Kansas Mathematics

Grade 8

Adopted 2017

Standards for Mathematical Practice

1. **Make sense of problems and persevere in solving them.** MP.1
2. **Reason abstractly and quantitatively.** MP.2
3. **Construct viable arguments and critique the reasoning of others.** MP.3
4. **Model with mathematics** MP.4
5. **Use appropriate tools strategically** MP.5
6. **Attend to precision.** MP.6
7. **Look for and make use of structure.** MP.7
8. **Look for and express regularity in repeated reasoning.** MP.8

Geometry

Geometric measurement: understand concepts of angle and measure angles.

1. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: 8.G.1
   a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles. 8.G.1.A
   b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees. 8.G.1.B
2. Measure angles in whole-number degrees using a protractor. Draw angles of specified measure using a protractor and straight edge. 8.G.2
3. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g. by using an equation with a symbol for the unknown angle measure. 8.G.3
4. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure. 8.G.4

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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.G.5
6. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on drawing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. 8.G.6

Understand and apply the Pythagorean Theorem.

7. Explain a proof of the Pythagorean Theorem and its converse. 8.G.7
8. 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.8
9. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. 8.G.9

Solve real-world and mathematical problems involving measurement.

10. Use the formulas or informal reasoning to find the arc length, areas of sectors, surface areas and volumes of pyramids, cones, and spheres. 8.G.10
11. Investigate the relationship between the formulas of three dimensional geometric shapes; 8.G.11
    a. Generalize the volume formula for pyramids and cones (V = 1/3Bh). 8.G.11.A
    b. Generalize surface area formula of pyramids and cones (SA = B + ½Pl). 8.G.11.B
12. Solve real-world and mathematical problems involving arc length, area of two-dimensional shapes including sectors, volume and surface area of three-dimensional objects including pyramids, cones and spheres. 8.G.12

The Number System

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. 8.NS.1
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). 8.NS.2

Expressions and Equations

Work with radicals and integer exponents.

1. 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 whole number perfect squares with solutions between 0 and 15 and cube roots of whole number perfect cubes with solutions between 0 and 5. Know that √2 is irrational. 8.EE.1

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2. 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.2
3. Read and write 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. 8.EE.3

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

4. Graph proportional relationships, interpreting its unit rate as the slope (m) of the graph. Compare two different proportional relationships represented in different ways. 8.EE.4
5. 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 and extend to include the use of the slope formula (m = y₂ - y₁/x₂ - x₁when given two coordinate points (x₁, y₁) and (x₂, y₂)). Generate the equation y = mx for a line through the origin (proportional) and the equation y = mx + b for a line with slope m intercepting the vertical axis at y-intercept b (not proportional when b ≠ 0). 8.EE.5
6. Describe the relationship between the proportional relationship expressed in y = mx and the non-proportional linear relationship y = mx + b as a result of a vertical translation. 8.EE.6

Analyze and solve linear equations and inequalities.

7. Fluently (efficiently, accurately, and flexibly) solve one-step, two-step, and multi-step linear equations and inequalities in one variable, including situations with the same variable appearing on both sides of the equal sign. 8.EE.7
    a. Give examples of linear equations in one variable with one solution (x = a), infinitely many solutions (a = a), or no solutions (a = b). 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). 8.EE.7.A
    b. Solve linear equations and inequalities with rational number coefficients, including equations/inequalities whose solutions require expanding and/or factoring expressions using the distributive property and collecting like terms. 8.EE.7.B

Statistics and Probability

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. 8.SP.1

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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.2
3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. 8.SP.3

Functions

Define, evaluate, and compare functions.

1. Explain 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. 8.F.1
2. Compare properties of two linear functions represented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions). 8.F.2
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.F.3

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. 8.F.4
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.5