Missouri Secondary Mathematics Learning Standards *(Proposed)*

DRAFT

TABLE OF CONTENTS

DRAFT

Grade 6

Domain	Standards	
Ratios and Proportional Relationships	**A. Understand ratio concepts and use ratio reasoning to solve problems.**	
	6.RP.A.1	Understand a ratio as a comparison of two quantities and represent these comparisons in the form of ratios and as verbal statements.
	6.RP.A.2	Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and describe the meaning of unit rate in the context of the relationship.
	6.RP.A.3	Solve real-world mathematical problems involving ratios and rates utilizing strategies such as tables of equivalent ratios, tape diagrams (bar models), double number line diagrams, and/or equations. a. Make tables of equivalent ratios, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems. *e.g., pricing and constant speed.* c. Calculate a percent of a quantity as a rate per 100; given a percent, solve problems involving finding the whole given a part and the part given the whole. d. Convert measurement units within one system of measurement and between two systems of measurements (customary and metric), given a conversion factor such as 1” = 2.54 cm.

DRAFT

Domain	Standards	
Number Sense and Operations	**A. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.**	
	6.NS.A.1	Compute and represent quotients of positive fractions. a. Compute quotients of fractions divided by fractions. b. Solve word problems involving division of fractions by fractions, including reasoning strategies such as using visual fraction models and/or equations to represent the problem.
	B. Compute with non-negative multi-digit numbers and find common factors and multiples.	
	6.NS.B.2	Divide multi-digit whole numbers using the standard algorithm.
	6.NS.B.3	Add, subtract, multiply, and divide decimals.
	6.NS.B.4	Find common factors and multiples. a. Find common factors and multiples, including the GCF of two whole numbers that are each ≤ 100 and the LCM of two whole numbers that are each ≤ 12. b. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *e.g., Express 36 + 8 as 4(9+2).*
	C. Apply and extend previous understandings of numbers to the system of rational numbers.	
	6.NS.C.5	Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
	6.NS.C.6	Understand a rational number as a point on the number line. a. Locate rational numbers on a horizontal or vertical number line. b. Write, interpret, and explain statements of order for rational numbers in mathematical and real-world contexts. c. Understand that a number and its opposite (additive inverse) are located on opposite sides of zero on the number line. Their sum will always be zero.
	6.NS.C.7	Understand that the absolute value of a rational number is its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.
	6.NS.C.8	Extend prior knowledge to generate equivalent representations of rational numbers between fractions, decimals, and percentages (limited to terminating decimals and/or benchmark fractions of 1/3 and 2/3).

DRAFT

Domain	Standards	
Expressions, Equations and Inequalities	**A. Apply and extend previous understandings of arithmetic to algebraic expressions.**	
	6.EEI.A.1	Understand the difference between an expression and an equation; and write and evaluate numerical expressions involving whole-number exponents.
	6.EEI.A.2	Read and write expressions involving whole number exponents in which letters are used to represent quantities that are either unknown, or that vary. a. Identify parts of an expression using mathematical terminology. i.e., sum, term, product, factor, quotient, coefficient, constant b. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. c. Evaluate expressions involving addition, subtraction, multiplication, and division of non-negative rational numbers, grouping symbols, and whole-number exponents using the order of operations. d. Write expressions using letters (variables) to represent quantities in real-world and mathematical situations. Understand the meaning of the variable in the context of the situation.
	6.EEI.A.3	Identify and generate equivalent algebraic expressions using mathematical properties, i.e., commutative, associative, distributive.
	B. Reason about and solve one-variable equations and inequalities.	
	6.EEI.B.4	Use substitution to determine whether a given number in a specified set makes a one-variable equation or an inequality true.
	6.EEI.B.5	Understand that if any solutions exist, the solution set for an equation or inequality consists of values that make the equation or inequality true.
	6.EEI.B.6	Write equations using letters (variable) to represent quantities in real-world and mathematical situations. Understand the meaning of the variable in the context of the situation.
	6.EEI.B.7	Solve one-step linear equations in one variable involving non-negative rational numbers for real-world and mathematical problems
	6.EEI.B.8	Recognize that inequalities may have infinitely many solutions. a. Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem, where c is a constant. b. Graph solutions of such inequalities on a number line.

DRAFT

	C. Represent and analyze quantitative relationships between dependent and independent variables.	
	6.EEI.C.9	Identify and describe relationships between two variables that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs, tables, and equations and relate these representations to each other.

Domain	Standards	
Geometry and Measurement	**A. Solve real-world and mathematical problems involving area, surface area, and volume.**	
	6.GM.A.1	Find the area of polygons by composing or decomposing the shapes into rectangles or triangles and apply these techniques to solve real-world problems.
	6.GM.A.2	Find the volume of right rectangular prisms. a. Understand that the volume of a right rectangular prism can be found by filling the prism with multiple layers of the base. Discover that using visual models (e.g. model by packing) produces the same volume as using the formulas, whether the side lengths are whole or fractional edge lengths. b. Apply V = l * w * h and V = Bh to find the volume of right rectangular prisms with whole or fractional edges for real-world and mathematical problems.
	6.GM.A.3	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. a. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. b. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate (length of horizontal or vertical line segments). c. Draw polygons in the coordinate plane given coordinates for the vertices.
	6.GM.A.4	Solve real-world and mathematical problems using nets. a. Represent three-dimensional figures using nets made

DRAFT

	up of rectangles and triangles. b. Use nets to find the surface area of three-dimensional figures whose sides are made up of rectangles and triangles to solve real-world and mathematical problems.

Domain	Standards	
Data Analysis, Statistics and Probability	**A. Develop understanding of statistical variability.**	
	6.DSP.A.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
	6.DSP.A.2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape of its representation.
	6.DSP.A.3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
	B. Summarize and describe distributions.	
	6.DSP.B.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
	6.DSP.B.5	Summarize numerical data sets in relation to their context by the following: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context of the data. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context of the data.
	6.DSP.B.6	Create circle graphs and interpret the data in context of real-world and mathematical situations.

DRAFT

Grade 7

Domain	Standards

Ratios and Proportional Relationships	**A. Analyze proportional relationships and use them to solve real-world and mathematical problems.**	
	7.RP.A.1	Compute unit rates, including those that involve complex fractions, with like or different units.
	7.RP.A.2	Recognize and represent proportional relationships between quantities in equations, tables, graphs, diagrams, and real-world situations. a. Determine when two quantities are in a proportional relationship. b. Identify and/or compute the constant of proportionality (unit rate). c. 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.
	7.RP.A.3	Solve real-world and mathematical problems involving ratios and percentages using proportional relationships, such as simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Domain	Standards	
Number Sense and Operations	**A. Apply and extend previous understandings of operations to add, subtract, multiply, and divide rational numbers.**	
	7.NS.A.1	Apply and extend previous understandings of numbers to add and subtract rational numbers. a. Add and subtract rational numbers to include fractions, decimals, and integers. b. Represent addition and subtraction on a horizontal or vertical number line. c. Describe situations and show that a number and its opposite have a sum of 0 (are additive inverses). d. Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. e. Show that the distance between two rational numbers on the number line is the absolute value of their difference. f. Interpret sums and differences of rational numbers by describing real world contexts.
	7.NS.A.2	Apply and extend previous understandings of numbers to multiply and divide rational numbers. a. Multiply and divide rational numbers to include fractions, decimals, and integers.

DRAFT

		b. Show that a number and its reciprocal have a product of 1 (multiplicative inverse). c. 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 –(p/q) = (–p)/q = p/(–q). d. Convert a rational number to a decimal using long division. e. Understand that some rational numbers can be written as integers and all rational numbers can be written as fractions or decimal numbers that terminate or repeat. f. Interpret products and quotients of rational numbers by describing real-world contexts.
	7.NS.A.3	Solve real-world and mathematical problems involving the four arithmetic operations with rational numbers.

Domain	Standards	
Expressions, Equations and Inequalities	**A. Use properties of operations to generate equivalent expressions.**	
	7.EEI.A.1	Apply properties of operations (i.e. commutative, associative, and distributive) to simplify and to factor linear algebraic expressions with rational coefficients.
	7.EEI.A.2	Understand how to use equivalent expressions to clarify quantities in a problem context. *e.g., Adding a 5% tax to the total is the same as multiplying the total by 1.05 a + 0.05a = 1.05a.*
	B. Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	
	7.EEI.B.3	Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (i.e. integers, fractions, and decimals) by applying properties of operations as strategies to calculate with numbers. a. Convert between forms as appropriate. b. Assess the reasonableness of answers using mental computation and estimation strategies.
	7.EEI.4	Solve real-world and mathematical problems by using and solving linear equations and inequalities in one variable. a. Write and solve equations of the form x+p = q and px = q in which p and q are rational numbers. b. Write and solve two-step equations of the form px + q = r and p(x + q) = r, where p, q, and r are rational numbers and interpret the meaning of the solution in the context of the problem. c. Write and solve inequalities of the form px + q > r or

DRAFT

		px + q < r, where p, q, and r are rational numbers. Graph the solution set of the inequality and interpret it in the context of a problem.

Domain	Standards	
Geometry and Measurement	**A. Draw and describe geometrical figures and describe the relationships between them.**	
	7.GM.A.1	Solve problems involving scale drawings of real-world objects and geometric figures, including computing actual lengths and areas from a scale drawing and reproducing the drawing at a different scale.
	7.GM.A.2	Use a variety of tools (freehand, ruler, protractor, and/or technology) to construct geometric shapes. a. Construct triangles given 3 sides, given 3 angles, or given a combination of 3 sides and/or angles and decide if the measurements determine a unique triangle, more than one triangle, or no triangle. b. Construct special quadrilaterals given specific parameters about angles or sides. i.e., kite, trapezoid, rhombus, parallelogram, rectangle
	7.GM.A.3	Describe the two-dimensional cross section of a three-dimensional shape.
	B. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	
	7.GM.B.4	Understand concepts of circles. a. Demonstrate an understanding of the relationships among radius, diameter, and circumference of a circle. b. Understand the relationship among the circumference, the diameter, and π. c. Explore the relationship between circumference and area of a circle. d. Know and apply the formulas for circumference and area of circles to solve real-world and mathematical problems.
	7.GM.B.5	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.
	7.GM.B.6	Solve real-world and mathematical problems involving area, volume and surface area. a. Understand the concept of area and find area of triangles, quadrilaterals, and other polygons composed of triangles and rectangles. b. Understand the concepts of volume and surface area and find related measures for cubes, right triangular prisms and pyramids, right rectangular prisms and

DRAFT

	pyramids, and cylinders.

Domain	Standards	
Data Analysis, Statistics and Probability	**A. Use random sampling to draw inferences about a population.**	
	7.DSP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population. a. Understand that a sample is a subset of a population and both have similar characteristics. b. Understand that generalizations from a sample are valid only if the sample is representative of the population. c. Understand that random sampling is used to produce representative samples and support valid inferences.
	7.DSP.A.2	Use data from multiple samples to draw inferences about a population and investigate variability in estimates of the characteristic of interest. *e.g. Estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data; gauge how far off each of the estimates or predictions might be.*
	B. Draw informal comparative inferences about two populations.	
	7.DSP.B.3	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. *e.g. The mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*
	7.DSP.B.4	Compare the numerical measures of center (mean, median, and mode) and variability (range and interquartile range) from two random samples to draw inferences about the populations.
	C. Develop, use, and evaluate probability models.	
	7.DSP.C.5	Investigate probability of chance events. a. Determine probabilities of simple (single) events. b. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. c. Understand that a probability near 0 indicates an unlikely event, a probability around 1/2 indicates an

DRAFT

		event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
	7.DSP.C.6	Investigate the relationship between theoretical and experimental probabilities for simple events. a. Predict outcomes using theoretical probability. b. Perform experiments that model theoretical probability. c. Compare theoretical and experimental probabilities.
	7.DSP.C.7	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. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *e.g.*, *If a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *e.g.*, *find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*
	7.DSP.C.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulations. a. 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. b. Design and use a simulation to generate frequencies for compound events.

DRAFT

Grade 8

Domain	Standards	
Number Sense and Operations	**A. Know that there are numbers that are not rational, and approximate them by rational numbers.**	
	8.NS.A.1	Explore the real number system. a. Know the differences between rational and irrational numbers. b. Understand that all rational numbers have a decimal expansion that terminates or repeats. c. Convert decimals which repeat into fractions and fractions into repeating decimals. d. Generate equivalent representations of rational numbers (fractions, decimals, and percentages).
	8.NS.A.2	Estimate the value and compare the size of irrational numbers and approximate their locations on a number line.

Domain	Standards	
Expressions, Equations and Inequalities	**A. Work with radicals and integer exponents.**	
	8.EEI.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
	8.EEI.A.2	Investigate concepts of square and cube roots. a. 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. b. Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000. c. Recognize that square roots of non-perfect squares are irrational. i.e., Explain why numbers are or are not perfect squares using area models.
	8.EEI.A.3	Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other.
	8.EEI.A.4	Use scientific notation to solve real-world and mathematical problems. a. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. b. 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 tectonic plate movement.* c. Input and interpret scientific notation using technology.

DRAFT

	B. Understand the connections between proportional relationships, lines, and linear equations.	
	8.EEI.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships given multiple representations including tables, graphs, and equations.
	8.EEI.B.6	Apply concepts of slope and y-intercept to graphs, equations, and proportional relationships. a. Explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. b. 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.
	C. Analyze and solve linear equations and inequalities and pairs of simultaneous linear equations.	
	8.EEI.C.7	Solve linear equations and inequalities in one variable. a. Give examples of linear equations with one solution, infinitely many solutions, or no solutions. b. Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and collecting like terms.
	8.EEI.C.8	Analyze and solve systems of linear equations. a. Graph systems of linear equations. b. Explain why solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs. c. Explain why systems of linear equations can have one solution, no solution, or infinitely many solutions. d. Solve systems of two linear equations in two variables algebraically, including methods of substitution and eliminations, or through inspection. e. Solve real-world and mathematical problems leading to two linear equations in two variables.

DRAFT

Domain	Standards	
Functions	**A. Define, evaluate, and compare functions.**	
	8.F.A.1	Explore the concept of functions. (The use of function notation is not required.) a. Understand that a function assigns to each input exactly one output. b. Determine if a relation is a function using multiple representations, including mappings, tables and graphs. c. Graph a function from a table of values.
	8.F.A.2	Compare characteristics of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
	8.F.A.3	Investigate the differences between linear and nonlinear functions. a. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line. b. Recognize that the graph of a linear function has a constant rate of change. c. Give examples of nonlinear functions.
	B. Use functions to model relationships between quantities.	
	8.F.B.4	Use functions to model linear relationships between quantities. a. Understand that the slope is the constant rate of change and the initial value is the y-intercept. Describe their meanings in the context of a given situation. b. Determine the slope and the y-intercept of a linear function given a description of the relationship or from two points, tables, or graphs.
	8.F.B.5	Describe the functional relationship between two quantities from a graph (*e.g., constant, increasing/decreasing, linear/nonlinear, continuous/discontinuous*) and be able to sketch a graph given a verbal description.

DRAFT

Domain	Standards	
Geometry and Measurement	**A. Understand congruence and similarity using physical models, transparencies, or geometry software.**	
	8.GM.A.1	Verify experimentally the congruence properties of rigid transformations (rotations, reflections, and translations). a. Verify that lines are mapped to lines, including parallel lines. b. Verify that corresponding angles are congruent. c. Verify that corresponding line segments are congruent.
	8.GM.A.2	Understand that two-dimensional figures are congruent if a series of rigid transformations (rotations, reflections, translations) can be performed to map the pre-image to the image. Given two congruent figures, describe the sequence of transformations that justifies the congruence between them.
	8.GM.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	8.GM.A.4	Understand that two-dimensional figures can be similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image. Given two similar figures, describe a sequence of transformations that justifies the similarity between them.
	8.GM.A.5	Explore angle relationships and establish informal arguments for the following: a. The sum of the angles in a triangle. b. The relationship between the interior and exterior angles of a triangle. c. The angles created when parallel lines are cut by a transversal. d. Congruent corresponding angles in similar figures.
	B. Understand and apply the Pythagorean Theorem.	
	8.GM.B.6	Use models to demonstrate a proof of the Pythagorean Theorem and its converse.
	8.GM.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensional contexts.
	8.GM.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
	C. Solve real-world and mathematical problems involving volume of cones, pyramids and spheres.	
	8.GM.C.9	Solve real-world and mathematical problems involving surface area and volume. a. Understand the concept of surface area and the find surface area of pyramids (triangular and rectangular). b. Understand the concepts of volume and find related

DRAFT

		measures for pyramids (triangular and rectangular), cones and spheres.

Domain	Standards	
Data Analysis, Statistics and Probability	**A. Investigate patterns of association in bivariate data.**	
	8.DSP.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 correlation, linear association, and nonlinear association.
	8.DSP.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 find a line of best fit, and informally assess the fit of the line by evaluating the closeness of the data points to the line.
	8.DSP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *e.g. 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.DSP.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. a. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. b. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *e.g., 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?*

DRAFT

Algebra 1

Domain	Standards	
Number and Quantity	**A. Extend and use properties of rational exponents.**	
	A1.NQ.A.1	Explain how the meaning of rational exponents follows from extending the properties of integer exponents to rational numbers. *e.g.*, $\left(5^{\frac{1}{3}}\right)^3 = 5$
	A1.NQ.A.2	Rewrite expressions involving simple radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1. *e.g.,* $\sqrt[n]{x}=x^{\frac{1}{n}}$
	B. Use units to solve problems.	
	A1.NQ.B.3	Use units of measure as a way to understand and solve problems involving rates, time, length, area, and capacity. a. Identify, label, and use appropriate units of measure within a context. b. Convert units and rates within a system without conversion factors provided and between systems with the conversion factor. c. Use units within multi-step problems. *e.g., An L-shaped concrete slab is composed of a rectangular piece 30 feet 6 inches by 20 feet 4 inches and a second piece 10 feet 8 inches by 8 feet 3 inches. If the slab is 4 inches thick, how many cubic yards (to the nearest greater ¼ cubic yard) need to be ordered?* d. Choose and interpret the scale and the origin in graphs and data displays.
	A1.NQ.B.4	Define and use appropriate quantities for representing a given context or problem.
	A1.NQ.B.5	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *e.g.*, *Problems involving money are normally computed to the nearest cent.*

Algebra— Seeing Structure in Expressions	**A. Interpret and use structure.**	
	A1.SSE.A.1	Interpret the contextual meaning of individual terms or factors from a given situation that utilizes formulas or expressions.
	A1.SSE.A.2	Analyze the structure of polynomial expressions in order to rewrite the expressions in equivalent forms.
	A1.SSE.A.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Find the zeros of a quadratic fuction by rewriting it in factored form. b. Find the maximum and minimum value of a quadratic function by completing the square.

DRAFT

Algebra—Creating Equations	**B. Create equations that describe linear, quadratic, and exponential functions.**	
	A1.CED.B.4	Create equations and inequalities in one variable and use them to model and/or solve problems, including, linear, quadratic, and exponential functions (integer inputs only)
	A1.CED.B.5	Create linear and simple quadratic and exponential equations in two variables. Graph the equations on coordinate axes with labels and scales.
	A1.CED.B.6	Represent constraints by equations or inequalities, and by systems of equations or inequalities. Interpret data points as a solution or non-solution in a modeling context.
	A1.CED.B.7	Solve literal equations and formulas for a specified variable that highlights a quantity of interest.

Algebra—Reasoning with Equations and Inequalities	**C. Understand solving equations as a process and solve equations and inequalities in one variable.**	
	A1.REI.C.8	Justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.
	A1.REI.C.9	Solve mathematical and real-world problems involving quadratic equations in one variable. a. Use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x-p)^2 = q$ that has the same solution. b. Derive the quadratic formula from $ax^2 + bx + c = 0$, (a,b,c any real number) c. Solve quadratic equations by inspection, taking square roots, completing the square, using the quadratic formula, and factoring as appropriate to the initial form of the equation.
	D. Solve systems of equations.	
	A1.REI.D.10	Solve systems of linear equations algebraically and graphically.
	A1.REI.D.11	Solve a simple system consisting of a linear equation and a quadratic function algebraically and graphically.
	A1.REI.D.12	Justify that the solution to a system of linear equations is not changed when one of the equations is replaced by a linear combination of the other equation.
	E. Represent and solve linear and exponential equations and inequalities graphically.	
	A1.REI.E.13	Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
	A1.REI.E.14	Graphically show that the solution to the equation $f(x) = g(x)$ is the x-coordinate(s) of the point(s) of intersection of $y = f(x)$

DRAFT

		and $y = g(x)$.
	A1.REI.E.15	Graph the solution to a linear inequality in two variables.
	A1.REI.E.16	Solve systems of linear inequalities by graphing.

Algebra-Arithmetic with Polynomials and Rationals	**F. Perform operations on polynomials.**	
	A1.APR.F.17	Add, subtract and multiply polynomials, and understand that polynomials are closed under these operations
	A1.APR.F.18	Divide polynomials by monomials.

DRAFT

Functions—Interpreting Functions	**A. Understand the concept of a function and use function notation.**	
	A1.IF.A.1	Extend previous knowledge of a function to apply to general behavior and features of a function. Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range. a. Represent a function using function notation and explain that $f(x)$ denotes the elements of the range of a function f that correspond to the elements of the domain. b. Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation $y = f(x)$.
	A1.IF.A.2	Using function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
	B. Interpret linear, quadratic, and exponential functions in terms of the context.	
	A1.IF.B.3	Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximum or minimum; symmetries; and end behavior.
	A1.IF.B.4	Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
	A1.IF.B.5	Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context
	A1.IF.B.6	Interpret the parameters of a linear or exponential function in terms of the context.
	C. Analyze linear, quadratic, and exponential functions using different representations.	
	A1.IF.C.7	Graph functions, including absolute value linear functions, from their symbolic representation and show key features of the graph both by hand and by using technology.
	A1.IF.C.8	Translate between different but equivalent forms of a function to reveal and explain different properties of the function and interpret these in terms of a context, *i.e., slope, intercepts, extreme values.*
	A1.IF.C.9	Compare the properties of two functions given different representations.

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Functions-Building Functions	D. **Build new functions from existing functions (limited to linear, quadratic, and exponential).**	
	A1.BF.D.10	Describe the effect of the transformations on the graph of $f(x)$ by $kf(x), f(x)+k, f(x+k)$ for specific values of *k* (both positive and negative). Find the specific value of *k* given the graphs of $f(x)$ and the graph after a transformation has been performed.

Functions—Linear, Quadratic and Exponential Models	**E. Construct and compare linear, quadratic, and exponential models and solve problems.**	
	A1. LQE.E.11	Distinguish between situations that can be modeled with linear and with exponential functions. a. Show that linear functions change by equal differences over equal intervals. Show that exponential functions change by equal factors over equal intervals. *e.g., by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals* b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
	A1. LQE.E.12	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
	A1. LQE.E.13	Construct linear and exponential equations given graphs, verbal descriptions or tables.
	F. Use arithmetic and geometric sequences.	
	A1. LQE .F.14	Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.
	A1. LQE .F.15	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.
	A1. LQE .F.16	Construct arithmetic and geometric sequences, given graphs, verbal descriptions, or tables.

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Statistics and Data	**A. Summarize, represent, and interpret data.**	
	A1.SD.A.1	Analyze and interpret data with plots on the real number line (dot plots, histograms, and box plots).
	A1.SD.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation*) of two or more different data sets. *The standard deviation should be limited to a small data set with an integral mean. *e.g., a sample of 10 quiz scores*
	A1.SD.A.3	Interpret differences in shape, center, and spreads in the context of the data sets, accounting for possible effects of extreme data points (outliers).
	A1.SD.A.4	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
	A1.SD.A.5	Represent data on two quantitative variables, given in table or contextual form, on a scatter plot, and describe how the variables are related. Identify a function that best describes the relationship and use this function to solve problems. a. Using estimation and/or technology, fit a linear function to bivariate data represented on a scatter plot that minimizes residuals. b. Using technology, fit an exponential or quadratic function to bivariate data represented on a scatter plot that minimizes residuals.
	A1.SD.A.6	Interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.
	A1.SD.A.7	Using available technology, determine the correlation between two numerical unknowns, interpret the correlation, and describe the strengths and weaknesses of the correlation coefficient as a measure of linear association.
	A1.SD.A.8	Distinguish between correlation and causation.

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Geometry

Congruence	**A. Experiment with transformations in the plane**	
	G.CO.A.1	Know precise definitions of angle, circle, perpendicular line, parallel line, line segment, and ray based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
	G.CO.A.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not. *e.g. translation versus horizontal stretch*
	G.CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
	G.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	G.CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
	B. Understand congruence in terms of rigid motions.	
	G.CO.B.6	Use the descriptions of rigid motions (translations, rotations, reflections) to transform figures and predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions (preserving size and shape) to decide if they are congruent (i.e. Is there a combination of rigid motions that transforms the first figure onto the second?)
	G.CO.B.7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
	G.CO.B.8	Explain how the criteria for triangle congruence (ASA, AAS, SAS, and SSS) follow from the definition of congruence in terms of rigid motions and that they represent minimum requirements for congruence of any two triangles.
	C. Prove geometric theorems.	
	G.CO.C.9	Prove theorems about lines and angles. (Theorems should include the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.)

DRAFT

	G.CO.C.10	Prove theorems about triangles. (Theorems should include the following: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.)
	G.CO.C.11	Prove theorems about parallelograms. (Theorems should include the following: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.)
	D. Make geometric constructions.	
	G.CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). a. Construct basic geometric components. *e.g. Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* b. Construct specific geometric shapes. *e.g.regular hexagons inscribed in circles, equilateral triangles, squares.*

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Similarity, Right Triangles and Trigonometry	**A. Understand similarity in terms of similarity transformations.**	
	G.SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the same ratio as given by the scale factor.
	G.SRT.A.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
	G.SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
	B. Prove theorems involving similarity.	
	G.SRT.B.4	Prove theorems about triangles. (Theorems should include: a line parallel to one side of a triangle divides the other two sides proportionally, and conversely, the Pythagorean Theorem proved using triangle similarity.)
	G.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
	C. Define trigonometric ratios and solve problems involving right triangles.	
	G.SRT.6	Understand, using similarity, that side ratios in right triangles define the trigonometric ratios (sine, cosine, tangent) for acute angles.
	G.SRT.7	Explain and use the relationship between the sine and cosine of complementary angles.
	G.SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Circles	**A. Understand and apply theorems about circles.**	
	G.C.A.1	Prove that all circles are similar using similarity transformations (dilations).
	G.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords. (Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.)
	G.C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

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Circles	**B. Find arc lengths and areas of sectors of circles.**	
	G.C.B.4	Derive, using similarity, the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as that constant of proportionality.
	G.C.B.5	Derive the formula for the area of a sector of a circle using ratios of arc lengths.

Expressing Geometric Properties with Equations	**A. Translate between the geometric description and the equation for a conic section.**	
	G.GPE.A.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
	G.GPE.A.2	Derive the equation of a parabola given a focus and directrix, using the fact that the distances to the focus and to the directrix are equal from any point on the parabola.
	B. Use coordinates to prove simple geometric theorems algebraically.	
	G.GPE.B.3	Use coordinates to prove simple geometric theorems algebraically. (e.g. prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1,\sqrt{3})$ lies on the circle centered at the origin and containing the point (0, 2).)
	G.GPE.B.4	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. *e.g. Find the equation of a line parallel or perpendicular to a given line that passes through a given point.*
	G.GPE.B.5	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
	G.GPE.B.6	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. *e.g. using the distance formula.*

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Geometric Measurement and Dimension	**A. Explain volume formulas and use them to solve problems.**	
	G.GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, or informal limit arguments.
	G.GMD.A.2	Use volume formulas for cylinders, pyramids, cones, spheres, and composite figures to solve mathematical modeling problems.
	B. Visualize relationships between two-dimensional and three-dimensional objects.	
	G.GMD.B.3	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by transformations of two-dimensional objects.

Modeling with Geometry	**A. Apply geometric concepts in modeling situations**	
	G.MG.A.1	Use geometric shapes, their measures, and their properties to describe objects. *e.g. modeling a tree trunk or a human torso as a cylinder.*
	G.MG.A.2	Apply concepts of density based on area and volume in modeling situations. *e.g., persons per square mile, BTUs per cubic foot*
	G.MG.A.3	Apply geometric methods to solve design mathematical modeling problems. *e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios*

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Conditional Probability and the Rules of Probability	**A. Understand independence and conditional probability and use them to interpret data.**	
	G.CP.A.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not).
	G.CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
	G.CP.A.3	Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
	G.CP.A.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *e.g. Collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*
	G.CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *e.g. Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*
	B. Use the rules of probability to compute probabilities of compound events in a uniform probability model.	
	G.CP.B.6	Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.
	G.CP.B.7	Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

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Algebra 2

	Standards	
Algebra	**A. Extend and use the relationship between rational exponents and radicals.**	
	A2.A.A.1	Extend the system of powers and roots to include rational exponents, particularly rational exponents with integer numerators other than 1.
	A2.A.A.2	Simplify and recognize equivalent expressions involving radical and exponential forms of expressions containing exponents, including rational exponents.
	A2.A.A.3	Solve equations involving rational exponents and/or radicals and manage appropriately the situations where extraneous solutions may result.
	B. Use complex numbers.	
	A2.A.B.4	Represent complex numbers in the form *a* + *bi*, where a and b are real numbers, and *i* is defined to be the square root of -1.
	A2.A.B.5	Add, subtract, and multiply complex numbers. Rationalize denominators of complex number fractions using conjugates. Leave all answers in the form *a* + *bi*.
	C. Recognize and use iterative and recursive patterns.	
	A2.A.C.6	Use explicit and recursive versions of the formulas for arithmetic and geometric sequences. Model real world or mathematical situations using sequences.
	A2.A.C.7	Find terms of general sequences, given an iterative formula.
	D. Perform operations on polynomials and rational expressions.	
	A2.A.D.8	Extend the knowledge of factoring to completely factor general polynomial expressions.
	A2.A.D.9	Use factoring techniques to solve general polynomial equations, which could include complex solutions.
	A2.A.D.10	Extend operations on polynomial expressions to include division of a polynomial of degree 2 or higher by a binomial. Express the result as a quotient with a remainder.
	A2.A.D.11	Find the least common multiple of two or more polynomials. Add, subtract, multiply and divide rational expressions.
	E. Solve equations and inequalities.	
	A2.A.E.12	Solve exponential equations that do not require the use of logarithms.
	A2.A.E.13	Solve single variable, linear inequalities involving absolute value.
	A2.A.E.14	Solve rational equations, where numerators and denominators are polynomials and where extraneous solutions may result.
	F. Solve general systems of equations and inequalities.	

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	A2.A.F.15	Extend solving systems of equations to finding solutions of systems with two unknowns that include non-linear equations or inequalities. Students should use graphical methods in most cases but could use algebraic methods in simple cases.
	G. Define and use logarithms.	
	A2.A.G.16	Define a logarithm of a given base b of a quantity to be the exponent to which you raise the base to get that quantity, i.e., $\log_b(x) = y$ if and only if $b^y = x$.
	A2.A.G.17	Use logarithms to solve simple exponential equations.
	A2.A.G.18	Use properties of logarithms to do the following: a. Convert an exponent into a multiplier (factor). b. Convert a logarithm of factors into the sum of the logarithms of the individual factors. c. Convert a logarithm of a quotient into the difference of the logarithms of the dividend and divisor.
	A2.A.G.19	Use logarithmic scales to compare quantities and solve problems involving logarithms. *e.g., pH scale, earthquake intensity, and sound intensity.*

Functions	**A. Use and interpret functions.**	
	A2.F.A.1	Perform operations on functions, including addition, subtraction, multiplication, division, and composition of functions. Modify the domain and range if necessary, *e.g., to restrict a range in order to avoid a zero denominator in a quotient of functions*.
	A2.F.A.2	Derive inverses of simple functions, and compose the inverse with the original function to show that the functions are inverses.
	A2.F.A.3	Identify domain and range of functions, and identify unique characteristics of functions represented graphically, with tables, and with algebraic symbolism. Function types and these unique characteristics are the following: a. Constant: x- and y- intercepts, if any b. Linear: x- and y- intercepts, if any; slope c. General Polynomial: x- and y- intercepts, if any; end behavior; limited domains / ranges; local maxima or minima values; and simple symmetries, *e.g. for quadratic functions* d. Absolute Value of Linear Functions: Vertex, x- and y- intercepts, if any; limited domains / ranges e. Simple piece-wise defined functions that may have points of discontinuity and that consist of other previously studied functions f. Exponential: x- and y- intercepts, if any; limited domains / ranges; horizontal asymptotes; growth and/or decay models; and end behavior g. Logarithmic: x- and y- intercepts, if any; limited

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		domains / ranges; vertical asymptotes; growth and/or decay models; and end behavior.
	A2.F.A.4	Explain and apply parameter changes algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections, and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential, and logarithmic functions.
	A2.F.A.5	Solve simple applications of quadratic and exponential function models, *e.g. price-demand-cost-revenue-profit situations, simple and compound interest problems, and exponential growth or decay problems.*
	B. Model with the Sine and Cosine Functions.	
	A2.F.B.6	Using a unit circle, create the functions f(t) = sin(t) and g(t) = cos(t) to define the position of a point on the circle, at time t. Graph these functions in the coordinate plane, and define and explore amplitude, period, and midline.
	A2.F.B.7	Use parameter changes to amplitude, period, midline, and phase to model real-world contexts. *e.g., height / position over time of a ferris wheel, amount of daylight in a particular location over a year, or the behavior of ocean tides over time.* Use the form f(t) = A sin(B(t+h)) + k and explain how to determine each of the parameters A, B, h and k.
	A2.F.B.8	Solve problems using the primary Pythagorean identity $(\sin x)^2 + (\cos x)^2 = 1$.
	A2.F.B.9	Solve simple equations involving sine and cosine functions. *e.g., $(\sin x)^2 = ¼$ for $0 < x < 2\pi$.*

Data and Statistical Analysis	**A. Make inferences and justify conclusions**	
	A2.D.S.A.1	Explain how random sampling could be used to make inferences about population parameters.
	A2.D.S.A.2	Determine whether a specified model is consistent with a given data set. e*.g., A model says a spinning coin falls heads up with probability 0.5. Would an experimental result of 5 tails in a row cause you to question the model?*
	A2.D.S.A.3	Describe and explain the purposes, relationship to randomization, and differences among sample surveys, experiments, and observational studies.
	A2.D.S.A.4	Use data from a sample survey to estimate a population mean or proportion and recognize the meaning of the margin of error in these estimates.
	A.2.D.S.A.5	Describe and explain how the relative sizes of a sample and the population affect the margin of error of predictions and thus the validity of these predictions.
	B. Fit a data set to a normal distribution.	

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	A2.D.S.B.6	Given a data set that is known to be normally distributed, predict what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean.
	A2.D.S.B.7	Fit a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.

Additional Coursework beyond Algebra 2:

It is strongly recommended by the Missouri Department of Higher Education, and by this standards-writing group that students take a Mathematics course during their senior year in high school in order to be college and career ready. Many Missouri high school students will be enrolled in Algebra II during their sophomore or junior year of high school and accordingly, should plan to take additional coursework in mathematics each year prior to graduation. Topics listed below are either recommended by the Missouri Department of Higher Education's (MDHE) Curriculum Alignment Initiative or are topics that have been historically covered in Honors/Advanced Algebra 2 courses and/or other mathematics courses beyond Algebra 2.

Law of Sines

Law of Cosines

Using and graphing with polar coordinates

Partial fraction decomposition of basic rational functions (where the denominators are products of linear functions)

Matrices and Vectors

Rational Functions (additional work beyond that which is already included in Algebra 2)

Fundamental Theorem of Algebra and Remainder Theorem.

Combinatorics, including combinations, permutations, Pascal's triangle as used in combinatorics and binomial expansions

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