal of a three-dimensional figure using Pythagorean Theorem. Read and interpret a word problem involving Pythagorean Theorem. Solve word problems involving Pythagorean Theorem. Solve multi-step equations. Identify the legs and hypotenuse of a right triangle. Round to given place value. Calculate the distance between two points in a coordinate plane using the Pythagorean Theorem. Plot points in a coordinate plane. Identify the legs and hypotenuse of a right triangle. Solve Pythagorean Theorem.
Pythagorean Theorem	Understand and apply the Pythagorean Theorem to solve problems. C.2.3.8.A.3 Apply properties of rational and irrational numbers to solve real-world or mathematical problems. CC.2.1.HS.F.2 Apply concepts of radicals and integer exponents to generate equivalent expressions. CC.2.2.8.B.1 Apply and extend the properties of exponents to solve problems with rational exponents. CC.2.1.HS.F.1	Explain a proof of the converse of Pythagorean theorem(If $a^2 + b^2 = c^2$, then a triangle is a right triangle) Identify the legs and hypotenuse of a right triangle. Calculate the length of a leg of a right triangle using Pythagorean theorem. Calculate the length of the hypotenuse of a right triangle using Pythagorean theorem. Calculate the diagonal of a three-dimensional figure using Pythagorean Theorem. Read and interpret a word problem involving Pythagorean Theorem. Solve word problems involving Pythagorean Theorem. Solve multi-step equations. Identify the legs and hypotenuse of a right triangle. Round to given place value. Calculate the distance between two points in a coordinate plane using the Pythagorean Theorem. Plot points in a coordinate plane. Identify the legs and hypotenuse of a right triangle. Solve Pythagorean Theorem.
Inequalities	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. CC.2.1.HS.F.5 Create and graph equations or inequalities to describe numbers or relationships. CC.2.2.HS.D.7 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.9 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. CC.2.2.HS.D.10 Use units as a way to understand problems and to guide the solution of multi-step problems. CC.2.1.HS.F.4	Write and/or solve inequalities. Solve inequalities using addition, subtraction, multiplication and division. Identify and graph the solution set to a linear inequality on a number line. Write or solve compound inequalities. Graph compound inequality solutions. Interpret solutions to problems in the context of the problem situation. Solve and interpret solutions to absolute value equations. Solve and interpret solutions to absolute value inequalities.
Linear Equations	Analyze and solve linear equations and pairs of simultaneous linear equations. CC.2.2.8.B.3 Define, evaluate, and compare functions. CCC.2.2.8.C.1 Use concepts of functions to model relationships between quantities. CC.2.2.8.C.2 Write functions or sequences that model relationships between two quantities. CC.2.2.HS.C.3 Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations. CC.2.2.7.B.3 Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. CC.2.1.HS.F.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. CC.2.1.HS.F.5	Write a linear equation. Solve a linear equation. Apply a linear equations to problem situation. Solve a linear equation with one solution. Solve a linear equation with infinitely many solutions. Solve a linear equation with no solution. Explain the differences between one solution, no solution, and infinitely many.

Systems of Linear Equations and Inequalities	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. CC.2.1.HS.F.5 Analyze and solve linear equations and pairs of simultaneous linear equations. CC.2.2.8.B.3 Create and graph equations or inequalities to describe numbers or relationships. CC.2.2.HS.D.7 Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.9 Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. CC.2.2.HS.D.10	Solve a linear system in two variables by substitution or elimination to find the ordered pair which satisfies both equations. Solve a linear system in two variables graphically by identifying the point of intersection. Determine whether a system of two linear equations has one solution, no solution or infinite solutions. Write a system of two linear equations that models a real-world situation. Interpret and determine the reasonableness of the algebraic or graphical solution of a system of two linear equations that models a real-world situation. Solve systems of linear inequalities algebraically and graphically. Interpret solutions to problems in the context of the problem situation. Graph linear equations and inequalities in two variables, including those that arise from a variety of real-world situations.
Polynomials and Rational Expressions	Interpret the structure of expressions to represent a quantity in terms of its context. CC.2.2.HS.D.1 Write expressions in equivalent forms to solve problems. CC.2.2.HS.D.2 Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.3 Use polynomial identities to solve problems. CC.2.2.HS.D.5 Extend the knowledge of rational functions to rewrite in equivalent forms. CC.2.2.HS.D.6 Develop and/or apply number theory concepts to find common factors and multiples. CC.2.1.6.E.3 Apply properties of rational and irrational numbers to solve real-world or mathematical problems. CC.2.1.HS.F.2	Simplify monomial expressions with integer exponents. Find sums and differences of polynomials. Find products of polynomials. Find the quotient of polynomials, using a monomial or binomial divisor, or completely factored divisor. Factor completely first-and second-degree polynomials with integral coefficients. Identify prime polynomials. Factor algebraic expressions, including difference of squares and trinomials. Simplify/reduce a rational algebraic expression. Find common factors and multiples. Find the Greatest Common Factor (GCF). Find the Least Common Multiple (LCM).

Topic:

Unit: Module 2: Linear Functions and Data Organizations
Unit Assignments:

Concept	Unit Goals/ Standards	Objectives	Assessments
Coordinate Geometry	- Use concepts of functions to model relationships between quantities. CC.2.2.8.C.2 - Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.1 - Graph and analyze functions and use their properties to make connections between the different representations. CC.2.2.HS.C.2 - Write functions or sequences that model relationships between two quantities. CC.2.2.HS.C.3 - Construct and compare linear, quadratic, and exponential models to solve problems. CC.2.2.HS.C.5 - Interpret functions in terms of the situations they model. CC.2.2.HS.C.6 - Summarize, represent, and interpret data on a single count or measurement variable. CC.2.4.HS.B.1	- Identify, describe, and/or use constant rates of change. - Identify the slope of a linear relationship from equations, tables, and graphs. - Create and label an appropriate quadrant I graph. - Describe unit rate as the slope of a graph. - Compare two different proportional relationships represented in different ways. - Determine the slope of a line by counting the rise over the run of the given line. - Explain why the slope of a line is the same for any two points on the graph using rise over run. - Explain slope as a constant rate of change (rise over run). - Apply the concept of linear rate of change to solve problems. - Given a line that passes through the origin, write the equation for the line in the form $y = mx$, where the slope is found using rise over run.	Assessments: - Summative Assessments - Informal Assessments - Formal Assessments Practice May Include: - Test - Quizzes - Exit Ticket - Practice Exercises - Conference with the teacher

- Given a line that passes the vertical axis at point other than the origin, write the equation for the line in the form $y = mx + b$, where the slope is found using rise over run and b is where the line intercepts the vertical axis.
- Graph a system of linear equations.
- Identify the point of intersection to a system of linear equations.
- Write or identify linear equations when given the graph of a line.
- Write or identify linear equations when given two points on the line.
- Write or identify linear equations when given the slope and a point on the line.
- Write or identify equations in point slope, standard, and/or slope-intercept form.
- Determine the slope and/or y-intercept represented by a linear equations or graph.
- Use the parent function $y=x$ and describe transformations defined by changes in the slope and of y-intercept.
- Find the slope of the line, given the equation of a linear function.
- Find the slope of a line, given the coordinates of two points on the line.
- Find the slope of a line, given the graph of a line.
- Recognize and describe a line with a slope that is positive, negative, zero, or undefined.
- Write an equation of a vertical line $x=a$
- Write an equation of a horizontal line as $y=c$
- Given a situation, including a real world situation determine if a direct or inverse variation exists
- Write an equation for a direct or inverse variation.
- Graph an equation representing a direct variation, given a set of data

- Define, evaluate, and compare functions. CC.2.2.8.C.1
- Use concepts of functions to model relationships between quantities. CC.2.2.8.C.2
- Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.1
- Graph and analyze functions and use their properties to make connections between the different representations. CC.2.2.HS.C.2
- Write functions or sequences that model relationships between two quantities. CC.2.2.HS.C.3
- Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.2
- Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. CC.2.1.HS.F.3
- Use units as a way to understand problems and to guide the solution of multi-step problems. CC.2.1.HS.F.4
- Understand the connections between proportional relationships, lines, and linear equations. CC.2.2.8.B.2
- Interpret the effects transformations have on functions and find the inverses of functions. CC.2.2.HS.C.4
- Interpret functions in terms of the situations they model. CC.2.2.HS.C.6
- Identify a function as a one-to-one correspondence.
- Find the input/output of function given a value from the domain or a value from the range.
- Plot an ordered pair on a coordinate axis.
- Define the x-coordinate as the input(domain) and the y-coordinate as the output(range).
- Identify a function as a set of ordered pairs on a graph.
- Identify a relation as a function from a graph, equation, or set of ordered pairs.
- Write the linear function from a table of values.
- Write the linear function from a graph.
- Write the linear function from a verbal description.
- Identify the different properties of a function.
- Compare the properties of two functions represented in different ways.
- Identify a linear function as $y=mx + b$.
- Identify functions that are not linear from equations tables, and graphs.
- Identify linear functions as having graphs that are straight lines.
- Identify linear functions in tables.
- Compare/contrast linear vs. non-linear functions represented as equations, tables, and graphs.
- Write a linear function rule for a given relationship.
- Calculate the slope/rate of change from a table, graph, equation, or two points.
- Calculate the initial value/y-intercept from a table, graph, equation, or two points.
- Describe the slope and y-intercept from a graph or table in terms of the situation.
- Identify the type of function given a graph.

	Describe the qualitative functional relationship given a graph.
	Sketch a graph that has been described verbally.
	Determine whether a relation, represented by a set of ordered pairs, a table, or a graph is a function.
	Identify the domain, range, zeros, and intercepts of a function presented algebraically and graphically.
	For each x in the domain of f, find $f(x)$.
	Represent relations and functions using multiple representations and convert between.
	Detect patterns in data and represent arithmetic and geometric patterns algebraically.
	Construct a scatter plot for bivariate data.
	Interpret scatter plots for bivariate data.
	Describe patterns for clustering of data.
Interpret functions in terms of the situations they model. CC.2.2.HS.C.6	Describe patterns for outliers of data.
Analyze and/or interpret bivariate data displayed in multiple representations. CC.2.4.8.B.1	Describe positive/negative association of data.
Summarize, represent, and interpret data on two categorical and quantitative variables. CC.2.4.HS.B.2	Describe linear/nonlinear association of data.
Understand that patterns of association can be seen in bivariate data utilizing frequencies. CC.2.4.8.B.2	Describe a linear relationship from a scatter plot.
Summarize, represent, and interpret data on a single count or measurement variable. CC.2.4.HS.B.1	Draw/sketch a line on a scatter plot that best fits the data.
Analyze linear models to make interpretations based on the data. CC.2.4.HS.B.3	Choose the line that most appropriately fits the data.
Make inferences and justify conclusions based on sample surveys, experiments, and observational studies. CC.2.4.HS.B.5	Plot ordered pairs on a coordinate plane.
Apply the rules of probability to compute probabilities of compound events in a uniform probability model. CC.2.4.HS.B.7	Describe the type of correlation from the trend line.
	Identify the slope and intercept from the equation of a linear model in the context of a problem.
	Draw logical conclusions using slope and y-intercept of the line.
	Describe the slope and intercept from the equation of a linear model to solve a problem.

- Construct a two-way table on two categorical variables collected from the same subjects.
- Describe patterns of association displayed in a two way table.
- Draw conclusions about the association between the data (positive association/negative association).
- Calculate relative frequencies from data given in a two way table.
- Describe possible associations based on the relative frequencies.
- Write an equation for a curve of best fit, given a set of no more than twenty data points in a table, a graph, or a real-world situation.
- Make predictions about unknown outcomes, using the equation of the curve of best fit.
- Design experiments and collect data to address specific, real-world questions.
- Evaluate the reasonableness of a mathematical model of a real-world situation.
- Draw, identify, find, and/or write an equation for a line of best fit or a scatter plot.
- Make predictions using the equations or graphs of best-fit lines of scatter plots.
- Compare, contrast, and analyze data, including data from real-world situations displayed in box-and-whisker plots.
- Analyze descriptive statistics to determine the implications for the real-world situations from which the data was derived.
- Given data, including data in a real-world context, calculate and interpret the mean absolute deviation of a data set.
- Given the data, including data in a real-world context, calculate the variance and standard deviation of a dataset and interpret the standard deviation.
- Given data, including data in a real world context, calculate and interpret z-scores for a data set.
- Explain ways in which standard deviation addresses dispersion by examining the formula for standard deviation.
- Compare and contrast mean absolute deviation and standard deviation in a real-world context.
- Calculate and/or interpret the range, quartiles, an interquartile range of data.
- Estimate or calculate to make predictions based on a circle, line, bar graph.
- Analyze data, make predictions, and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).
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	Find probabilities for compound events.
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	Represent probabilities as a fraction, decimal, or percent.
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	Design experiments and collect data to address specific, real-world questions.
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	Evaluate the reasonableness of a mathematical model of a real world situation.

This Curriculum Map Unit has no Topics to display

Unit: Module:3: 8th Grade PSSA Math Concepts Not Already Taught
Unit Assignments:

Concept	Unit Goals/ Standards	Objectives	Assessments
Transformations	Understand and apply congruence, similarity, and geometric transformations using various tools. CC.2.3.8.A.2	Translate, rotate, and reflect lines and line segments. Explain the preservation of the sides of a figure through a given transformation. Identify corresponding parts between a figure and its image using prime notation. Show that lines are taken to lines and line segments are taken to line segments. Translate, rotate, and reflect geometric shapes on a coordinate plane. Measure angles using a protractor. Identify corresponding parts between a figure and its image using prime notation. Show that angles are taken to angles of the same measure. Translate, rotate, and reflect parallel lines on a coordinate plane. Explain that the slope and distance between two parallel lines will be preserved after a translation, rotation, or reflection of the parallel lines. Identify corresponding lines after a translation, rotation, or reflection, by using prime notation. Show that parallel lines are translated, rotated, or reflected parallel lines. Explain the preservation of congruence when a figure is rotated, reflected, and/or translated. Describe the sequence of transformations that occurred from the original 2D figure to the image. Draw a reflection of an object. Draw a translation of an object. Draw a rotation of an object. Name corresponding parts in congruent figures. Dilate a two-dimensional figure using coordinates. Describe the effect of dilating a two-dimensional figure using coordinates. Rotate a two-dimensional figure using coordinates. Describe the effect of rotating a two-dimensional figure using coordinates. Translate a two-dimensional figure using coordinates. Describe the effect of translating a two-dimensional figure using coordinates. Reflect a two-dimensional figure using coordinates. Describe the effect of reflecting a two-dimensional figure using coordinates. Explain the preservation of similarity when a figure is dilated, rotated, reflected, and/ or translated. Describe the sequence of transformations that occurred from the original 2D figure to the image to show the similarity.	Assessments: Summative Assessments Informal Assessments Formal Assessments Practice May Include: Test Quizzes Exit Ticket Practice Exercises Conference with the teacher
Volume and Similar Solids	Apply the concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems. CC.2.3.8.A.1	Write and solve using the formula for the volume of a cone. Write and solve using the formula for the volume of a cylinder. Write and solve using the formula for the volume of a sphere. Solve word problems involving the volume of cones, cylinders, and spheres. Solve a multi-step equation for a missing variable.	

Angles and Triangles

Understand and apply congruence, similarity, and geometric transformations using various tools. CC.2.3.8.A.2

Prove/explain why the three angles of a triangle equal 180° .
Prove/explain why the exterior angle theorem of a triangle.
Prove/explain why alternate interior angles are congruent.
Prove/explain why alternate exterior angles are congruent.
Prove/explain why corresponding angles are congruent.
Prove/explain why angle-angle criterion works to prove similarity of two triangles.