Independent School District of Boise City

Math 8 - Pre-Algebra

Course Description

Open to: 7, 8

Duration: One Year Course

Content: Content: In eighth grade, instruction is focused on the following 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; and (4) defining the properties of integer exponents and irrational numbers.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions (y/x = m or y = mx) as special linear equations (y = mx + b), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount m × A. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

2. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

3. Students are introduced to the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. Students can define, evaluate, and compare functions in multiple forms (pictures, tables, graphs, equations, etc.).

4. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds; for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

5. Students use their understanding of multiplication and apply properties to develop an understanding of radicals and integer exponents. Students use and perform operations with numbers expressed in scientific notation. They use their knowledge of rational numbers to develop an understanding of irrational numbers.

Adopted Materials

- Amplify – *Grade 8 Mathematics*
- Scales Folder

First Semester	Second Semester
Unit 1: Rigid Transformations & Congruence	**Unit 5:** Functions & Volume
Unit 2: Dilations, Similarity & Introducing Slope	**Unit 6:** Associations in Data
Unit 3: Proportional & Linear Relationships	**Unit 7:** Exponents & Scientific Notation
Unit 4: Linear Equations & Linear Systems	**Unit 8:** The Pythagorean Theorem & Irrational Numbers

Unit 1 - Rigid Transformations & Congruence

Learning Intentions

I am learning how to perform and describe rigid transformations and use angle relationships to prove and justify congruence. (Scale)

Unit Priority Standards:

- 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.
- 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.

Unit Supporting Standards:

- 8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are transformed to lines, and line segments to line segments of the same length. b. Angles are transformed to angles of the same measure. c. Parallel lines are transformed to parallel lines.
- 8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two dimensional figures using coordinates.

Unit Additional Standards:

- 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.
- 8.EE.B.6. Use similar triangles to explain why the slope 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 - Dilations, Similarity & Introducing Slope

Learning Intentions

- I am learning to perform dilations to prove similarity on and off of a coordinate grid, so I can use similar triangles to model proportional relationships relating to slope. (Scale)

Unit Priority Standards:

- 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.

Unit Supporting Standards:

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

Unit Additional Standards:

- 8.EE.B.6. Use similar triangles to explain why the slope 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 3 - Proportional & Linear Relationships

Learning Intentions

- I am learning how to compare and interpret linear relationships through multiple representations, so I can be flexible when describing and justifying a linear relationship in context. (Scale)

Unit Priority Standards:

- 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.
- 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.

Unit Supporting Standards:

- 8.EE.B.6. Use similar triangles to explain why the slope 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.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.
- 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.

Unit 4 - Linear Equations & Linear Systems

Learning Intentions

- I am learning how to set up and solve multi-step linear equations and systems of equations, so I can solve problems with unknown amounts to model real world contexts. (Scale)

Unit Priority Standards:

- 8.EE.C.7 Solve linear equations in one variable.
- 8.EE.C.7b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
- 8.EE.C.8cSolve 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.
- 8.EE.C.8 Analyze and solve pairs of simultaneous linear equations.
- 8.EE.C.8a 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.
- 8.EE.C.8b. Solve systems of two linear equations in two variables algebraically (including but not limited to using substitution and elimination strategies), and estimate solutions by graphing the equations; solve simple cases by inspection.

Unit Supporting Standards:

- 8.EE.C.7a. 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 (1 solution), a = a (infinitely many solutions), or a = b (no solution) results (where a and b are different numbers.

Unit 5 - Functions & Volume

Learning Intentions

- **5a -** I am learning how to describe and analyze representations of functions, so I can model real world relationships between quantities and make predictions. (Scale)
- **5b -** I am learning how to calculate the volume of cylinders, cones, and spheres, so I can use the volume formulas to solve real world problems. (Scale)

Unit Priority Standards:

- 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. (Function notation is not required in Grade 8).
- 8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- 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.
- 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 Supporting Standards:

- 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.
- 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.

Unit 6 - Associations in Data

Learning Intentions

- I am learning to construct a scatter plot and analyze the patterns of associations between two quantities, so I can interpret data and make predictions in real world situations.
- I am learning to display and analyze categorical data in a two-way frequency table, so I can interpret data and make predictions in real world situations. (Scale)

Unit Priority Standards:

- 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.
- 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.
- 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.)
- 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.

Unit Supporting Standards:

- 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.

Unit 7 - Exponents & Scientific Notation

Learning Intentions

- I am learning to write equivalent expressions involving positive, negative and zero exponents, so I can flexibly move between expanded form and simplified exponential notation. (Scale)

Unit Priority Standards:

- 8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.

Unit Supporting Standards:

- 8.EE.A.2. Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = 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. Teacher Note: Students first need to understand the difference between rational and irrational numbers to identify √2 as irrational, which is standard 8.NS.A.1.
- 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.
- 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.

NOTE: Students use scientific notation in Science, some in 8th grade but essential in 9th grade.

Unit 8 - The Pythagorean Theorem & Irrational Numbers

Learning Intentions

- I am learning to apply the Pythagorean Theorem to determine missing measurements of right triangles, so I can use the relationship between the squares of right triangle side lengths to solve real-world problems. (Scale)

Unit Priority Standards:

- 8.G.B.6 Analyze and justify the Pythagorean Theorem and its converse using pictures, diagrams, narratives, or models.
- 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.
- 8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
- 8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = 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.

Unit Supporting Standards:

- 8.NF.A.2 (ID) 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., π2).
- 8.NF.A.1 (ID) 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.in two and three dimensions.
- 8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = 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.