USD 368
Curriculum Guide

▲KS Assessment

Curricular Area: Math
Grade/Course: Algebra III

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.
Benchmark 1: Number Sense – The student demonstrates number sense for real numbers and algebraic expressions in a variety of situations.

Knowledge Base Indicators

The student…

1. knows, explains, and uses equivalent representations for real numbers and algebraic expressions including integers, fractions, decimals, percents, ratios; rational number bases with integer exponents; rational numbers written in scientific notation; absolute value; time; and money (2.4.K1a) $, e.g., $^{-}4/2 = (^{-}2)$; $a^{(-2)}\ b^{(3)} = b^3/a^2$.
2. compares and orders real numbers and/or algebraic expressions and explains the relative magnitude between them (2.4.K1a) $, e.g., will 3n + 2 always, sometimes, or never be larger than 3n? The student might respond with $(5n)^2$ is greater than 5n, if n > 1 and $(5n)^2$ is smaller than 5n, if 0 < n < 1.
3. knows and explains what happens to the product or quotient when a real number is multiplied or divided by (2.4.K1a):
   a. a rational number greater than zero and less than one,
   b. a rational number greater than one,
   c. a rational number less than zero.

Application Indicators

The student…

1. generates and/or solves real-world problems using equivalent representations of real numbers and algebraic expressions (2.4.A1a) $, e.g., a math classroom needs 30 books and 15 calculators. If B represents the cost of a book and C represents the cost of a calculator, generate two different expressions to represent the cost of books and calculators for 9 math classrooms.
2. determines whether or not solutions to real-world problems using real numbers and algebraic expressions are reasonable (2.4.A1a) $, e.g., in January, a business gave its employees a 10% raise. The following year, due to the sluggish economy, the employees decided to take a 10% reduction in their salary. Is it reasonable to say they are now making the same wage they made prior to the 10% raise?

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.
Benchmark 2: Number Systems and Their Properties – The student demonstrates an understanding of the real number system; recognizes, applies, and explains their properties, and extends these properties to algebraic expressions.

Knowledge Base Indicators

The student…

1. explains and illustrates the relationship between the subsets of the real number system [natural (counting) numbers, whole numbers, integers, rational numbers, irrational numbers] using mathematical models
2. (2.4.K1a), e.g., number lines or Venn diagrams. identifies all the subsets of the real number system [natural (counting) numbers, whole numbers, integers, rational numbers, irrational numbers] to which a given number belongs (2.4.K1m).
3. ▲names, uses, and describes these properties with the real number system and demonstrates their meaning including the use of concrete objects (2.4.K1a) $:
   a. commutative (a + b = b + a and ab = ba), associative [a = (b + c) = (a + b) + c and a(bc) = (ab)c], distributive [a (b + c) = ab + ac], and substitution properties (if a = 2, then 3a = 3 x 2 = 6);
   b. identity properties for addition and multiplication and inverse properties of addition and multiplication (additive identity: a + 0 = a, multiplicative identity: a • 1 = a, additive inverse: $^{+}5 + {}^{-}5 =$ 0, multiplicative inverse: 8 x 1/8 = 1);
   c. symmetric property of equality (if a = b, then b = a);
   d. addition and multiplication properties of equality (if a = b, then a + c = b + c and if a = b, then ac = bc) and inequalities (if a > b, then a + c > b + c and if a > b, and c > 0 then ac > bc);
   e. zero product property (if ab = 0, then a = 0 and/or b = 0).

Application Indicators

The student…

1. generates and/or solves real-world problems with real numbers using the concepts of these properties to explain reasoning (2.4.A1a) $:
   a. commutative, associative, distributive, and substitution properties, e.g., the chorus is sponsoring a trip to an amusement park. They need to purchase 15 adult tickets at $6 each and 15 student tickets at $4 each. How much money will the chorus need for tickets? Solve the problem two ways.
   b. identity and inverse properties of addition and multiplication, e.g., the purchase price (P) of a series EE Savings Bond is found by the formula ½ F = P where F is the face value of the bond. Use the formula to find the face value of a savings bond purchased for $500.
   c. symmetric property of equality, e.g., Sam took a $15 check to the bank and received a $10 bill and a $5 bill. Later Sam took a $10 bill and a $5 bill to the bank and received a check for $15. $15 = $10 + $5 is the same as $10 + $5 = $15.
   d. addition and multiplication properties of equality, e.g., the total price for the purchase of three shirts in $62.54 including tax. If the tax is 3.89, what is the cost of one shirt, if all shirts cost the same.
   e. zero product property, e.g., Jenny was thinking of two numbers. Jenny said that the product of the two numbers was 0. What could you deduct from this statement? Explain your reasoning.
2. analyzes and evaluates the advantages and disadvantages of using integers, whole numbers, fractions (including mixed numbers), decimals or irrational numbers and their rational approximations in solving a given real-world problem (2.4.A1a) $, e.g., a store sells CDs for $12.99 each. Knowing that the sales tax is 7%, Marie estimates the cost of a CD plus tax to be $14.30. She selects nine CDs. The clerk tells Marie her bill is $157.18. How can Marie explain to the clerk she has been overcharged?

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 3: Estimation – The student uses computational estimation with real numbers in a variety of situations.

Knowledge Base Indicators

The student…

1. estimates real number quantities using various computational methods including mental math, paper and pencil, concrete objects, and/or appropriate technology (2.4.K1a) **$**.
2. uses various estimation strategies and explains how they were used to estimate real number quantities and algebraic expressions (2.4.K1a) **$**.
3. knows and explains why a decimal representation of an irrational number is an approximate value(2.4.K1a) .
4. knows and explains between which two consecutive integers an irrational number lies (2.4.K1a).

Application Indicators

The student…

1. ▲adjusts original rational number estimate of a real-world problem based on additional information (a frame of reference) (2.4.A1a) **$**, e.g., estimate how long it takes to walk from here to there; time how long it takes to take five steps and adjust your estimate.
2. estimates to check whether or not the result of a real-world problem using real numbers and/or algebraic expressions is reasonable and makes predictions based on the information (2.4.A1a) **$**, e.g., if you have a $4,000 debt on a credit card and the minimum of $30 is paid per month, is it reasonable to pay off the debt in 10 years?
3. determines if a real-world problem calls for an exact or approximate answer and performs the appropriate computation using various computational strategies including mental math, paper and pencil, concrete objects, and/or appropriate technology (2.4.A1a) **$**, e.g., do you need an exact or an approximate answer in calculating the area of the walls and to determine the number of rolls of wallpaper needed to paper a room? What would you do if you were wallpapering 2 rooms?
4. explains the impact of estimation on the result of a real-world problem (underestimate, overestimate, range of estimates) (2.4.A1a) $, e.g., if the weight of 25 pieces of paper was measured as 530.6 grams, what would the weight of 2000 pieces of paper equal to the nearest gram? If the student were to estimate the weight of one piece of paper as about 20 grams and then multiply this by 2,000 rather than multiply the weight of 25 pieces of paper by 80; the answer would differ by about 2,400 grams. In general, multiplying or dividing by a rounded number will cause greater discrepancies than rounding after multiplying or dividing.

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 4: Computation – The student models, performs, and explains computation with real numbers and polynomials in a variety of situations.

Knowledge Base Indicators

The student…

1. computes with efficiency and accuracy using various computational methods including mental math, paper and pencil, concrete objects, and appropriate technology (2.4.K1a) $.
2. performs and explains these computational procedures (2.4.K1a):
   a. **N** addition, subtraction, multiplication, and division using the order of operations
   b. multiplication or division to find $:
      i. a percent of a number, e.g., what is 0.5% of 10?
      ii. percent of increase and decrease, e.g., a college raises its tuition form $1,320 per year to $1,425 per year. What percent is the change in tuition?
      iii. percent one number is of another number, e.g., 89 is what percent of 82?
      iv. a number when a percent of the number is given, e.g., 80 is 32% of what number?
   c. manipulation of variable quantities within an equation or inequality (2.4.K1d), e.g., 5x – 3y = 20 could be written as 5x – 20 = 3y *or* 5x(2x + 3) = 8 could be written as 8/(5x) = 2x + 3;
   d. simplification of radical expressions (without rationalizing denominators) including square roots of perfect square monomials and cube roots of perfect cubic monomials;
   e. simplification or evaluation of real numbers and algebraic monomial expressions raised to a whole number power and algebraic binomial expressions squared or cubed;
   f. simplification of products and quotients of real number and algebraic monomial expressions using the properties of exponents;
   g. matrix addition $, e.g., when computing (with one operation) a building's expenses (data) monthly, a matrix is created to include each of the different expenses; then at the end of the year, each type of expense for the building is totaled;
   h. scalar-matrix multiplication $, e.g., if a matrix is created with everyone's salary in it, and everyone gets a 10% raise in pay; to find the new salary, the matrix would be multiplied by 1.1.
3. finds prime factors, greatest common factor, multiples, and the least common multiple of algebraic expressions (2.4.K1b).

Application Indicators

The student…

1. generates and/or solves multi-step real-world problems with real numbers and algebraic expressions using computational procedures (addition, subtraction, multiplication, division, roots, and powers excluding logarithms), and mathematical concepts with $:
   a. ▲applications from business, chemistry, and physics that involve addition, subtraction, multiplication, division, squares, and square roots when the formulae are given as part of the problem and variables are defined (2.4.A1a) $, e.g., given F = ma, where F = force in newtons, m = mass in kilograms, a = acceleration in meters per second squared. Find the acceleration if a force of 20 newtons is applied to a mass of 3 kilograms.
   b. ▲volume and surface area given the measurement formulas of rectangular solids and cylinders (2.4.A1f), e.g., a silo has a diameter of 8 feet. and a height. of 20 feet. How many cubic feet. of grain can it store?
   c. probabilities (2.4.A1h), e.g., if the probability of getting a defective light bulb is 2%, and you buy 150 light bulbs, how many would you expect to be defective?
   d. ▲application of percents (2.4.A1a), e.g., $A = P(1+\frac{r}{n})^{nt}$, A = amount, P= principal, r = annual interest, n = number of compounding periods per year, t = number of years. If $1,000 is placed in a savings account with a 6% annual interest rate and is compounded semiannually, how much money will be in the account at the end of 2 years?
   e. simple exponential growth and decay (excluding logarithms) and economics (2.4.A1a) $, e.g., a population of cells doubles every 20 years. If there are 20 cells to start with, how long will it take for there to be more than 150 cells? *or* If the radiation level is now 400 and it decays by ½ or its half-life is 8 hours, how long will it take for the radiation level to be below an acceptable level of 5?

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.
Benchmark 1: Patterns – The student recognizes, describes, extends, develops, and explains the general rule of a pattern in a variety of situations.

Knowledge Base Indicators

The student…
1. identifies, states, and continues the following patterns using various formats including numeric (list or table), algebraic (symbolic notation), visual (picture, table, or graph), verbal (oral description), kinesthetic (action), and written
   a. arithmetic and geometric sequences using real numbers and/or exponents (2.4.K1a); e.g., radioactive half-lives;
   b. patterns using geometric figures (2.4.K1h);
   c. algebraic patterns including consecutive number patterns or equations of functions, e.g., n, n + 1, n + 2, ... or f(n) = 2n – 1 (2.4.K1c,e);
   d. special patterns (2.4.K1a), e.g., Pascal's triangle and the Fibonacci sequence.
2. generates and explains a pattern (2.4.K1f).
3. classify sequences as arithmetic, geometric, or neither.

Application Indicators

The student…
1. recognizes the same general pattern presented in different representations [numeric (list or table), visual (picture, table, or graph), and written] (2.4.A1i) $.
2. solves real-world problems with arithmetic or geometric sequences by using the explicit equation of the sequence (2.4.K1c) $, e.g.; an example of an arithmetic sequence: A brick wall is 3 feet high and the owners want to build it higher. If the builders can lay 2 feet every hour, how long will it take to raise it to a height of 20 feet? or an example of a geometric sequence: A savings program can double your money every 12 years. If you place $100 in the program, how many years will it take to have over $1000?

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.
Benchmark 2: Variables, Equations, and Inequalities – The student uses variables, symbols, real numbers, and algebraic expressions to solve equations and inequalities in variety of situations.

Knowledge Base Indicators

The student…
1. knows and explains the use of variables as parameters for a specific variable situation (2.4.K1f), e.g., the m and b in y = mx + b or the h, k, and r in $(x – h)^2 + (y – k)^2 = r^2$.
2. manipulates variable quantities within an equation or inequality (2.4.K1e), e.g., 5x – 3y = 20 could be written as 5x – 20 = 3y *or* 5x(2x + 3) = 8 could be written as 8/(5x) = 2x + 3.

3. ▲solves (2.4.K1d) $:
   a. **N** linear equations and inequalities both analytically and graphically;
   b. quadratic equations with integer solutions (may be solved by trial and error, graphing, quadratic formula, or factoring);
   c. ▲ systems of linear equations with two unknowns using integer coefficients and constants;
   d. radical equations with no more than one inverse operation around the radical expression;
   e. equations where the solution to a rational equation can be simplified as a linear equation with a nonzero denominator, e.g., $\frac{3}{(x + 2)} = \frac{5}{(x - 3)}$.
   f. equations and inequalities with absolute value quantities containing one variable with a special emphasis on using a number line and the concept of absolute value.
   g. exponential equations with the same base without the aid of a calculator or computer, e.g., $3^{x + 2} = 3^5$.

Application Indicators

The student…
1. represents real-world problems using variables, symbols, expressions, equations, inequalities, and simple systems of linear equations (2.4.A1c-e) $.
2. ▲represents and/or solves real-world problems with (2.4.A1c) $:
   a. ▲**N** linear equations and inequalities both analytically and graphically, e.g., tickets for a school play are $5 for adults and $3 for students. You need to sell at least $65 in tickets. Give an inequality and a graph that represents this situation and three possible solutions.
   b. quadratic equations with integer solutions (may be solved by trial and error, graphing, quadratic formula, or factoring), e.g., a fence is to be built onto an existing fence. The three sides will be built with 2,000 meters of fencing. To maximize the rectangular area, what should be the dimensions of the fence?
   c. systems of linear equations with two unknowns, e.g., when comparing two cellular telephone plans, Plan A costs $10 per month and $.10 per minute and Plan B costs $12 per month and $.07 per minute. The problem is represented by Plan A = .10x + 10 and Plan B = .07x + 12 where x is the number of minutes.
   d. radical equations with no more than one inverse operation around the radical expression, e.g., a box has a volume of 400 cubic inches with a height of 5 inches. What is the length of the side of the square base?
   e. a rational equation where the solution can be simplified as a linear equation with a nonzero denominator, e.g. John is 2 feet taller than Fred. John's shadow is 6 feet in length and Fred's shadow is 4 feet in length. How tall is Fred?
3. explains the mathematical reasoning that was used to solve a real-world problem using equations and inequalities and analyzes the advantages and disadvantages of various strategies that may have been used to solve the problem (2.4.A1c).

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.
Benchmark 3: Functions – The student analyzes functions in a variety of situations.

Knowledge Base Indicators

The student…
1. evaluates and analyzes functions using various methods including mental math, paper and pencil, concrete objects, and graphing utilities or other appropriate technology (2.4.K1a,d-f).
2. matches equations and graphs of constant and linear functions and quadratic functions limited to $y = ax^2 + c$ (2.4.K1d,f).

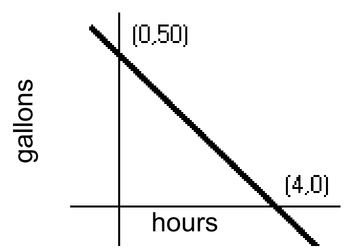
3. determines whether a graph, list of ordered pairs, table of values, or rule represents a function (2.4.K1e-f).
4. determines x- and y-intercepts and maximum and minimum values of the portion of the graph that is shown on a coordinate plane (2.4.K1f).
5. identifies domain and range of:
   a. relationships given the graph or table (2.4.K1e-f),
   b. linear, constant, and quadratic functions given the equation(s) (2.4.K1d).
6. ▲recognizes how changes in the constant and/or slope within a linear function changes the appearance of a graph (2.4.K1f) $.
7. uses function notation.
8. evaluates function(s) given a specific domain $.
9. describes the difference between independent and dependent variables and identifies independent and dependent variables $.

Application Indicators

The student…

1. translates between the numerical, graphical, and symbolic representations of functions (2.4.A1c-e) $.
2. ▲ interprets the meaning of the x- and y- intercepts, slope, and/or points on and off the line on a graph in the context of a real-world situation (2.4.A1e) $, e.g., the graph below represents a tank full of water being emptied. What does the y-intercept represent? What does the x-intercept represent? What is the rate at which it is emptying? What does the point (2, 25) represent in this situation? What does the point (2,30) represent in this situation?

   The Water Tank



3. analyzes (2.4.A1c-e):
   a. the effects of parameter changes (scale changes or restricted domains) on the appearance of a function's graph,
   b. how changes in the constants and/or slope within a linear function affects the appearance of a graph,
   c. how changes in the constants and/or coefficients within a quadratic function in the form of $y = ax^2 + c$ affects the appearance of a graph.

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.

Benchmark 4: Models – The student develops and uses mathematical models to represent and justify mathematical relationships found in a variety of situations involving tenth grade knowledge and skills.

Knowledge Base Indicators

The student…

1. knows, explains, and uses mathematical models to represent and explain mathematical concepts, procedures, and relationships. Mathematical models include:
   a. process models (concrete objects, pictures, diagrams, number lines, hundred charts, measurement tools, multiplication arrays, division sets, or coordinate grids) to model computational procedures, algebraic relationships, and mathematical relationships and to solve equations (1.1.K1-3, 1.2.K1, 1.2.K3-4, 1.3.K1-4, 1.4.K1, 1.4.K2a-b, 2.1.K1a, 2.1.K1d, 2.1.K2, 2.2.K4, 2.3.K1, 3.2.K1-3, 3.2.K6, 3.3.K1-4, 4.2.K3-4) $;
   b. factor trees to model least common multiple, greatest common factor, and prime factorization (1.4.K3);
   c. algebraic expressions to model relationships between two successive numbers in a sequence or other numerical patterns (2.1.K1c);
   d. equations and inequalities to model numerical and geometric relationships (1.4.K2c, 2.2.K3, 2.3.K1-2, 3.2.K7) $;
   e. function tables to model numerical and algebraic relationships (2.1.K1c, 2.2.K2, 2.3.K1, 2.3.K3, 2.3.K5) $;
   f. coordinate planes to model relationships between ordered pairs and equations and inequalities and linear and quadratic functions (2.2.K1, 2.3.K1-6, 3.4.K1-8) $;
   g. constructions to model geometric theorems and properties (3.1.K2, 3.1.K6);
   h. two- and three-dimensional geometric models (geoboards, dot paper, coordinate plane, nets, or solids) and real-world objects to model perimeter, area, volume, and surface area, properties of two- and three-dimensional figures, and isometric views of three-dimensional figures (2.1.K1b, 3.1.K1-8, 3.2.K1, 3.2.K4-5, 3.3.K1-4);
   i. scale drawings to model large and small real-world objects;
   j. Pascal's Triangle to model binomial expansion and probability;
   k. geometric models (spinners, targets, or number cubes), process models (concrete objects, pictures, diagrams, or coins), and tree diagrams to model probability (4.1.K1-3);
   l. frequency tables, bar graphs, line graphs, circle graphs, Venn diagrams, charts, tables, single and double stem-and-leaf plots, scatter plots, box-and-whisker plots, histograms, and matrices to organize and display data (4.2.K1, 4.2.K5-6) $;
   m. Venn diagrams to sort data and show relationships (1.2.K2).

Application Indicators

The student…

1. recognizes that various mathematical models can be used to represent the same problem situation. Mathematical models include:
   a. process models (concrete objects, pictures, diagrams, flowcharts, number lines, hundred charts, measurement tools, multiplication arrays, division sets, or coordinate grids) to model computational procedures, algebraic relationships, mathematical relationships, and problem situations and to solve equations (1.1.K1, 1.2.A1-2, 1.3.A1-4, 1.4.A1a, 1.4A1d-e, 3.1.A1-3, 3.2.A1-3, 3.3.A2, 3.3.A4, 3.4.A2, 4.2.A1a-b) $;
   b. algebraic expressions to model relationships between two successive numbers in a sequence or other numerical patterns;
   c. equations and inequalities to model numerical and geometric relationships (2.1.A2, 2.2.A1-3, 2.3.A1) $;
   d. function tables to model numerical and algebraic relationships (2.3.A1, 2.3.A3, 3.4.A2) $;
   e. coordinate planes to model relationships between ordered pairs and equations and inequalities and linear and quadratic functions (2.2.A1, 2.3.A1-3, 3.4.A1-2, 3.4.A4) $;
   f. two- and three-dimensional geometric models (geoboards, dot paper, coordinate plane, nets, or solids) and real-world objects to model perimeter, area, volume, and surface area, properties of two and three-dimensional figures and isometric views of three-dimensional figures (3.3.A1, 4.2.A1c);
   g. scale drawings to model large and small real-world objects (3.3.A3, 3.4.A3);

h. geometric models (spinners, targets, or number cubes), process models (coins, pictures, or diagrams), and tree diagrams to model probability (1.4.A1c, 4.2.A1, 4.2.A3);
i. ▲frequency tables, bar graphs, line graphs, circle graphs, Venn diagrams, charts, tables, single and double stem-and-leaf plots, scatter plots, box-and-whisker plots, histograms, and matrices to describe, interpret, and analyze data (2.1.A1, 4.1.A1, 4.1.A3-4, 4.1.A6, 4.2.A1) $;
j. Venn diagrams to sort data and show relationships.

2. uses the mathematical modeling process to analyze and make inferences about real-world situations $.

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 1: Geometric Figures and Their Properties – The student recognizes geometric figures and compares and justifies their properties of geometric figures in a variety of situations.

<u>Knowledge Base Indicators</u>

The student…

1. recognizes and compares properties of two-and three-dimensional figures using concrete objects, constructions, drawings, appropriate terminology, and appropriate technology (2.4.K1h).
2. discusses properties of regular polygons related to (2.4.K1g-h):
   a. angle measures,
   b. diagonals.
3. recognizes and describes the symmetries (point, line, plane) that exist in three-dimensional figures (2.4.K1h).
4. recognizes that similar figures have congruent angles, and their corresponding sides are proportional (2.4.K1h).
5. uses the Pythagorean Theorem to (2.4.K1h):
   a. determine if a triangle is a right triangle,
   b. find a missing side of a right triangle.
6. recognizes and describes (2.4.K1g-h):
   a. congruence of triangles using: Side-Side-Side (SSS), Angle-Side-Angle (ASA), Side-Angle-Side (SAS), and Angle-Angle-Side (AAS);
   b. the ratios of the sides in special right triangles: 30°-60°-90° and 45°-45°-90°.
7. recognizes, describes, and compares the relationships of the angles formed when parallel lines are cut by a transversal (2.4.K1h).
8. recognizes and identifies parts of a circle: arcs, chords, sectors of circles, secant and tangent lines, central and inscribed angles (2.4.K1h).

Application Indicators

The student…

1. ▲solves real-world problems by (2.4.A1a):
   a. using the properties of corresponding parts of similar and congruent figures, e.g., scale drawings, map reading, or proportions;
   b. ▲ applying the Pythagorean Theorem, e.g., when checking for square corners on concrete forms for a foundation, determine if a right angle is formed by using the Pythagorean Theorem;
   c. using properties of parallel lines, e.g., street intersections.
2. uses deductive reasoning to justify the relationships between the sides of 30°-60°-90° and 45°-45°-90° triangles using the ratios of sides of similar triangles (2.4.A1a).

3. understands the concepts of and develops a formal or informal proof through understanding of the difference between a statement verified by proof (theorem) and a statement supported by examples (2.4.A1a).

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.
Benchmark 2: Measurement and Estimation – The student estimates, measures and uses geometric formulas in a variety of situations.

Knowledge Base Indicators

The Student…
1. determines and uses real number approximations (estimations) for length, width, weight, volume, temperature, time, distance, perimeter area, surface area, and angle measurement using standard and nonstandard units of measure (2.4.K1a)$.
2. selects and uses measurement tools, units of measure, and level of precision appropriate for a given situation to find accurate real number representations for length, weight, volume, temperature, time, distance, area, surface area, mass, midpoint, and angle measurements (2.4.K1a)$.
3. approximates conversions between customary and metric systems given the conversion unit or formula (2.4.K1a).
4. states, recognizes, and applies formulas for (2.4.K1h) $:
   a. perimeter and area of squares, rectangle, and triangles;
   b. circumference and area of circles;
   c. volume of rectangular solids.
5. uses given measurement formulas to find perimeter, area, volume, and surface area of two- and three-dimensional figures (regular and irregular) (2.4.K1h).
6. recognizes and applies properties of corresponding parts of similar and congruent figures to find measurements of missing sides (2.4.K1a).
7. knows, explains, and uses ratios and proportions to describe rates of change (2.4.K1d) $, e.g., miles per gallon, meters per second, calories per ounce, or rise over run.

Application Indicators

The student…
1. solves real-world problems by (2.4.A1a) $:
   a. finding the perimeter and the area of circles, squares, rectangles, triangles, parallelograms, and trapezoids, e.g., a track is made up of a rectangle with dimensions 100 meters by 50 meters with semicircles at each end (having a diameter of 50 meters). What is the distance of one lap around the inside lane of the track?
   b. finding the volume and the surface area of rectangular solids and cylinders, e.g., if a car engine has 6 cylinders and each cylinder has a height of 8.4 cm and a diameter of 8.8 cm, then what is the total volume of the cylinders?
   c. using the Pythagorean theorem, e.g., a baseball diamond is a square with 90 feet between each base. What is the approximate distance from home plate to second base?
2. estimates to check whether or not measurements or calculations for length, weight, volume, temperature, time, distance, perimeter, area, surface area, and angle measurement in real-world problems are reasonable and adjusts original measurement or estimation based on additional information (a frame of reference) (2.4.A1a) $.

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 3: Transformational Geometry – The student recognizes and applies transformations on two- and three-dimensional figures in a variety of situations.

Knowledge Base Indicators

The student…

1. generates a two-dimensional representation of a three-dimensional figure (2.4.K1a).

Application Indicators

The student…

1. ▲analyzes the impact of transformations on the perimeter and area of circles, rectangles, and triangles and volume of rectangular prisms and cylinders (2.4.A1f), e.g., reducing by a factor of ½ multiplies an area by a factor of ¼ and multiplies the volume by a factor of 1/8, whereas, rotating a geometric figure does not change perimeter or area.
2. describes and draws a simple three-dimensional shape after undergoing one specified transformation without using concrete objects to perform the transformation (2.4.A1a).
3. uses a variety of scales to view and analyze two- and three-dimensional figures (2.4.A1g).
4. analyzes and explains transformations using such things as sketches and coordinate systems (2.4.A1a).

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 4: Geometry from an Algebraic Perspective – The student uses an algebraic perspective to analyze the geometry of two-and three-dimensional figures in a variety of situations.

Knowledge Base Indicators

1. recognizes and examines two- and three-dimensional figures and their attributes including the graphs of functions on a coordinate plane using various methods including mental math, paper and pencil, concrete objects, and graphing utilities or other appropriate technology (2.4.K1f).
2. determines if a given point lies on the graph of a given line or parabola without graphing and justifies the answer (2.4.K1f).
3. calculates the slope of a line from a list of ordered pairs on the line and explains how the graph of the line is related to its slope (2.4.K1f).
4. ▲ finds and explains the relationship between the slopes of parallel and perpendicular lines (2.4.K1f), e.g., the equation of a line 2x + 3y = 12. The slope of this line is 2/3. What is the slope of a line perpendicular to this line? Write an equation for a line perpendicular to 2x + 3y = 12 (or for multiple choice: Which is an equation of a line perpendicular to 2x + 3y = 12?
5. uses the Pythagorean Theorem to find distance (may use the distance formula) (2.4.K1f).
6. ▲recognizes the equation of a line and transforms the equation into slope-intercept form in order to identify the slope and y-intercept and uses this information to graph the line (2.4.K1f).
7. recognizes the equation $y = ax^2 + c$ as a parabola; represents and identifies characteristics of the parabola including opens upward or opens downward, steepness (wide/narrow), the vertex, maximum and minimum values, and line of symmetry; and sketches the graph of the parabola (2.4.K1f).

8. explains the relationship between the solution(s) to systems of equations and systems of inequalities in two unknowns and their corresponding graphs (2.4.K1f), e.g., for equations, the lines intersect in either one point, no points, or infinite points; and for inequalities, all points in double-shaded areas are solutions for both inequalities.

Applicators Indicators

The student…

1. represents, generates, and/or solves real-world problems that involve distance and two-dimensional geometric figures including parabolas in the form $ax^2 + c$ (2.4.A1e), e.g., compare the heights of 2 different objects whose paths are represented $h_1(t) = 3t^2 + 1$ and $h_2(t) = \frac{1}{2}t^2 + 4$ (where h represents the height in feet and t represents elapsed time in seconds) after 5 seconds.
2. translates between the written, numeric, algebraic, and geometric representations of a real-world problem (2.4.A1a-e) **($)**, e.g., given a situation, write a function rule, make a T-table of the algebraic relationship, and graph the order pairs.
3. recognizes and explains the effects of scale changes on the appearance of the graph of an equation involving a line or parabola (2.4.A1g).
4. analyzes how changes in the constants and/or leading coefficients within the equation of a line or parabola affects the appearance of the graph of the equation (2.4.A1e).

Standard 4: Data – The student uses concepts and procedures of data analysis in a variety of situations.

Benchmark 1: Probability – The student applies probability theory to draw conclusions, generate convincing arguments, make predictions and decisions, and analyze decisions including the use of concrete objects in a variety of situations.

<u>Knowledge Base Indicators</u>

The student…

1. finds the probability of two independent events in an experiment, simulation, or situation (2.4.K1k) **$** .
2. finds the conditional probability of two dependent events in an experiment, simulation, or situation (2.4.K1k).
3. ▲explains the relationship between probability and odds and computes one given the other (2.4.K1a,k).

Application Indicators

The student…

1. conducts an experiment or simulation with two dependent events; records the results in charts, tables, or graphs; and uses the results to generate convincing arguments, draw conclusions and make predictions (2.4.A1h-i).
2. uses theoretical or empirical probability of a simple or compound event composed of two or more simple, independent events to make predictions and analyze decisions about real-world situations including:
   a. work in economics, quality control, genetics, meteorology, and other areas of science (2.4.A1a);
   b. games (2.4.A1a);
   c. situations involving geometric models, e.g., spinners or dartboards (2.4.A1f).
3. compares theoretical probability (expected results) with empirical probability (experimental results) of two independent and/or dependent events and understands that the larger the sample size, the greater the likelihood that experimental results will match theoretical probability (2.4.A1h).

4. uses conditional probabilities of two dependent events in an experiment, simulation, or situation to make predictions and analyze decisions.

Standard 4: Data – The student uses concepts and procedures of data analysis in a variety of situations.

Benchmark 2: Statistics – The student collects, organizes, displays, explains, and interprets numerical (rational) and non-numerical data sets in a variety of situations.

Knowledge Base Indicators

The student…

1. organizes, displays, and reads quantitative (numerical) and qualitative (non-numerical) data in a clear, organized, and accurate manner including a title, labels, categories, and rational number intervals using these **data displays** (2.4.K1l).
   a. frequency tables;
   b. bar, line, and circle graphs;
   c. Venn diagrams or other pictorial displays;
   d. charts and tables;
   e. stem-and-leaf plots (single and double);
   f. scatter plots;
   g. box-and-whiskers plots;
   h. histograms.
2. explains how the reader's bias, measurement errors, and display distortions can affect the interpretation of data.
3. calculates and explains the meaning of range, quartiles and interquartile range for a real number data set (2.4.K1a).
4. ▲explains the effects of outliers on the measures of central tendency (mean, median, mode) and range and interquartile range of a real number data set (2.4.K1a).
5. ▲approximates a line of best fit given a scatter plot and makes predictions using the equation of that line (2.4.K1k).
6. compares and contrasts the dispersion of two given sets of data in terms of range and the shape of the display including (2.4.K1k):
   a. symmetrical (including normal),
   b. skew (left or right),
   c. bimodal,
   d. uniform (rectangular).

Application Indicators

The student…

1. ▲ uses data analysis (mean, median, mode, range, quartile, interquartile range) in real-world problems with rational number data sets to compare and contrast two sets of data, to make accurate inferences and predictions, to analyze decisions, and to develop convincing arguments from these **data displays** (2.4.A1i) $:
   a. frequency tables;
   b. bar, line, and circle graphs;
   c. Venn diagrams or other pictorial displays;
   d. charts and tables;
   e. stem-and-leaf plots (single and double);
   f. scatter plots
   g. box-and-whiskers plots;
   h. histograms.

2. determines and describes appropriate data collection techniques (observations, surveys, or interviews) and sampling techniques (random sampling, samples of convenience, biased sampling, census of total population, or purposeful sampling) in a given situation.
3. uses changes in scales, intervals, and categories to help support a particular interpretation of the data (2.4.A1i).
4. determines and explains the advantages and disadvantages of using each measure of central tendency and the range to describe a data set (2.4.K1i).
5. analyzes the effects of:
   a. outliers on the mean, median, and range of a real number data set;
   b. changes within a real number data set on mean, median, mode, range, quartiles, and interquartile range.
6. approximates a line of best fit given a scatter plot, makes predictions, and analyzes decisions using the equation of that line(2.4.A1I).