

Course Title:	Pre-Algebra
Grade(s):	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. Course Units: 1. Rigid Transformations and Congruence 2. Dilations, Similarity, and Introducing Slope 3. Linear Relationships 4. Linear Equations and Systems 5. Functions and Volumes 6. Associations in Data 7. Exponents and Scientific Notation 8. Pythagorean Theorem and Irrational Numbers
Approved Curricular Materials/Textbook(s)
IM 360 Online Resource

Unit Title	Unit Description (Include Unit Objectives)	Unit Pacing
Unit 1: RIGID	In this unit, students learn to understand and use the terms “reflection,” “rotation,” “translation,” recognizing what determines each type of transformation, e.g., two points determine a translation. They learn to understand and use the terms	20-24 days (September -

TRANSFORMATIONS & CONGRUENCE	“transformation” and “rigid transformation.” They identify and describe translations, rotations, and reflections, and sequences of these, using the terms “corresponding sides” and “corresponding angles,” and recognizing that lengths and angle measures are preserved. They draw images of figures under rigid transformations on and off square grids and the coordinate plane. They use rigid transformations to generate shapes and to reason about measurements of figures. They learn to understand congruence of plane figures in terms of rigid transformations. They recognize when one plane figure is congruent or not congruent to another. Students use the definition of “congruent” and properties of congruent figures to justify claims of congruence or non-congruence. • Rigid Transformations • Properties of Rigid Transformations • Congruence • Angles in a Triangle	October)
Unit 2: DILATIONS, SIMILARITY & INTRODUCING SLOPE	In this unit, students learn to understand and use the term “dilation,” and to recognize that a dilation is determined by a point called the “center” and a number called the “scale factor.” They learn that under a dilation, the image of a circle is a circle and the image of a line is a line parallel to the original. They draw images of figures under dilations on and off the coordinate plane. They use the terms “corresponding sides” and “corresponding angles” to describe correspondences between a figure and its dilated image, and recognize that angle measures are preserved, but lengths are multiplied by the scale factor. They learn to understand similarity of plane figures in terms of rigid transformations and dilations. They learn to recognize when one plane figure is similar or not similar to another. They use the definition of “similar” and properties of similar figures to justify claims of similarity or non-similarity. Students learn the terms “slope” and “slope triangle,” and use the similarity of slope triangles on the same line to understand that any two distinct points on a line determine the same slope. • Dilations • Similarity • Slope	15-18 days (October)

Unit 3: LINEAR RELATIONSHIPS	In this unit, students learn to understand and use the terms “rate of change,” “linear relationship,” and “vertical intercept.” They deepen their understanding of slope, and they learn to recognize connections among rate of change, slope, and constant of proportionality, and between linear and proportional relationships. They learn to understand that lines with the same slope are translations of each other. They represent linear relationships with tables, equations, and graphs that include lines with negative slopes or vertical intercepts, and horizontal and vertical lines. They learn to use the term “solution of an equation” when working with one or two linear equations in two variables, and learn to understand the graph of a linear equation as the set of its solutions. Students use these terms and representations in reasoning about situations involving one or two constant rates. • Proportional Relationships • Representing Linear Relationships • Finding Slopes • Linear Equations	17-20 days (November - December)
Unit 4: LINEAR EQUATIONS & SYSTEMS	In this unit, students write and solve linear equations in one variable. These include equations in which the variable occurs on both sides of the equal sign, and equations with no solutions, exactly one solution, and infinitely many solutions. They learn that any one such equation is false, true for one value of the variable, or true for all values of the variable. They interpret solutions in the contexts from which the equations arose. Students write and solve systems of linear equations in two variables and interpret the solutions in the contexts from which the equations arose. They learn what is meant by a solution for a system of equations, namely that a solution of the system is a solution for each equation in the system. Students use the understanding that each pair of values that make an equation true are coordinates of a point on the graph of the equation and conversely that the coordinates of each point on the graph of an equation make the equation true. Thus, a pair of values that satisfies a system of equations are coordinates of a point that lies on the graphs of all the equations in the system, and, conversely, a point that lies on the graphs of all the equations in the system has coordinates that satisfy all the equations in the system. Students learn to understand and use the terms “system of equations,” “solution for the system of equations,” “zero solutions,” “no solution,” “one solution,” and “infinitely many	18-21 days (December - January)

	solutions.” ● Puzzle Problems ● Linear Equations in One Variable ● Systems of Linear Equations	
Unit 5: FUNCTIONS & VOLUME	In this unit, students are introduced to the concept of a function. They learn to understand and use the terms “input,” “output,” and “function,” e.g., “temperature is a function of time.” They describe functions as increasing or decreasing between specific numerical inputs, and they consider the inputs of a function to be values of its independent variable and its outputs to be values of its dependent variable. (The terms “Independent variable” and “dependent variable” were introduced in grade 6). They use tables, equations, and graphs to represent functions, and describe information presented in tables, equations, or graphs in terms of functions. In working with linear functions, students coordinate and synthesize their understanding of “constant of proportionality” (which was introduced in grade 7), “rate of change” and “slope” (which were introduced earlier in grade 8), and increasing and decreasing. Students perceive similarities in structure between pairs of known and new volume formulas: for a rectangular prism and a cylinder; and for a cylinder and a cone. Students rearrange these formulas to show functional relationships and use them to reason about how the volume of a figure changes as another measurement changes, e.g., the height of a cylinder is proportional to its volume; if the radius of a cylinder triples, its volume becomes nine times larger. ● Inputs and Outputs ● Representing and Interpreting Functions ● Linear Functions and Rates of Change ● Cylinders and Cones ● Spheres and Dimensions	25-29 days (January-March)
Unit 6: ASSOCIATIONS IN DATA	In this unit, students generate and work with bivariate data sets that have more variability than in previous units. They learn to understand and use the terms “scatter plot” and “association,” and describe associations as “positive” or “negative” and “linear” or “non-linear.” Students describe scatter plots, using a term previously used to describe univariate data “cluster,” and the new term	13-15 days (March)

	“outlier.” They fit lines to scatter plots and informally assess their goodness of fit by judging the closeness of the data points to the lines, and compare predicted and actual values. Students learn to understand and use the terms “two-way table,” “bar graph,” and “segmented bar graph,” using two-way tables to investigate categorical data. Students should be able to construct and interpret points on a scatter plot, informally fit linear models to data, interpret a given linear model in the context of data, and generally recognize patterns of association using relative frequencies in a two-way table. • Does This Predict That • Associations in Numerical Data • Associations in Categorical Data	
Unit 7: EXPONENTS & SCIENTIFIC NOTATION	In grade 6, students studied whole-number exponents. In this unit, they extend the definition of exponents to include all integers, and in the process codify the properties of exponents. They apply these concepts to the base-ten system, and learn about orders of magnitude and scientific notation in order to represent and compute with very large and very small quantities. • Exponent Review • Exponent Rules • Scientific Notation	18-20 days (March-April)
Unit 8: PYTHAGOREAN THEOREM & IRRATIONAL NUMBERS	In this unit, students work with geometric and symbolic representations of square and cube roots. They understand and use notation such as $\sqrt{2}$ and $\sqrt[3]{5}$ for square and cube roots. They understand the terms “rational number” and “irrational number,” using long division to express fractions as decimals. They use their understanding of fractions to plot rational numbers on the number line and their understanding of approximation of irrationals by rationals to approximate the number-line location of a given irrational. Students learn (without proof) that $\sqrt{2}$ is irrational. They understand two proofs of the Pythagorean Theorem—an algebraic proof that involves manipulation of two expressions for the same area and a geometric proof that involves decomposing and rearranging two squares. They use the Pythagorean Theorem in two and three dimensions, e.g., to determine lengths of diagonals of rectangles and right rectangular prisms, and to estimate distances between points in the coordinate plane.	20-26 days (May-June)

	• Side Lengths and Areas of Squares • The Pythagorean Theorem • Side Lengths and Volumes of Cubes • Decimal Representations of Rational and Irrational Numbers	
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