| **Required Course Numbers** |
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| **Test Content Categories** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Numbers and Operations
 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. **Understands operations and properties of the real number system**
 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Represents and solves word problems involving addition, subtraction, multiplication, and division of real numbers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Represents and identifies the effect that an operation has on a given number (e.g., adding a negative, adding the inverse, dividing by a nonzero fraction) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses the order of operations to simplify computations and solve problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies and applies properties of operations on a number system (e.g., commutative, associative, distributive, identity) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Compares and orders real numbers, including absolute values of real numbers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Classifies real numbers (e.g., natural, whole, integer, rational, irrational) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies whether the sum or product of rational and/or irrational numbers must be rational, must be irrational, or can be rational or irrational (e.g., the sum of two rational numbers must be rational, the product of two irrational numbers can be rational or irrational) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Performs operations involving integer exponents |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Approximates the value of a radical expression |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses scientific notation to represent and compare numbers and to perform calculations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Understands the relationships among fractions, decimals, and percent** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Converts among fractions, decimals, and percent |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Represents repeating decimals as fractions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Represents fractions, decimals, and percepts with models (e.g., area models, base-10 blocks, set models, colored rods) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Understands how to use ratios and proportional relationships to solve problems** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses the language of ratio and rate to describe relationships between two quantities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies and represents proportional relationships and uses them to solve problems (e.g., unit rates, scale factors, constant of proportionality) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves percent problems (e.g., expressing a percent as a ratio per 100, discounts, markups, taxes, tips, simple interest, percent error) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Understands how to reason quantitatively and use units to solve problems** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Chooses and interprets units consistently in formulas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Chooses and interprets the scale in graphs and data displays |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving dimensional analysis (e.g., feet per second to miles per hour, feet per second to kilometers per hour) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Understands how to use basic concepts of number theory (e.g., divisibility, prime factorization, multiples) to solve problems** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses the definitions of prime and composite numbers to solve problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving factors, multiples, and divisibility |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| II. Algebra |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands how to create, evaluate, and manipulate algebraic expressions, equations, and formulas** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Adds, subtracts, and multiplies linear and quadratic polynomials, including polynomials with rational coefficients |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Evaluates, manipulates, and compares algebraic expressions involving rational exponents (e.g., radicals, negative exponents) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses variables to construct and solve equations and inequalities in real-world contexts |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Translates verbal relationships into algebraic equations or expressions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Interprets parts of expressions and equations in terms of a real-world setting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Rewrites linear, quadratic, and exponential expressions in equivalent forms to reveal properties of the quantity represented by the expression |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the nature of the solutions of a quadratic equation (e.g., interprets the graph, finds the discriminant, writes the equation in factored form) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Rearranges formulas to solve for a specified variable (e.g., solve  for *t*) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B. Understands how to recognize and represent linear relationships algebraically |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the equation of a line from information presented in various forms (e.g., table, graph, description) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Recognizes and is able to extract information about a linear equation when it is presented in various forms (e.g., slope-intercept, point-slope, standard) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Converts among various forms of linear equations (e.g., slope-intercept, point-slope, standard) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Understands how to solve equations and inequalities** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves one-variable linear equations and inequalities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves one-variable nonlinear equations and inequalities (e.g., absolute value, quadratic) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Represents solutions to equations and inequalities (e.g., on a number line, in the ) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Justifies each step in solving equations and inequalities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Understands how to solve systems of equations and inequalities** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves a system of two linear equations or inequalities in two variables algebraically and graphically |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves a system consisting of a linear equation and a quadratic equation in two variables graphically |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Finds the solutions of  approximately (e.g., uses technology to graph the functions); includes cases where  and/or  are linear, quadratic, or exponential functions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Graphs the solution set to a system of linear inequalities in two variables in the   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • In a modeling context, represents constraints by systems of equations and/or inequalities and interprets solutions as viable or nonviable options |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| III. Functions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands how to identify, define, and evaluate functions** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines whether a relation is a function |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Given a function (presented as a table of values, algebraically, or graphically), determines if the function is linear, quadratic, or exponential |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the value of a function for a specified value in its domain |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Knows how to determine and interpret the domain and the range of a function presented as a table of values, algebraically, or graphically** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the domain and range of a function |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Interprets domain and range in real-world settings |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Understands basic characteristics of linear functions (e.g., intercepts, slope)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Calculates the intercepts of a line and interprets them in a modeling context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Calculates the slope of a line presented as a table of values, algebraically, or graphically and interprets it in a modeling context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Interprets what a point  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  and , where *r* is the unit rate |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Understands the relationships among functions, tables, and graphs** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines an equation to represent a linear or quadratic function presented graphically |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the type of equation that best represents a given graph |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Sketches a graph, given an equation of a function (e.g., square root, absolute value) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Compares properties (e.g., intercepts, slope, maximum) of two functions presented as tables of values, algebraically, graphically, or by verbal descriptions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies the symbolic representation of a linear function that is created when a graph is translated horizontally or vertically or reflected across the *x*-axis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Knows how to analyze and represent functions (i.e., linear, quadratic, exponential) that model given information** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Interprets statements that use function notation in terms of a context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Interprets the parameters in a linear or exponential function in terms of a context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Calculates the rate of change of a function over a given interval and interprets it in a context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines and interprets the *x*- and *y*-intercepts of quadratic functions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Develops a function—represented by a graph, equation, or table—to model a given set of conditions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Evaluates whether a particular mathematical model (e.g., graph, equation, table) can be used to describe a given set of conditions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Interprets a particular mathematical model (e.g., graph, equation, table) in a given context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **F. Understands differences between linear, quadratic, and exponential models, including how their equations are created and used to solve problems** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies situations in which one quantity changes at a constant rate per unit interval relative to another |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Observes that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratic ally |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **G. Is familiar with how to represent arithmetic sequences as functions** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Writes arithmetic sequences both recursively and with an explicit formula and uses them to model situations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| IV. Geometry and Measurement |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| A. Knows the properties of types of lines (e.g., parallel, perpendicular, intersecting) and angles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving parallel, perpendicular, and intersecting lines |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Applies angle relationships (e.g., supplementary, vertical, alternate interior) to solve problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Understands the properties of triangles** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving the Pythagorean theorem in two dimensions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies characteristics of special triangles (e.g., equilateral, isosceles, right) and uses them to solve problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines whether given side lengths or angle measures would produce a triangle (e.g., triangle inequality theorem) and classifies triangles by their sides or angles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines whether given conditions would produce a unique triangle, no triangle, or more than one triangle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Knows the properties of quadrilaterals and other polygons** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies the relationships among various quadrilaterals (e.g., parallelogram, rectangle, rhombus) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving sides and angles of polygons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Knows the concepts of transformations (i.e., translations, reflections, rotations, dilations)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Applies properties of translations, reflections, and rotations (e.g., line segments are taken to congruent line segments, angles are taken to congruent angles, parallel lines are taken to parallel lines) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Applies properties of dilations (e.g., angles are taken to congruent angles, parallel lines are taken to parallel lines) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Identifies a sequence of transformations that maps a preimage onto an image |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Given a figure, describes the transformations that map the figure onto itself, including reflection over a line of symmetry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • For a given transformation, determines the coordinates of a point on an image |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Understands the concepts of congruence and similarity** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines whether two figures are congruent or similar |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses congruence and similarity to solve problems with two-dimensional and three-dimensional figures |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **F. Understands the properties of circles** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves problems involving circles (e.g., circumference, area) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| G. Knows how to interpret relationships between geometric objects in the  (e.g., distance, midpoint) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses coordinate geometry to represent and identify the properties of geometric shapes and to solve problems (e.g., Pythagorean theorem, perimeter, area) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the distance between two points |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Determines the midpoint of a segment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H. Understands how to solve problems involving perimeter and area of polygons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Calculates and interprets perimeter and area of polygons that can be composed of triangles and quadrilaterals, including in real-world situations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Calculates changes in perimeter and area as the dimensions of a polygon change |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **I. Knows how to solve problems involving solids** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Calculates and interprets surface area and volume of solids (e.g., prisms, pyramids, cylinders, spheres) and composite solids, including in real-world situations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Calculates changes in surface area and volume as the dimensions of a solid change |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses two-dimensional representations (e.g., nets) of three-dimensional objects to visualize and solve problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **J. Understands systems of measurement (i.e., metric, United States customary)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Solves measurement, estimation, and conversion problems involving time, length, temperature, volume, and mass in standard measurement systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| • Uses appropriate units of measurement in a given context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V. Statistics and Probability |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands statistical processes and how to evaluate them** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Recognizes a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Uses statistics to make inferences about population parameters based on a sample from that population |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Distinguishes between random and biased sampling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B. Understands how to interpret, analyze, and represent data presented in a variety of displays |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Represents and analyzes data in various displays (e.g., bar graphs, line graphs, circle graphs, boxplots, histograms, scatterplots, stem-and-leaf plots, two-way tables) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Calculates relative frequencies for rows or columns in two-way tables and uses the calculations to describe possible associations between the two variables |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Uses the equation of a linear model to solve problems in the context of bivariate measurement data (e.g., interpreting the slope and intercept, interpolation) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Describes how two quantitative variables are related (e.g., fit a function to data, association, correlation) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Chooses appropriate graphs based on data type (e.g., numerical, categorical) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Understands concepts associated with measures of central tendency and dispersion** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Solves for the mean and weighted average of given sets of data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Determines and interprets measures of center (e.g., mean, median, mode) and spread (e.g., range, interquartile range) in a variety of problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Summarizes a given numerical data set in relation to its context |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Describes the distribution of a set of data by its center and spread |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Uses statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Interprets differences in center and spread in the context of the data sets, accounting for possible effects of outliers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Knows how to use and evaluate probability models** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Uses counting techniques (e.g., the counting principle, tree diagrams) to answer questions involving a finite sample space |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Solves probability problems involving simple events |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Solves probability problems involving compound events |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Interprets a probability model and uses it to find probabilities of events |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Compares probabilities from a model to observed frequencies and identifies possible sources of the discrepancy if the agreement is not good |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Interprets a uniform probability model and uses it to determine probabilities of events |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |