Common Core State Standards Pacing Guide – 8th Grade

August (12) / September (21)

Common Core State Standard	Suggested Program Pacing
The Number System 8.NS **Know that there are numbers that are not rational, and approximate them by rational numbers.** 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. 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.* Expressions and Equations 8.EE **Work with radicals and integer exponents.** 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. Geometry 8.G **Understand and apply the Pythagorean Theorem.** 6. Explain a proof of the Pythagorean Theorem and its converse. 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. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	**Looking for Pythagoras – Investigation 1,2,3,4** 19 days **Goals of the Unit** • Relate the area of a square to the side length • Estimate the values of square roots of whole numbers • Locate irrational numbers on a number line • Develop strategies for finding the distance between two points on a coordinate grid • Understand and apply the Pythagorean Theorem • Use the Pythagorean Theorem to solve everyday problems **Developing Students' Mathematical Habits** Through their work in this and other geometry units, students learn important questions to ask themselves about any situation that can be represented and modeled mathematically, such as • *Is it appropriate and useful to use the Pythagorean Theorem in this situation? How do I know this?* • *Do I need to find the distance between two points?* • *What are the quantities in this problem?* • *How can I estimate the square root of a number?* • *How can I find the length of something without directly measuring it?*
Expressions and Equations 8.EE **Work with radicals and integer exponents.** 1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.*	**Growing, Growing, Growing –Investigation 5.1, 5.2** 5 days 5.1 Predicting the Ones Digit 5.2 Operating With Exponents.
Expressions and Equations 8.EE **Work with radicals and integer exponents.** 1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.* 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.	**CMP Common Core Supplement – Investigation 1** 4 days **Goals of the Investigation** • Know and apply the properties of integer exponents to generate equivalent expressions. • Use cube root symbols to represent solutions to equations of the form $x^3 = p$. • Evaluate cube roots of small perfect cubes.

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Expressions and Equations 8.EE

Work with radicals and integer exponents.

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 $\times 10^8$ the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*
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.

Supplementary Materials for Scientific Notation

5 days

October (20) / November (18)

Expressions and Equations 8.EE

Understand the connections between proportional relationships, lines, and linear equations.

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.*

Analyze and solve linear equations and pairs of simultaneous linear equations.

8. Analyze and solve pairs of simultaneous linear equations.
   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.
   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.*
   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.*

Functions 8.F

Define, evaluate, and compare functions.

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]
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.*
3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
   For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Use functions to model relationships between quantities.

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.

Moving Straight Ahead -- Investigations 1-4

26 days

Goals of the Unit

- Recognize problem situations in which two or more variables have a linear relationship to each other
- Construct tables, graphs, and symbolic equations that express linear relationships
- Translate information about linear relations given in a table, a graph, or an equation to one of the other forms
- Understand the connections between linear equations and the patterns in the tables and graphs of those equations: rate of change, slope, and *y*-intercept
- Solve linear equations
- Solve problems and make decisions about linear relationships using information given in tables, graphs, and symbolic expressions
- Use tables, graphs, and equations of linear relations to answer questions

Developing Students' Mathematical Habits

Through their work in this and other units about linear relationships, students learn important questions to ask themselves about any situation that can be represented and modeled mathematically, such as

- *What are the variables in the problem?*
- *Do the variables in the problem have a linear relationship to each other?*
- *What patterns in the problem suggest that it is linear?*
- *How can the linear pattern be represented in a problem, in a table, in a graph, or with an equation?*
- *How do changes in one variable affect changes in a related variable?*
- *How are these changes captured in a table, graph, or equation?*

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	• *How can tables, graphs, and equations of linear relationships be used to express and answer questions?*
Expressions and Equations 8.EE **Understand the connections between proportional relationships, lines, and linear equations.** 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*. **Analyze and solve linear equations and pairs of simultaneous linear equations.** 7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where *a* and *b* are different numbers). Functions 8.F **Define, evaluate, and compare functions.** 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] 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.* 3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* **Use functions to model relationships between quantities.** 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.	**CMP Common Core Supplement – Investigation 2** 7 days **Goals of the Unit** • Graph proportional relationships, interpreting the unit rate as the slope of the graph • Compare proportional relationships represented in different ways • Use similar triangles on the coordinate plane to explain why the slope between any two points on a line is a constant • Derive the equations y = mx and y= mx + b to describe lines on the coordinate plane • Simplify a linear equations in one variable to determine whether it has not solution, one solutions, or infinitely many solutions • Understand that a function is a rule that assigns a unique output to each input, and that a graph of a function is a set of ordered pairs consisting of each input and corresponding output.
December (12)	
Expressions and Equations 8.EE **Analyze and solve linear equations and pairs of simultaneous linear equations.** 7. Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where *a* and *b* are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	**Say It With Symbols -- Investigation 1-3.1,3.2** 18 days **Goals of the Unit** • Model situations with symbolic statements • Write equivalent expressions • Determine if different symbolic expressions are mathematically equivalent • Interpret the information equivalent expressions represent in a given context

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Functions 8.F

Define, evaluate, and compare functions.

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]
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.*
3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
   For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Use functions to model relationships between quantities.

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.
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.

- Determine which equivalent expression to use to answer particular questions
- Solve linear equations involving parentheses
- Use equations to make predictions and decisions
- Analyze equations to determine the patterns of change in the tables and graphs that the equation represents
- Understand how and when to use symbols to display relationships, generalizations, and proofs

Developing Students' Mathematical Habits

As students work on the problems in this unit, ask them questions about problem situations that involve symbolic expressions and equations.

- *What expression or equation represents the pattern or relationship in a context?*
- *What information do you get from an equivalent expression for a quantity?*
- *What information do you get by combining two or more expressions?*
- *How can you tell if two or more expressions are equivalent?*
- *What operations can transform a given equation or expression into an equivalent form that can be used to answer a question?*
- *What patterns of change do the equation or expression represent?*
- *How can symbolic reasoning help confirm a conjecture?*

January (19)

Statistics and Probability 8.SP

Investigate patterns of association in bivariate data.

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.
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.
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?*

Samples and Populations --Investigation 1 & 4

CCSS Investigation 5 (8SP.4)**-- Categorical Data & Statistics**

14 days

Goals of the Unit

- Use the process of statistical investigation to explore problems
- Compare sample distributions using measures of center (mean, median), measures of variability (range, minimum and maximum data values, percentiles), and data displays that group data (histograms, box-and-whisker plots)
- Explore relationships between paired values of numerical variables

CCSS Inv.5 Goals of the Investigation

- Understand that patterns in bivariate categorical data can be seen by displaying frequencies and relative frequencies in two-way tables
- Construct and interpret tow way tables summarizing bivariate categorical data

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	• Use relative frequencies for rows or columns in a two-way table to describe possible associations between the two variables
February (20) **/ March** (17)	
Geometry 8.G **Understand congruence and similarity using physical models, transparencies, or geometry software.** 1. Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. 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. 3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 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. 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. **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** 9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	**Kaleidoscopes, Hubcaps, and Mirrors--Investigation 1-5** 28 days **+ CMP Common Core Supplements-- Investigations 3 & 4** + 10 days **Goals of the Unit** • Understand important properties of symmetry • Recognize and describe symmetries of figures • Use tools to examine symmetries and transformations • Make figures with specified symmetries • Identify a basic design element that can be used with a transformation to replicate a given design • Perform symmetry transformations of figures, including reflections, translations, and rotations • Examine and describe the symmetries of a design made from a figure and its image(s) under a symmetry transformation • Give precise mathematical directions for performing reflections, rotations, and translations in terms of the effect of the transformation on points of the original figure • Draw conclusions about a figure in terms of the effect of the transformation on points of the original figure based on what symmetry or symmetries the figure has • Understand that figures with the same shape and size are congruent • Use symmetry transformations to explore whether two figures are congruent • Give examples of minimum sets of measures of angles and sides that will guarantee that two triangles are congruent • Use congruence of triangles to explore congruence of two quadrilaterals • Use symmetry and congruence to deduce properties of figures • Write coordinate rules for specifying the image of a point under particular transformations • Appreciate the power of transformational geometry in the real-world

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	CCSS Inv.3 & 4 Goals of the Investigation • Verify the properties of translations, rotations, and reflections of figures including lines, line segments, angles, and parallel lines • Describe the effects of translations, rotations, reflections, and dilations on two-dimensional figures using coordinates. • Understand that two figures are similar if one can be made from the other by a sequence of transformations. • Describe the sequence of translations, rotations, reflections, or dilations that exhibits the similarity of two similar figures. • Use informal arguments to establish facts about the angle sum and exterior angle of triangles. • Use informal arguments to establish facts about the angles created when parallel lines are cut by a transversal. • Use informal arguments to establish facts about the angle-angle criterion for similarity of triangles. • Know and use the formulas for volumes of cones, cylinders and spheres to solve problems.
April (20)	
Expressions and Equations 8.EE **Analyze and solve linear equations and pairs of simultaneous linear equations.** 8. Analyze and solve pairs of simultaneous linear equations. 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. 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.* 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.* Functions 8.F **Define, evaluate, and compare functions.** 3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* Statistics and Probability 8.SP **Investigate patterns of association in bivariate data.** 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*	**Shapes of Algebra –Investigation 2,3,4** 18 days **Goals of the Unit** • Write and use equations of circles • Determine if lines are parallel or perpendicular by looking at patterns in their graphs, coordinates, and equations • Find coordinates of points that divide line segments in various ratios • Find solutions to inequalities represented by graphs or equations • Write inequalities that fit given situations • Solve systems of linear equations by graphing, by substituting, and by combining equations • Choose strategically the most efficient solution method for a given system of linear equations • Graph linear inequalities and systems of inequalities • Describe the points that lie in regions determined by linear inequalities and systems of inequalities • Use systems of linear equations and inequalities to solve problems

1.5 cm in mature plant height.

Developing Students' Mathematical Habits
Through their work in this unit, students should ask themselves questions about situations that involve algebra, such as:
- *What patterns relate the coordinates of points on lines and curves?*
- *Does the problem involve an equation or an inequality?*
- *Does the problem call for writing and/or solving a system of equations? If so, what method would be useful for solving the system?*
- *What patterns relate the points whose coordinates satisfy linear equations?*
- *Are there systematic methods that can be used to solve any systems of linear equations?*

May (19)

Expressions and Equations 8.EE
Understand the connections between proportional relationships, lines, and linear equations.
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.*
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.

Analyze and solve linear equations and pairs of simultaneous linear equations.
7. Solve linear equations in one variable.
   a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
   b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Functions 8.F
Define, evaluate, and compare functions.
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]
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.*
3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

Use functions to model relationships between quantities.
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

Thinking with Mathematical Models – Investigation 1-3
22 days

Goals of the Unit
- Recognize linear and nonlinear patterns from verbal descriptions, tables, and graphs and describe those patterns using words and equations
- Write equations to express linear patterns appearing in tables, graphs, and verbal contexts
- Write a linear equation when given specific information, such as two points or a point and the slope
- Approximate linear data patterns with graph and equation models
- Solve linear equations
- Develop an informal understanding of inequalities
- Write equations describing inverse variation
- Use linear and inverse variation equations to solve problems and to make predictions and decisions

Developing Students' Mathematical Habits
Through their work in this and other algebra units, students learn important questions to ask themselves about any situation that can be represented and modeled mathematically, such as:
- *What are the key variables in this situation?*
- *What is the pattern relating the variables?*
- *What kind of equation will express the relationship?*
- *How can I use the equation to answer questions about the relationship?*

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. 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. Statistics and Probability 8.SP **Investigate patterns of association in bivariate data.** 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. 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. 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.*	

The number of instructional days is listed only as a guide for planning. (Actual number of instructional days may vary due to minutes per period, and/or year/site schedules).