

The North Dakota Standards and Benchmarks

Content Standards – DRAFT

Mathematics Grades K-12 – Content Only

January 2004

North Dakota Department of Public Instruction

Dr. Wayne G. Sanstead, State Superintendent

600 E Boulevard Avenue, Dept. 201

Bismarck, North Dakota 58505-0440

www.dpi.state.nd.us



Standard 1: Number and Operation

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

Kindergarten

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- K.1.1. Count to 20
- K.1.2. Count backward from 10 to 1
- K.1.3. Demonstrate one-to-one correspondence by counting up to 10 objects
- K.1.4. Identify ordinal numbers to order objects, 1st – 5th
- K.1.5. Identify and write numerals to 10
- K.1.6. Determine the relationship between two sets with 10 or fewer objects; i.e., less than, greater than, or equal to
- K.1.7. Use concrete materials to represent wholes and halves

OPERATIONS AND THEIR PROPERTIES

No expectations at this level

COMPUTATIONAL FLUENCY AND ESTIMATION

No expectations at this level

Grade 1

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 1.1.1. Count and order numbers to 100
- 1.1.2. Identify and write numerals to 100

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

- 1.1.3. Count backward from 20
- 1.1.4. Count by 2's to 20, and 10's to 100
- 1.1.5. Group objects by 2's, 5's, and 10's
- 1.1.6. Identify position using ordinal numbers
- 1.1.7. Connect number words and numerals to the quantities they represent (0 - 10)
- 1.1.8. Represent and explain fractions (i.e., one half, one fourth) as part of a whole and part of a set using concrete materials/drawings
- 1.1.9. Identify place value for ones and tens
- 1.1.10. Compare two digit numbers using symbols; i.e., $>$, $<$, $=$
- 1.1.11. Use grade-appropriate terms when communicating about addition and subtraction; i.e., sum, difference

OPERATIONS AND THEIR PROPERTIES

- 1.1.12. Use symbols to write addition and subtraction number sentences; i.e., $+$, $-$, $=$

COMPUTATIONAL FLUENCY AND ESTIMATION

- 1.1.13. Recall addition facts and subtraction facts (0-10)
- 1.1.14. Estimate the number of objects and check by counting

Grade 2

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 2.1.1. Count and order numbers up to 1,000
- 2.1.2. Count backward from 100
- 2.1.3. Count by 2's, 5's, and 10's

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

- 2.1.4. Identify and write numerals to 1,000
- 2.1.5. Connect number words and numerals to the quantities they represent up to 100
- 2.1.6. Demonstrate, identify, and explain the difference between odd and even numbers using concrete objects or drawings
- 2.1.7. Identify place value concepts through the hundreds place
- 2.1.8. Use the appropriate symbols (i.e., $>$, $<$, $=$) to compare whole numbers to 1,000
- 2.1.9. Round numbers to tens and hundreds
- 2.1.10. Use grade-appropriate terms when communicating about addition and subtraction; i.e., addend, sum, difference
- 2.1.11. Represent and explain fractions (i.e., one half, one third, one fourth, one sixth and one eighth) as part of a whole and part of a set

OPERATIONS AND THEIR PROPERTIES

- 2.1.12. Select the appropriate operation to solve problems involving addition and subtraction of whole numbers
- 2.1.13. Demonstrate the inverse relationship between addition and subtraction; e.g., $3+4=7$, $7-4=3$
- 2.1.14. Model multiplication using equal sets of objects
- 2.1.15. Add and subtract two-digit whole numbers between 0 and 100 without regrouping

COMPUTATIONAL FLUENCY AND ESTIMATION

- 2.1.16. Recall addition facts and subtraction facts (0-18)
- 2.1.17. Estimate whole number sums and differences

Grade 3

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 3.1.1. Count and order numbers up to 10,000
- 3.1.2. Read and write numerals to 10,000

Standard 1: Students understand and use basic and advanced concepts of number and number systems**BENCHMARK EXPECTATION**

- 3.1.3. Represent numbers up to 10,000 in standard, expanded, and word form
- 3.1.4. Identify the odd and even whole numbers from 0 to 10,000
- 3.1.5. Identify place values from ten thousands through the hundredths place
- 3.1.6. Use the appropriate symbols to compare whole numbers from 0 to 10,000; i.e., $>$, $<$, $=$
- 3.1.7. Use appropriate terms when communicating about computations; i.e., factor, product, divisor, dividend, quotient
- 3.1.8. Round numbers to tens, hundreds, and thousands
- 3.1.9. Represent fractions and mixed numbers using words, numerals, and physical models
- 3.1.10. Model, represent, and explain the concept of multiplication; i.e., repeated addition, rectangular arrays, and skip counting
- 3.1.11. Model, represent, and explain the concept of division; i.e., repeated subtraction, rectangular arrays, and equal sharing
- 3.1.12. Use a variety of methods and tools for problem solving; e.g., computing, including mental math, paper and pencil, calculator, manipulatives

OPERATIONS AND THEIR PROPERTIES

- 3.1.13. Add and subtract whole numbers between 0 and 10,000
- 3.1.14. Model and use the commutative and associative properties of addition and multiplication
- 3.1.15. Apply the multiplication property of zero and one
- 3.1.16. Multiply two- and three-digit numbers by a single-digit number
- 3.1.17. Divide two- and three-digit numbers by a single-digit number without remainders
- 3.1.18. Demonstrate the inverse relationship between multiplication and division
- 3.1.19. Add and subtract simple fractions with like denominators; e.g., $1/4 + 2/4 = 3/4$

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

COMPUTATIONAL FLUENCY AND ESTIMATION

- 3.1.20. Recall multiplication and division facts (0-10)
- 3.1.21. Estimate whole number products and quotients
- 3.1.22. Use estimation to determine if solutions are reasonable

Grade 4

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 4.1.1. Identify place value from hundred thousands through the hundredths place
 - 4.1.2. Order and compare using symbols; i.e., $>$, $<$, $=$, whole numbers (0 to 100,000) and decimals to hundredths
 - 4.1.3. Read and write numerals to 100,000
 - 4.1.4. Round whole numbers to the nearest tens, hundreds, thousands, ten thousands, and hundred thousands
 - 4.1.5. Represent numbers up to hundred thousands in standard and expanded forms
 - 4.1.6. Write tenths and hundredths as decimals and fractions
 - 4.1.7. Compare equivalent decimals and fractions, e.g., $5/10 = .5$
 - 4.1.8. Use appropriate terms when communicating about computations; i.e., numerator and denominator
 - 4.1.9. Explain the meaning of remainders in real-world situations
 - 4.1.10. Determine what information is relevant for solving a problem
 - 4.1.11. Use a variety of strategies to solve problems; e.g., guess and check, work backwards, draw pictures, use objects
- OPERATIONS AND THEIR PROPERTIES
- 4.1.12. Add and subtract whole numbers between 0 and 100,000

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

- 4.1.13. Multiply multi-digit numbers by two-digit numbers
- 4.1.14. Divide multi-digit numbers by a single-digit number
- 4.1.15. Add and subtract fractions and mixed numbers with like denominators
- 4.1.16. Add and subtract decimals
- 4.1.17. Use the distributive property to simplify and perform computations

COMPUTATIONAL FLUENCY AND ESTIMATION

- 4.1.18. Determine when a rounded solution is appropriate
- 4.1.19. Estimate computations of whole numbers, fractions, and decimals

Grade 5

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 5.1.1. Identify place value from the billions through the thousandths place
- 5.1.2. Order and compare whole numbers using symbols
- 5.1.3. Round whole numbers to the nearest million
- 5.1.4. Read and represent numbers to 1,000,000 in standard, expanded, and short word form
- 5.1.5. Place integers on a number line
- 5.1.6. Use negative integers in real-world situations; e.g., thermometer reading, yardage in a football game
- 5.1.7. Identify prime and composite numbers
- 5.1.8. Round, order, and compare using symbols fractions with like and unlike denominators
- 5.1.9. Round, order, and compare using symbols decimals to the tenths, hundredths, and thousandths place

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

5.1.10. Explain and demonstrate the concept of a percent

5.1.11. Compare equivalent fractions, decimals, and percents, e.g., $75/100 = .75 = 75\%$

5.1.12. Represent ratios and percents as parts of a whole using models and pictures

5.1.13. Explain and demonstrate the relationship between exponential notation and repeated multiplication; e.g., $3^2 = 3 \times 3$

OPERATIONS AND THEIR PROPERTIES

5.1.14. Add and subtract whole numbers between 0 and 1,000,000

5.1.15. Use commutative, associative, and identity properties to solve problems

5.1.16. Use divisibility rules for 2, 5, and 10

5.1.17. Determine the prime factors for a number using a factor tree

5.1.18. Determine least common multiple

5.1.19. Determine greatest common factor

5.1.20. Use order of operations to simplify numeric expressions

5.1.21. Multiply multi-digit numbers by three-digit numbers

5.1.22. Divide multi-digit numbers by two-digit numbers with or without remainders

5.1.23. Add and subtract improper fractions and mixed numbers with unlike denominators

5.1.24. Add and subtract multi-digit decimals

5.1.25. Multiply and divide multi-digit decimals

COMPUTATIONAL FLUENCY AND ESTIMATION

No new content at this level

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

Grade 6

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 6.1.1. Use a fraction to represent parts of a whole, division, or a ratio
- 6.1.2. Explain and use whole number percents 1 to 100
- 6.1.3. Find the equivalent forms among fractions, decimals, and whole number percents
- 6.1.4. Compare and order fractions, decimals, mixed numbers and integers
- 6.1.5. Generate a list of factors, prime factors, and multiples
- 6.1.6. Use rules to determine divisibility by 2, 3, 5, 6, 9, and 10

OPERATIONS AND THEIR PROPERTIES

- 6.1.7. Explain the effects of arithmetic operations on fractions and decimals
- 6.1.8. Identify the uses of the commutative and associative properties of addition and multiplication; e.g., grouping numbers to make addition or multiplication easier
- 6.1.9. Use order of operations; i.e., multiplication, division, addition and subtraction, to simplify numeric expressions

COMPUTATIONAL FLUENCY AND ESTIMATION

- 6.1.10. Multiply and divide decimals
- 6.1.11. Add, subtract, multiply, and divide fractions
- 6.1.12. Express an exponent in standard form
- 6.1.13. Use problem solving strategies to solve and verify the results of problems
- 6.1.14. Estimate the results of problems involving whole numbers, fractions, and decimals

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

Grade 7

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 7.1.1. Use ratios and proportions to represent relationships
- 7.1.2. Explain and use percents greater than 100
- 7.1.3. Use prime factorization to determine the greatest common factor and least common multiple
- 7.1.4. Use integers to represent and compare quantities

OPERATIONS AND THEIR PROPERTIES

- 7.1.5. Explain the effects of arithmetic operations on integers
- 7.1.6. Use order of operations (i.e., parentheses and operations) to simplify numeric expressions

COMPUTATIONAL FLUENCY AND ESTIMATION

- 7.1.7. Add, subtract, multiply, and divide fractions and terminating decimals
- 7.1.8. Solve real-world problems using integers, fractions, decimals, and percents
- 7.1.9. Estimate the results of problems involving fractions, decimals, and percents
- 7.1.10. Use proportions to solve problems

Grade 8

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 8.1.1. Identify subsets of the real number system; i.e., natural and whole numbers, integers, rational and irrational numbers
- 8.1.2. Solve real-world problems involving ratio, proportion, and percent
- 8.1.3. Identify perfect squares 1 to 144 and approximate square roots
- 8.1.4. Represent large and small numbers using scientific notation

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

OPERATIONS AND THEIR PROPERTIES

8.1.5. Apply operation properties to simplify computations and solve problems; i.e., commutative, associative, and distributive

8.1.6. Apply the order of operations to simplify numeric expressions and solve problems

COMPUTATIONAL FLUENCY AND ESTIMATION

8.1.7. Add, subtract, multiply, and divide integers

8.1.8. Select and use an appropriate computational technique (e.g., mental calculation, paper-and-pencil, or technology) to solve problems

8.1.9. Determine when an estimate is sufficient and an exact answer is needed in problem situations

Grades 9-10

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

9-10.1.1. Express numbers between one-billionth and one billion in fraction, decimal, and verbal form; express numbers of all magnitudes in scientific notation

9-10.1.2. Describe the hierarchal relationships (e.g., integers are rationals) among subsets of the real number system; i.e., reals, rationals, irrationals, integers, wholes, and naturals

9-10.1.3. Identify the properties of the real number system; i.e., commutative, associative, distributive, closure, inverse, and identity properties

9-10.1.4. Represent a set of data in a matrix

OPERATIONS AND THEIR PROPERTIES

9-10.1.5. Use the order of operations to simplify an algebraic expression

9-10.1.6. Analyze the effects of multiplication, division, raising to a power, and extracting a root on the magnitudes of quantities; e.g., when will the square root of a number be greater than the number itself, or what will happen to the magnitude of a number when you multiply it by a negative number?

9-10.1.7. Apply basic properties of exponents to simplify algebraic expressions; i.e., power of a product, power of a power, products and quotients of powers, zero and negative exponents

Standard 1: Students understand and use basic and advanced concepts of number and number systems

BENCHMARK EXPECTATION

COMPUTATIONAL FLUENCY AND ESTIMATION

- 9-10.1.8. Apply estimation skills to predict realistic solutions to problems
- 9-10.1.9. Select and use an appropriate computational technique (i.e., mental calculation, paper-and-pencil, or technology) to solve problems involving real numbers
- 9-10.1.10. Explain the reasonableness of a problem's solution and the process used to obtain it
- 9-10.1.11. Add, subtract, and perform scalar multiplication on matrices

Grades 11-12

NUMBERS, NUMBER RELATIONSHIPS, AND NUMBER SYSTEMS

- 11-12.1.1. Translate between radical expressions and expressions involving rational exponents
- 11-12.1.2. Describe the hierarchal relationships (e.g., explain why real numbers are complex) among subsets of the complex number system, i.e., complex, real, and imaginary
- 11-12.1.3. Use imaginary numbers to express the square root of a negative number
- 11-12.1.4. Justify the steps of an algebraic process using the properties of the real number system; e.g., write an algebraic proof

OPERATIONS AND THEIR PROPERTIES

- 11-12.1.5. Determine which properties of the real number system hold for matrices; e.g., matrix multiplication is not commutative
- 11-12.1.6. Apply basic properties of exponents and logarithms to rewrite algebraic expressions; i.e., power of a product, power of a power, products and quotients of powers, zero and negative exponents, and log of a product, quotient, or power

COMPUTATIONAL FLUENCY AND ESTIMATION

- 11-12.1.7. Add, subtract, and multiply complex numbers
- 11-12.1.8. Multiply matrices containing no more than three rows or columns without the use of technology

Standard 2: Geometry and Spatial Sense

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

Kindergarten

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

K.2.1. Identify and reproduce two-dimensional figures; i.e., circle, triangle, rectangle, and square

K.2.2. Match a three-dimensional object with its stated name; i.e., cone, sphere, cube, cylinder (e.g., which of these is a cone?)

COORDINATE GEOMETRY

No expectations at this level

TRANSFORMATION AND SYMMETRY

No expectations at this level

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

K.2.3. Identify position and direction; i.e., inside, outside, between, above, below, behind, left, and right

Grade 1

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

1.2.1. Identify, compare, draw, and sort two-dimensional figures; i.e., circle, triangle, rectangle, square, oval and diamond

1.2.2. Identify three-dimensional objects; i.e., pyramid, cube, cone, cylinder, sphere

COORDINATE GEOMETRY

No expectations at this level

TRANSFORMATION AND SYMMETRY

1.2.3. Identify lines of symmetry in two-dimensional figures

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

- 1.2.4. Arrange and describe objects in space by proximity, position, and direction; e.g., near, far, below, above, up, down, behind, in front of, next to, left or right of

Grade 2

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 2.2.1. Recognize geometric shapes and structures in their environment
- 2.2.2. Identify, describe, and sort three-dimensional objects; i.e., pyramid, cube, rectangular prism, cone, cylinder, and sphere
- 2.2.3. Predict and demonstrate the results of putting together and taking apart shapes

COORDINATE GEOMETRY

No expectations at this level

TRANSFORMATION AND SYMMETRY

- 2.2.4. Identify symmetrical shapes and draw their line of symmetry
- 2.2.5. Identify congruent figures from a selection of similar figures

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

No expectations at this level

Grade 3

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 3.2.1. Compare physical attributes of two-dimensional shapes; i.e., square, triangle, rectangle, and parallelogram
- 3.2.2. Describe the characteristics of a cylinder, pyramid, cube, sphere, and cone
- 3.2.3. Identify points, endpoints, lines, line segments, rays, and angles and use symbols to represent them
- 3.2.4. Identify right angles

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

COORDINATE GEOMETRY

3.2.5. Use ordered pairs to identify the locations of points in a grid; e.g., A-10 on a map

TRANSFORMATION AND SYMMETRY

3.2.6. Identify and create shapes that have lines of symmetry

3.2.7. Identify two-dimensional shapes that are congruent or similar

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

No new expectations at this level

Grade 4

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

4.2.1. Analyze the attributes of two- and three-dimensional shapes (i.e., circle, squares, trapezoid, rhombus) and use vocabulary to describe the attributes

4.2.2. Identify, describe, and model (e.g., using straws or other materials) parallel, perpendicular, and intersecting lines and line segments

COORDINATE GEOMETRY

No new expectations at this level (See grade 3)

TRANSFORMATION AND SYMMETRY

4.2.3. Recognize the changes in position and orientation of two-dimensional figures after transformations; i.e., flips (reflections), turns (rotations), and slides (translations)

4.2.4. Use motion geometry to show that shapes are congruent or similar

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

No new expectations at this level

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations**BENCHMARK EXPECTATION****Grade 5**

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 5.2.1. Describe properties and attributes of two- and three-dimensional figures; i.e., obtuse angle, acute angle, radius, chord, diagonal, equilateral triangle, isosceles triangle, parallel lines, perpendicular lines
- 5.2.2. Draw circles using a compass, and identify the components; i.e., radius, chord, diameter, center, and circumference
- 5.2.3. Identify the attributes of an angle and draw angles using protractors
- 5.2.4. Determine the degrees of the interior angles of triangles and quadrilaterals
- 5.2.5. Determine the characteristics of, and the relationships among, points, lines, line segments, rays, and planes

COORDINATE GEOMETRY

- 5.2.6. Use ordered pairs in quadrant 1 of a coordinate grid

TRANSFORMATION AND SYMMETRY

- 5.2.7. Describe properties of congruent figures and use them to solve problems

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

No new expectations at this level

Grade 6

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 6.2.1. Identify relationships between pairs of angles; i.e., adjacent, vertical, complementary, and supplementary
- 6.2.2. Identify polygons; i.e., triangle, rectangle, square, rhombus, parallelogram, trapezoid, pentagon, hexagon, octagon
- 6.2.3. Describe the characteristics of a right triangle

COORDINATE GEOMETRY

- 6.2.4. Use ordered pairs to locate a point on a coordinate plane

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations**BENCHMARK EXPECTATION**

TRANSFORMATION AND SYMMETRY

6.2.5. Identify, describe, and model motion geometry; i.e., rotations, reflections, and translations

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

6.2.6. Draw basic geometric figures using appropriate tools; i.e., circle with a compass, triangle and rectangle with a ruler or straight edge

Grade 7

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

7.2.1. Make observations about relationships between two- and three-dimensional figures; e.g., a cube is made with six squares

7.2.2. Classify triangles based on side and angle measurements; i.e., scalene, isosceles, equilateral, acute, obtuse, and right

COORDINATE GEOMETRY

7.2.3. Draw and label the components of the coordinate plane; i.e., coordinates, quadrants, origin, x- and y-axes

TRANSFORMATION AND SYMMETRY

7.2.4. Identify relationships between congruent figures and similar figures

7.2.5. Draw the result of a transformation in the coordinate plane; i.e., translation, reflection, and rotation

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

7.2.6. Build and sketch three-dimensional solids; e.g., using nets, manipulatives

Grade 8

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

8.2.1. Use nets to represent the relationships between two- and three-dimensional figures

8.2.2. Classify quadrilaterals based on side lengths, angle measures, and sets of parallel sides

8.2.3. Identify the angles formed and the relationships between the angles when parallel lines are intersected by a transversal

8.2.4. Apply the Pythagorean Theorem to problems involving right triangles

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

COORDINATE GEOMETRY

8.2.5. Represent shapes using coordinate geometry

TRANSFORMATION AND SYMMETRY

8.2.6. Draw the results of a combination of transformations in the coordinate plane; i.e., reflections, rotations, and translations

8.2.7. Use scale, proportion, and congruency to solve problems involving similar figures

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

8.2.8. Use two-dimensional representations of three-dimensional objects to visualize and solve problems; e.g., those involving surface area and volume

Grades 9-10

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

9-10.2.1. Identify the properties and attributes of two- and three-dimensional objects that distinguish one from another; e.g., a cylinder has two parallel circular bases

9-10.2.2. Determine congruence and similarity among geometric objects

9-10.2.3. Use trigonometric relationships and the Pythagorean Theorem to determine side lengths and angle measures in right triangles

9-10.2.4. Using given information, establish the validity of a conjecture using a two-column or paragraph proof

COORDINATE GEOMETRY

9-10.2.5. Use Cartesian coordinates to determine distance, midpoint, and slope

9-10.2.6. Use distance, midpoint, and slope to establish relationships between points, lines, and plane figures in the Cartesian coordinate system; e.g., determine whether a triangle is scalene, isosceles, or equilateral given the coordinates of its vertices

TRANSFORMATION AND SYMMETRY

9-10.2.7. Identify and perform transformations of objects in the plane using sketches (translations, reflections, rotations, and dilations) and coordinates (translations, reflections, and dilations)

9-10.2.8. Analyze the effects of combining basic transformations in a plane; e.g., two reflections over parallel lines results in a translation

Standard 2: Student understands and applies geometric concepts and spatial relationships to represent and solve problems in mathematical and nonmathematical situations

BENCHMARK EXPECTATION

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

- 9-10.2.9. Construct plane figures using traditional and/or technological tools; i.e., congruent segments, congruent angles, angle and segment bisectors, perpendicular and parallel lines
- 9-10.2.10. Given a two-dimensional image of a three-dimensional object, recognize images of the same object shown from different perspectives
- 9-10.2.11. Use geometric models to gain insights into, and to answer questions in, other areas of mathematics, other disciplines, and other areas of interest; e.g., art and architecture

Grades 11-12

TWO- AND THREE-DIMENSIONAL SHAPES, GEOMETRIC PROPERTIES AND RELATIONSHIPS

- 11-12.2.1. Use trigonometric relationships to determine side lengths and angle measures in triangles; i.e., right triangle trigonometry, Law of Sines, and Law of Cosines

COORDINATE GEOMETRY

No further expectations

TRANSFORMATION AND SYMMETRY

No further expectations

VISUALIZATION, SPATIAL REASONING, AND GEOMETRIC MODELING

No further expectations

Standard 3: Data Analysis, Statistics, and Probability

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

Kindergarten

DATA COLLECTION, DISPLAY, AND INTERPRETATION

K.3.1. Sort objects according to a given attribute; e.g., use, size, color, shape

K.3.2. Use picture graphs as sources of information

PROBABILITY

No expectations at this level

STATISTICAL METHODS

No expectations at this level

PREDICTIONS, DATA ANALYSIS AND INFERENCES

No expectations at this level

Grade 1

DATA COLLECTION, DISPLAY, AND INTERPRETATION

1.3.1. Identify and display various forms of data in their world using charts and graphs; e.g., tally charts and bar graphs

1.3.2. Read and interpret tally charts and picture graphs as sources of information

1.3.3. Sort objects by common attribute

PROBABILITY

No expectations at this level

STATISTICAL METHODS

No expectations at this level

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

PREDICTIONS, DATA ANALYSIS AND INFERENCES

No expectations at this level

Grade 2

DATA COLLECTION, DISPLAY, AND INTERPRETATION

2.3.1. Sort and classify objects according to their attributes and organize data about the objects; e.g., Venn diagrams, graphs, tables

2.3.2. Demonstrate that data can be represented in more than one way

2.3.3. Formulate and answer simple questions from data represented by graphs

PROBABILITY

No expectations at this level

STATISTICAL METHODS

No expectations at this level

PREDICTIONS, DATA ANALYSIS AND INFERENCES

2.3.4. Record results of activities involving chance (e.g., coin flips, dice rolls) and make reasonable predictions based upon data

2.3.5. Describe the likelihood of an event; e.g., cloudy, it may rain

Grade 3

DATA COLLECTION, DISPLAY, AND INTERPRETATION

3.3.1. Identify different parts of a graph; i.e., label, scale, and data

3.3.2. Display and interpret graphs with symbols or pictures that represent more than one object or event

3.3.3. Solve problems based on data displayed on a graph

3.3.4. Recognize the elements in the union and intersection of sets represented by Venn diagrams

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

PROBABILITY

3.3.5. Use a simple probability experiment to collect data, display the data in a graph, and interpret the likelihood of the outcome

STATISTICAL METHODS

No expectations at this level

PREDICTIONS, DATA ANALYSIS AND INFERENCES

3.3.6. Determine which outcomes are most likely to occur in certain situations; e.g., spinning red is most likely to occur when the spinner is divided among red, blue, green, red

Grade 4

DATA COLLECTION, DISPLAY, AND INTERPRETATION

4.3.1. Determine a sample group to survey

4.3.2. Collect and record data

4.3.3. Organize and display data in line graphs and circle graphs

4.3.4. Read, interpret, and generate questions from data displayed in graphs; i.e., line graphs and circle graphs

4.3.5. Use computers and spreadsheets to organize and display data

4.3.6. Use number lines and coordinate graphs to represent data

PROBABILITY

4.3.7. Conduct simple probability experiments

STATISTICAL METHODS

4.3.8. Determine or calculate the mode, mean/average, and range for a data set

PREDICTIONS, DATA ANALYSIS AND INFERENCES

4.3.9. Make predictions and draw conclusions from simple probability experiments

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

Grade 5

DATA COLLECTION, DISPLAY, AND INTERPRETATION

5.3.1. Read and interpret bar, line, and circle graphs, pictographs, and frequency tables

PROBABILITY

5.3.2. Determine the probability of a simple event and express it as a ratio

5.3.3. State possible outcomes for a given situation

5.3.4. Determine possible arrangements of four or fewer items

STATISTICAL METHODS

5.3.5. Determine or calculate the mode, mean, and range of a set of data

PREDICTIONS, DATA ANALYSIS AND INFERENCES

5.3.6. Make predictions and draw conclusions based on data collected from a sample group

Grade 6

DATA COLLECTION, DISPLAY, AND INTERPRETATION

6.3.1. Collect and organize data, select and use an appropriate display; i.e., a frequency table, a line and bar graph

PROBABILITY

6.3.2. Count possible outcomes using lists

6.3.3. Use experiments or simulations to determine probabilities

6.3.4. Use decimal values and ratios to represent probability

STATISTICAL METHODS

6.3.5. Calculate the mean, median, mode, and range of a set of data

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

PREDICTIONS, DATA ANALYSIS AND INFERENCES

6.3.6. Make predictions based on trends identified in tables and graphs

Grade 7

DATA COLLECTION, DISPLAY, AND INTERPRETATION

7.3.1. Formulate a question; collect, organize, and display data using a bar, line, and circle graph

PROBABILITY

7.3.2. Determine possible outcomes using organized lists, tree diagrams, or Venn diagrams

7.3.3. Formulate hypotheses, conduct probability experiments, and draw conclusions from results

7.3.4. Compute probabilities for simple events

STATISTICAL METHODS

7.3.5. Calculate and compare information provided by the mean, median, mode, and range of a set of data

PREDICTIONS, DATA ANALYSIS AND INFERENCES

7.3.6. Describe how scale can make graphs, tables, and charts appear misleading

7.3.7. Explain inferences made from statistical information

Grade 8

DATA COLLECTION, DISPLAY, AND INTERPRETATION

8.3.1. Formulate a question and select a random or representative sample

8.3.2. Collect, organize, and display data using scatter and stem-and-leaf plot

PROBABILITY

8.3.3. Determine possible outcomes using organized lists, tree diagrams, Venn diagrams, factorials, and the basic counting principle

8.3.4. Distinguish between experimental and theoretical probability; i.e., the results of an experiment may not match the theoretical probability

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

STATISTICAL METHODS

8.3.5. Calculate and compare the measures of central tendency (i.e., mean, median, mode) and spread (i.e., range)

8.3.6. Identify an outlier within a set of data and discuss its effects on the measures of central tendency and spread

PREDICTIONS, DATA ANALYSIS AND INFERENCES

8.3.7. Make inferences based on analysis of data and interpretation of graphs

Grades 9-10

DATA COLLECTION, DISPLAY, AND INTERPRETATION

9-10.3.1. Construct appropriate displays of given data; i.e., circle graphs, bar graphs, histograms, stem-and-leaf plots, box-and-whisker plots, and scatter plots

9-10.3.2. Interpret a given visual representation (i.e., circle graphs, bar graphs, histograms, stem-and-leaf plots, box-and-whisker plots, and scatter plots) of a set of data

9-10.3.3. Identify the variable, sample, and population in a well-designed study; e.g., in an exit poll for a tax increase, the variable is the outcome of the vote, the sample is the set of people surveyed, the population is the set of all voters

PROBABILITY

9-10.3.4. Determine the number of possible outcomes for a given event, using appropriate counting techniques; e.g., fundamental counting principle, factorials, combinations, permutations

9-10.3.5. Calculate experimental and theoretical probabilities with and without replacement

9-10.3.6. Calculate probabilities of compound events using addition and multiplication rules

STATISTICAL METHODS

9-10.3.7. Calculate measures of central tendency and spread; i.e., mean, median, mode, range, and quartiles

9-10.3.8. Discuss relationships among measures of central tendency and spread; i.e., mean, median, mode, range, and quartiles

PREDICTIONS, DATA ANALYSIS AND INFERENCES

9-10.3.9. Select two points and approximate an equation for the line of best fit (if appropriate) for a set of data

Standard 3: Students use data collection and analysis techniques, statistical methods, and probability to solve problems

BENCHMARK EXPECTATION

9-10.3.10. Identify the trend of the data and estimate the strength of the correlation between two variables; e.g., strong vs. weak, positive vs. negative

Grades 11-12

DATA COLLECTION, DISPLAY, AND INTERPRETATION

11-12.3.1. Choose, construct, and interpret an appropriate display to represent a set of data

PROBABILITY

11-12.3.2. Make predictions based on theoretical probabilities and experimental results

STATISTICAL METHODS

11-12.3.3. Select, calculate, and use appropriate measures of central tendency and spread (i.e., mean, median, mode, range, and quartiles) to draw meaningful conclusions about a set of data

PREDICTIONS, DATA ANALYSIS AND INFERENCES

11-12.3.4. Given a set of data exhibiting a linear trend, approximate an equation for the line of best fit (with or without technology) and use that model to make predictions

Standard 4: Measurement

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

Kindergarten

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- K.4.1. Name the days of the week in order
- K.4.2. Tell time to the hour using digital and analog clocks
- K.4.3. Order pictures first, next, last based on time
- K.4.4. Compare and order objects according to their length or weight
- K.4.5. Identify a penny, nickel, and dime and state its value

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- K.4.6. Measure length with non-standard units; e.g., paper clips, cubes

Grade 1

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 1.4.1. Use the days of the week to show knowledge of yesterday, today, and tomorrow
- 1.4.2. Tell time to the hour and half-hour using digital and analog clocks
- 1.4.3. Estimate, and verify by measuring, length, weight, or capacity using nonstandard units
- 1.4.4. Estimate, and verify by measuring length to the nearest inch, foot, and centimeter
- 1.4.5. Identify a penny, nickel, dime, and quarter and state its value
- 1.4.6. Count a like set of pennies, nickels, or dimes to \$1.00

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

1.4.7. Demonstrate that different combinations of coins (i.e., pennies, nickels and dimes) can have the same value

1.4.8. Sequence events with respect to time; e.g., yesterday, today, tomorrow, seasons

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

1.4.9. Identify the appropriate tool used to measure length (i.e., ruler), weight (i.e., scale), time (i.e., clock, calendar) and temperature (i.e., thermometer)

Grade 2

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

2.4.1. Tell time to the nearest quarter hour and 5 minute interval using digital and analog clocks

2.4.2. Distinguish between week days and weekend days

2.4.3. Recall the months of the year in order

2.4.4. Count mixed coins to \$1.00

2.4.5. Estimate and measure weight to the nearest pound or kilogram

2.4.6. Estimate and measure capacity to the nearest cup or liter

2.4.7. Estimate and measure length to the nearest inch, half-inch, foot, or centimeter

2.4.8. Estimate and verify a quantity; e.g., marbles in a jar

2.4.9. Compare and order given lengths, capacities, weights, or temperatures that are expressed in the same unit of measure

2.4.10. Identify the approximate size of basic units; e.g., width of finger is about one centimeter, large soda bottle is two liters, a paper clip weighs one gram

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

2.4.11. Select the appropriate units for measuring time, length, weight, and temperature

2.4.12. Use the symbols for the dollar and cent

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

Grade 3

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 3.4.1. Tell time to the nearest minute using digital and analog clocks
- 3.4.2. Determine elapsed time by the hour
- 3.4.3. Count coins and bills
- 3.4.4. Read and measure temperature with a thermometer using Fahrenheit and Celsius scales
- 3.4.5. Estimate and measure to the nearest half inch or centimeter
- 3.4.6. State specific relationships between units within the same measuring system; e.g., hours in a day, inches in a foot, cups in a pint
- 3.4.7. Estimate and measure perimeter, area, and volume using links, tiles, grid paper, geoboards, and dot paper

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 3.4.8. Select a variety of tools for measuring length, weight, and capacity

Grade 4

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 4.4.1. State specific relationships between units within the same measuring system; e.g., feet to yards, minutes to hours, milliliters to liters
- 4.4.2. Estimate and measure length to the nearest quarter inch
- 4.4.3. Analyze relationships between perimeter and area
- 4.4.4. Make change up to \$20
- 4.4.5. Apply the concept of elapsed time; i.e., schedules, and calendars

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 4.4.6. Select appropriate units for measuring perimeter, area, and volume

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

Grade 5

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 5.4.1. Estimate and measure length to the nearest eighth inch
- 5.4.2. Measure and apply elapsed time; i.e., time zones, schedules, and calendars
- 5.4.3. Measure angles using protractors
- 5.4.4. Estimate angle measures using the benchmark angles 45° , 90° , 180° , 270° , and 360°

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 5.4.5. Select and use appropriate units when measuring length, area, and volume
- 5.4.6. Use formulas to calculate the perimeter and area of squares and rectangles
- 5.4.7. Use formulas to calculate the volume of rectangular prisms

Grade 6

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 6.4.1. Measure length to the nearest sixteenth of an inch
- 6.4.2. Select an appropriate unit of measure; e.g., What unit do you use to measure a person's height?
- 6.4.3. Convert unit measurements within the same system (metric and standard)
- 6.4.4. Distinguish between perimeter, area, surface area, and volume

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 6.4.5. Select appropriate tools and units to determine the measurements needed for calculating perimeter, circumference, area, surface area, and volume
- 6.4.6. Use formulas to determine the circumference and area of circles and the perimeter and area of triangles and parallelograms
- 6.4.7. Use area formulas to determine the surface area of right prisms and square pyramids

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

6.4.8. Use formulas to determine the volume of rectangular prisms

Grade 7

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 7.4.1. Estimate a measurement to the degree of precision that the tool provides
- 7.4.2. Convert unit measurements within the same system (metric and standard) when solving problems
- 7.4.3. Select the appropriate measure of perimeter, area, surface area, or volume to solve a problem

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 7.4.4. Select and use appropriate tools and units to determine the measurements needed for calculating perimeter, circumference, area, surface area, and volume
- 7.4.5. Solve problems involving scale factors, using ratio and proportion
- 7.4.6. Use formulas to determine the perimeter and area of trapezoids
- 7.4.7. Use area formulas to determine the surface area of right cylinders
- 7.4.8. Use formulas to determine the volume of right cylinders
- 7.4.9. Determine the area of irregularly shaped objects

Grade 8

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 8.4.1. Select an appropriate degree of precision when using measurements for calculations
- 8.4.2. Compare unit measurements between systems; e.g., a yard is almost a meter

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 8.4.3. Use formulas to determine the surface area and volume of right cones and spheres

Standard 4: Students use concepts and tools of measurement to describe and quantify the world

BENCHMARK EXPECTATION

Grades 9-10

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

- 9-10.4.1. Select appropriate units and scales for problem situations involving measurement
- 9-10.4.2. Describe the effects of scalar change on the area and volume of a figure; e.g., the effect of doubling one or more edges of a solid on its surface area and volume
- 9-10.4.3. Use approximations to compare the standard and metric systems of measurement; e.g., a five-kilometer race is about three miles long
- 9-10.4.4. Given a conversion factor, convert between standard and metric measurements

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

- 9-10.4.5. Use methods necessary to achieve a specified degree of precision and accuracy (i.e., appropriate number of significant digits) in measurement situations
- 9-10.4.6. Employ estimation techniques to evaluate reasonableness of results in measurement situations
- 9-10.4.7. Use unit analysis to track units during computations
- 9-10.4.8. Given a formula list, compute the area of a regular polygon
- 9-10.4.9. Given a formula list, compute the surface area and volume of a right prism, right cylinder, right pyramid, right cone, and sphere
- 9-10.4.10. Apply indirect measurement techniques to solve problems involving irregular shapes or inaccessible objects; e.g., calculate the distance across a lake, triangulate an irregular region to find its approximate area

Grades 11-12

MEASURABLE ATTRIBUTES, MEASUREMENT SYSTEMS AND UNITS

No further expectations

MEASUREMENT TOOLS, TECHNIQUES, AND FORMULAS

No further expectations

Standard 5: Algebra, Functions, and Patterns

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Kindergarten

PATTERNS, RELATIONS, AND FUNCTIONS

K.5.1. Identify, sort, and classify objects by attributes

K.5.2. Recognize, extend, and describe simple patterns

NUMERIC AND ALGEBRAIC REPRESENTATIONS

No expectations at this level

MATHEMATICAL MODELING

K.5.3. Use tools and strategies (e.g., manipulatives) to model problems

RATES OF CHANGE

No expectations at this level

Grade 1

PATTERNS, RELATIONS, AND FUNCTIONS

1.5.1. Identify, sort, and classify objects by two or more attributes

1.5.2. Recognize, extend, create and describe patterns

NUMERIC AND ALGEBRAIC REPRESENTATIONS

1.5.3. Demonstrate the commutative property of addition; e.g., $3+5=5+3$

MATHEMATICAL MODELING

No expectations at this level

RATES OF CHANGE

No expectations at this level

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Grade 2

PATTERNS, RELATIONS, AND FUNCTIONS

2.5.1. Extend and create number patterns

2.5.2. State the rule that describes a given repeating and growing pattern

NUMERIC AND ALGEBRAIC REPRESENTATIONS

2.5.3. Solve addition and subtraction equations with unknown variables; e.g., $2 + \square = 5$

MATHEMATICAL MODELING

2.5.4. Use symbols (i.e., +, -, =, <, >) to write simple number sentences

2.5.5. Use words, objects, and number sentences to represent addition and subtraction problems

RATES OF CHANGE

No expectations at this level

Grade 3

PATTERNS, RELATIONS, AND FUNCTIONS

3.5.1. Use patterns to solve problems

3.5.2. Create patterns using multiplication

3.5.3. Determine the missing elements of a pattern of multiples

NUMERIC AND ALGEBRAIC REPRESENTATIONS

3.5.4. Solve addition, subtraction, multiplication, and division equations with unknown numbers; e.g., $8 \times \square = 56$

MATHEMATICAL MODELING

3.5.5. Use symbols to write number sentences; i.e., +, -, >, <, =, x, and ÷

RATES OF CHANGE

No new expectations at this level

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Grade 4

PATTERNS, RELATIONS, AND FUNCTIONS

4.5.1. Determine the missing elements of complex repeating patterns

NUMERIC AND ALGEBRAIC REPRESENTATIONS

4.5.2. Explain that variables represent unknowns

MATHEMATICAL MODELING

4.5.3. Solve problems with variables

4.5.4. Use parentheses in solving simple equations

RATES OF CHANGE

No new expectations at this level

Grade 5

PATTERNS, RELATIONS, AND FUNCTIONS

5.5.1. Analyze patterns represented by tables and graphs

5.5.2. Identify a rule for a pattern involving addition, subtraction, or multiplication

5.5.3. Identify the rule for a pattern and then use the rule to solve a problem

NUMERIC AND ALGEBRAIC REPRESENTATIONS

5.5.4. Identify a variable in an expression

MATHEMATICAL MODELING

5.5.5. Use equations to solve problems; e.g., $28/x=7$

RATES OF CHANGE

No new expectations at this level

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Grade 6

PATTERNS, RELATIONS, AND FUNCTIONS

6.5.1. Identify and describe patterns represented by tables, graphs, and sequences

NUMERIC AND ALGEBRAIC REPRESENTATIONS

6.5.2. Use a variable to represent an unknown quantity

MATHEMATICAL MODELING

6.5.3. Use representations to solve problems; i.e., tables and numerical sentences

RATES OF CHANGE

6.5.4. Recognize examples of change over time; e.g. growth of a sixth grader from September to May

Grade 7

PATTERNS, RELATIONS, AND FUNCTIONS

7.5.1. Create tables and graphs to analyze and describe patterns

NUMERIC AND ALGEBRAIC REPRESENTATIONS

7.5.2. Create algebraic expressions and equations to represent word phrases and sentences

7.5.3. Apply the order of operations and the commutative, associative, and distributive properties to evaluate numeric expressions

7.5.4. Use inverse operations and properties of equality to solve one-step equations and inequalities in one variable

MATHEMATICAL MODELING

7.5.5. Write one-step equations and inequalities to represent problem situations

RATES OF CHANGE

7.5.6. Graph change over time; e.g., growth, distance, population

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

Grade 8

PATTERNS, RELATIONS, AND FUNCTIONS

8.5.1. Extend numerical patterns; e.g., Pascal's triangle and the Fibonacci sequence

NUMERIC AND ALGEBRAIC REPRESENTATIONS

8.5.2. Use variables, expressions and equations to represent problem situations

8.5.3. Apply the order of operations and the commutative, associative, and distributive properties to simplify algebraic expressions

8.5.4. Apply inverse operations and the properties of equality to solve multi-step equations and inequalities in one variable

MATHEMATICAL MODELING

8.5.5. Write multi-step equations and inequalities to represent problem situations

RATES OF CHANGE

8.5.6. Solve problems involving rates; i.e. speed equals distance divided by time (miles per hour)

Grades 9-10

PATTERNS, RELATIONS, AND FUNCTIONS

9-10.5.1. Given the explicit and/or the recursive definition of a sequence, generate a specific term (explicit formula only) or a specified number of terms

9-10.5.2. Express relations and functions using a variety of representations; i.e., numeric, graphic, symbolic, and verbal

9-10.5.3. Determine whether a relation is a function by examining various representations of the relation; e.g., table, graph, equation, set of ordered pairs

9-10.5.4. Perform the operations of addition, subtraction, multiplication, and division on algebraic functions; e.g., given $f(x) = 2x$ and $g(x) = 5x - 7$, find $f(x) + g(x)$

9-10.5.5. Identify the independent variable, dependent variable, domain, and range of a function

9-10.5.6. Draw graphs of linear and quadratic functions using paper and pencil, labeling key features; e.g., graph a line and label its x-intercept and y-intercept, graph a parabola and label its vertex and one point on each side of the vertex

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems

BENCHMARK EXPECTATION

NUMERIC AND ALGEBRAIC REPRESENTATIONS

- 9-10.5.7. Develop algebraic expressions or equations involving one or two variables to represent relationships found in various contexts (time and distance problems, mixture problems, etc.); e.g., given a verbal statement, write an equivalent algebraic expression or equation
- 9-10.5.8. Manipulate algebraic expressions and equations using properties of real numbers; e.g., simplify, factor
- 9-10.5.9. Solve linear equations and inequalities, systems of two linear equations or inequalities, and quadratic equations having rational solutions; e.g., factoring, quadratic formula
- 9-10.5.10. Solve a literal equation for a specified variable; e.g., solve $I = prt$ for r , or solve $7n + p = t$ for n

MATHEMATICAL MODELING

- 9-10.5.11. Use essential quantitative relationships in a situation to determine whether the relationship can be modeled by a linear function; e.g., simple interest is linear, compound interest is not linear
- 9-10.5.12. Graphically represent the solution or solutions to an equation, inequality, or system
- 9-10.5.13. Interpret a graphical representation of a real-world situation
- 9-10.5.14. Draw conclusions about a situation being modeled

RATES OF CHANGE

- 9-10.5.15. Approximate and interpret rates of change from graphical and numerical data

Grades 11-12

PATTERNS, RELATIONS, AND FUNCTIONS

- 11-12.5.1. Perform advanced operations (i.e., composition and finding inverses) on algebraic functions
- 11-12.5.2. Generate graphs of a variety of functions (i.e., linear, quadratic, polynomial, absolute value, and exponential), using technology when appropriate

NUMERIC AND ALGEBRAIC REPRESENTATIONS

- 11-12.5.3. Solve quadratic equations involving complex roots
- 11-12.5.4. Use transformations (i.e., reflection, translation, dilation) to graph linear, quadratic, and absolute value functions

Standard 5: Students use algebraic concepts, functions, patterns, and relationships to solve problems**BENCHMARK EXPECTATION**

11-12.5.5. Given the graph of a transformed linear, quadratic, or absolute value function, write its equation

MATHEMATICAL MODELING

11-12.5.6. Determine and write an equation for a function (i.e., linear, quadratic, polynomial, absolute value, and exponential) that models a mathematical relationship

RATES OF CHANGE

No further expectations