



## Curriculum Summary

### Seventh Grade – Pre-Algebra

Students should know and be able to demonstrate mastery in the following skills by the end of Seventh Grade:

#### Ratios and Proportional Relationships

- Analyze proportional relationships and use them to solve real-world and mathematical problems
  - Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
  - Recognize and represent proportional relationships between quantities.
  - Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
  - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
  - Represent proportional relationships by equations.
  - Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate.
  - Use proportional relationships to solve multistep ratio and percent problems.

#### The Number System

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
  - Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
  - Describe situations in which opposite quantities combine to make 0.
  - Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
  - Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
  - Apply properties of operations as strategies to add and subtract rational numbers.
  - Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
  - Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

## **The Number System**

- Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
  - Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-\left(\frac{p}{q}\right) = \frac{(-p)}{q} = \frac{p}{(-q)}$ . Interpret quotients of rational numbers by describing real-world contexts.
  - Apply properties of operations as strategies to multiply and divide rational numbers.
  - Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
  - Solve real-world and mathematical problems involving the four operations with rational numbers.
- Know that there are numbers that are not rational, and approximate them by rational numbers.
  - 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.
  - 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.,  $\pi^2$ ).

## **Expressions and Equations**

- Use properties of operations to generate equivalent expressions.
  - Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
  - Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
  - Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
  - Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
  - Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
  - Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.

## **Expressions and Equations**

- Work with radicals and integer exponents.
  - Know and apply the properties of integer exponents to generate equivalent numerical expressions.
  - 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.
  - 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.
  - 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.
- Understand the connections between proportional relationships, lines, and linear equations.
  - Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
  - 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.
  - Solve linear equations in one variable.
  - 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).
  - Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

## **Geometry**

- Draw, construct, and describe geometrical figures and describe the relationships between them.
  - Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
  - Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
  - Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
  - Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

## **Geometry**

- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
  - Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
  - Solve real-world and mathematical problems involving area, volume and surface area of two and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
- Understand congruence and similarity using physical models, transparencies, or geometry software.
  - Verify experimentally the properties of rotations, reflections, and translations: Lines are taken to lines, and line segments to line segments of the same length.
  - Verify experimentally the properties of rotations, reflections, and translations: Angles are taken to angles of the same measure.
  - Verify experimentally the properties of rotations, reflections, and translations: Parallel lines are taken to parallel lines.
  - 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.
  - Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
  - 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.
  - 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.
- Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
  - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real world and mathematical problems.

## **Statistics and Probability**

- Use random sampling to draw inferences about a population.
  - Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
  - Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- Draw informal comparative inferences about two populations.
  - Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.
  - Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

## **Statistics and Probability**

- Investigate chance processes and develop, use, and evaluate probability models.
  - Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around  $\frac{1}{2}$  indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
  - Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
  - Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
  - Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
  - Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
  - Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
  - Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
  - Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
  - Design and use a simulation to generate frequencies for compound events.

## **Functions**

- Define, evaluate, and compare functions.
  - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
  - 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.
- Use functions to model relationships between quantities.
  - 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.

## **Compliance Statement**

It is the policy of Bear Creek Community Charter School not to discriminate on the basis of race, sex, religion, color, national origin, age, handicap or limited English proficiency in its educational programs, services, facilities, activities or employment policies as required by Title IX of the 1972 Educational Amendments, Title VI and VII of the Civil Rights Act of 1964, as amended, Section 504 Regulations of the Rehabilitation Act of 1973, the Age Discrimination Act of 1975, Section 204 Regulations of the 1984 Carl D. Perkins Act or any applicable federal statute.

For information regarding programs, services, activities, and facilities that are accessible to and usable by handicapped persons or for inquiries regarding civil rights compliance, contact: Bear Creek Community Charter School, 30 Charter School Way, Bear Creek Township, PA 18702; or the Director of the Office of Civil Rights, Department of Health, Education and Welfare, Washington, D.C.