# TITLE 6PRIMARY AND SECONDARY EDUCATIONCHAPTER 29STANDARDS FOR EXCELLENCEPART 7MATHEMATICS

**6.29.7.1 ISSUING AGENCY:** Public Education Department, hereinafter the department. [6.29.7.1 NMAC - N, 6-30-2009]

6.29.7.2 SCOPE: All public schools, state educational institutions and educational programs conducted in state institutions other than New Mexico military institute.[6.29.7.2 NMAC - N, 6-30-2009]

#### 6.29.7.3 STATUTORY AUTHORITY:

A. Section 22-2-2 NMSA 1978 grants the authority and responsibility for the assessment and evaluation of public schools, state-supported educational institutions and educational programs conducted in state institutions other than New Mexico military institute.

B. Section 22-2-2 NMSA 1978 directs the department to set graduation expectations and hold schools accountable. Section 22-2C-3 NMSA 1978 requires the department to adopt academic content and performance standards and to measure the performance of public schools in New Mexico. [6.29.7.3 NMAC - N, 6-30-2009]

**6.29.7.4 DURATION:** Permanent. [6.29.7.4 NMAC - N, 6-30-2009]

**6.29.7.5 EFFECTIVE DATE:** June 30, 2009, unless a later date is cited at the end of a section. [6.29.7.5 NMAC - N, 6-30-2009]

**6.29.7.6 OBJECTIVE:** The New Mexico content standards with benchmarks and performance standards for mathematics provide a framework of required knowledge and skills in this field. The content standards with benchmarks and performance standards for mathematics were adopted in 1996 as part of 6.32 NMAC; they were replaced in 2002. The mathematics content standards for grades 9-12 were revised in April 2008. The content standards are mandated for grades K-12. For grades 9-12, students shall take a minimum of four units in mathematics, of which one shall be equivalent to or higher than the level of algebra 2, unless the parent has submitted a written, signed permission for the student to complete a lesser mathematics unit. [6.29.7.6 NMAC - N, 6-30-2009]

#### 6.29.7.7 **DEFINITIONS:** [Reserved]

## 6.29.7.8 CONTENT STANDARDS WITH BENCHMARKS AND PERFORMANCE STANDARDS FOR MATHEMATICS, Grades K-4:

A. Strand: Number and operations. Content standard 1: Students will understand numerical concepts and mathematical operations.

(1) Grades K-4 benchmark 1: Understand numbers, ways of representing numbers, relationships among numbers and number systems.

- (a) Grade K performance standards:
  - (i) Demonstrate an understanding of the place-value structure of the base-ten number

system.

- (ii) Count with understanding and recognize "how many" in sets of objects up to 20.
- (iii) Read and write whole numbers up to 20.
- (iv) Compare and order whole numbers up to 20.
- (v) Connect numerals to the quantities they represent using various physical models.

(vi) Use an organized counting method to keep track of quantities while counting (one-

to-one correspondence - e.g., touch object once and only once as counting a set).

- (vii) Order sets of objects and numbers from least to most or most to least.
- (b) Grade 1 performance standards:
  - (i) Demonstrate an understanding of the place-value structure of the base-ten number

system.

(ii) Read, write, model and sequence whole numbers up to 100, including filling in missing numbers in a sequence.

(iii) Count with understanding and recognize "how many" in sets of objects up to 50.

- (iv) Count orally by 2s to 20 and by 5s and 10s to 100.
- (v) Count orally backward from 100.
- (vi) Compare and order numbers up to 100.

(vii) Decompose and recombine numbers using manipulatives (e.g., by breaking numbers apart and recombining) to create and construct equivalent representations for the same number (e.g., 10 = 3 + 7 or 1 + 2 + 7 or 3 + 2 + 5).

(viii) Group objects by 10s and 1s to explore place value (e.g., 24 equals two tens and four ones); use ordinal numbers (e.g., what position?) and cardinal numbers (e.g., how many?) appropriately.

(ix) Connect number words and numbers to the quantities they represent.

(c) Grade 2 performance standards:

(i) Understand the relationship between numbers, quantities and place value in whole numbers up to 1,000 and develop flexible ways of thinking about numbers: use multiple models to explore place value and the base-ten number system; represent whole numbers and use them in flexible ways including decomposing and recombining numbers to see their relationships (e.g., 3 is one less than 4, one more than 2, two less than 5); identify whether a set of objects has an odd or even number of elements; compare and order numbers using a variety of terms (e.g., tens, less than, odd numbers); apply strategies for computation utilizing an understanding of place value (e.g., 48 + 25 would be 40 + 20 is 60, 8 + 5 is 13, 60 + 13 is 73).

(ii) Apply counting skills and number sense through meaningful activities: count and recognize "how many" in sets of objects up to 1,000; count forward and backward from given numbers to 1,000; connect number words and numerals to the quantities they represent using physical models and other representations (e.g., 23 can be twenty-three 1s, one 10 and thirteen 1s, or two 10s and three 1s); model how many parts make a whole using equal fractional parts (e.g., 1/2, 1/3, 1/4 and 1/6 as equal parts of a whole).

(d) Grade 3 performance standards:

(i) Exhibit an understanding of the place-value structure of the base-ten number system by: reading, modeling, writing and interpreting whole numbers up to 10,000; comparing and ordering numbers up to 1,000; recognizing the position of a given number in the base-ten number system and its relationship to benchmark numbers such as 10, 50, 100, 500.

(ii) Use whole numbers by using a variety of contexts and models (e.g., exploring the size of 1,000 by skip-counting to 1,000 using "hundred charts or strips" 10 or 100 centimeters long).

(iii) Identify some representations for some numbers and generate them by decomposing and recombining numbers (e.g.,  $853 = 8 \times 100 + 5 \times 10 + 3$ ;  $85 \times 10 + 3 = 853$ ; 853 = 900 - 50 + 3).

(iv) Identify the relationship among commonly encountered factors and multiples (e.g., factor pairs of 12 are 1 x 12, 2 x 6, 3 x 4; multiples of 12 are 12, 24, 36).

(v) Use visual models and other strategies to recognize and generate equivalents of commonly used fractions and mixed numbers (e.g., halves, thirds, fourths, sixths, eighths and tenths).

(vi) Demonstrate an understanding of fractions as parts of unit wholes, parts of a collection or set, and as locations on a number line.

(vii) Use common fractions for measuring and money (e.g., using fractions and decimals as representations of the same concept, such as half of a dollar = 50 cents).

(e) Grade 4 performance standards:

(i) Exhibit an understanding of the place-value structure of the base-ten number system by reading, modeling, writing and interpreting whole numbers up to 100,000; compare and order the numbers: recognize equivalent representations for the same number and generate them by decomposing and combining numbers (e.g.,  $853 = 8 \times 100 + 5 \times 10 + 3$ ;  $853 = 85 \times 10 + 3$ ; 853 = 900 - 50 + 3); identify the numbers less than 0 by extending the number line and using negative numbers through familiar applications (e.g., temperature, money).

(ii) Identify fractions as parts of unit wholes, as parts of groups, and as locations on number lines: use visual models and other strategies to compare and order commonly used fractions; use models to show how whole numbers and decimals (to the hundredths place) relate to simple fractions (e.g., 1/2, 5/10, 0.5); identify different interpretations of fractions (division of whole numbers by whole numbers, ratio, equivalence, ordering of fractions, parts of a whole or parts of a set).

(iii) Add and subtract fractions with common and uncommon denominators using a variety of strategies (e.g., manipulatives, numbers, pictures): recognize and generate equivalent decimal forms of

commonly used fractions (e.g., halves, quarters, tenths, fifths); identify the numbers less than 0 by extending the number line and using negative numbers through familiar applications (e.g., temperature, money).

(iv) Recognize classes of numbers (e.g., odd, even, factors, multiples, square numbers) and apply these concepts in problem-solving situations.

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(2) Grades K-4 benchmark 2: Understand the meaning of operations and how they relate to one

another.

(a) Grade K performance standards:

- (i) Represent numbers using pictures, objects, or numerals.
  - (ii) Use concrete objects to solve simple addition and subtraction story problems (e.g.,

oral, not written).

- Grade 1 performance standards:
- (i) Use a variety of models to demonstrate an understanding of addition and subtraction

Solve addition and subtraction problems with one- and two-digit numbers (e.g., 5 +

of whole numbers.

58 = ?).

(b)

(ii)

(iii) Find the sum of three one-digit numbers to the sum of 15.

(iv) Understand and use the inverse relationship between addition and subtraction to solve problems and check solutions (e.g., 8 + 6 = 14 is related to 14 - 6 = 8).

(v) Use concrete materials to investigate situations that relate to multiplication and division (e.g., equal groupings of objects, sharing equally), and, given simple story problems, explain verbally how to select and use appropriate operations.

(c) Grade 2 performance standards:
(i) Find the sum of two whole numbers up to three digits long (e.g., 235 + 476 = ?; 564 -

273 = ?).

(ii) Find the difference of two whole numbers up to three digits long.

(iii) Understand and use the inverse relationships between addition and subtraction to

solve problems and check solutions (28 + 31 = 59; therefore, 59 - 31 = 28). (iv) Identify and describe situations that require multiplication and division and develop

strategies to solve problems for repeated joining of groups and partitioning into equal subgroups or shares (e.g., repeated addition and subtraction, counting by multiples, equal sharing).

(d) Grade 3 performance standards:

(i) Use a variety of models to show an understanding of multiplication and division of whole numbers (e.g., charts, arrays, diagrams, and physical models; i.e., modeling multiplication with a variety of pictures, diagrams and concrete tools to help students learn what the factors and products represent in various contexts).

(ii) Find the sum or difference of two whole numbers between 0 and 10,000.

- (iii) Solve simple multiplication and division problems (e.g.,  $135 \div 5 = ?$ ).
- (iv) Identify how the number of groups and the number of items in each group equal a

product.

(v) Demonstrate the effects of multiplying and dividing on whole numbers (e.g., to find the total number of legs on 12 cats, 4 represents the number of each "cat" unit, so  $12 \times 4 = 48$  "leg" units;

(vi) Identify and use relationship between multiplication and division (e.g., division is the inverse of multiplication) to solve problems, and select and use operations (e.g., addition, subtraction, multiplication and division) to solve problems.

(e) Grade 4 Performance Standards:

(i) Demonstrate an understanding of and the ability to use: standard algorithms for the addition and subtraction of multi-digit numbers; standard algorithms for multiplying a multi-digit number by a two-digit number and for dividing a multi-digit number by a one-digit number.

(ii) Select and use appropriate operations (addition, subtraction, multiplication and division) to solve problems.

(iii) Extend the uses of whole numbers to the addition and subtraction of simple decimals (positive numbers to two places).

(iv) Demonstrate commutative, associative, identity and zero properties of operations on whole numbers; e.g.,  $37 \times 46 = 46 \times 37$  and  $(6 \times 2) \times 5 = 6 \times (2 \times 5)$ .

(v) Demonstrate the concept of distributivity of multiplication over addition and subtraction; e.g.,  $7 \times 28$  is equivalent to  $(7 \times 20) + (7 \times 8)$  or  $(7 \times 30) - (7 \times 2)$ .

(3) Grades K-4 benchmark 3: Compute fluently and make reasonable estimates.

- Grade K performance standard: Estimate quantities of objects up to 20. (a)
- (b) Grade 1 performance standards:

Use strategies for whole-number computation, with a focus on addition and (i)

subtraction (e.g., counting on or counting back, doubles, sums that make 10, direct modeling with pictures or objects, numerical reasoning based on number combinations and relationships).

(ii) Demonstrate a variety of methods to compute (e.g., objects, mental computation, paper and pencil, and estimation).

(iii) Perform addition and subtraction with whole number combinations.

Use and explain estimation strategies to determine the reasonableness of answers (iv) involving addition and subtraction.

Grade 2 performance standards: (c)

- Use and explain strategies for addition and subtraction of multi-digit whole numbers. (i)
- (ii) Model and solve problems representing adding and subtracting amounts of money using dollars and coins.

(iii) Use addition combinations (addends through 10) and related subtraction combinations to develop strategies for computing based on number sense (e.g., for 25 + 37, take 3 from the 25 and use it to turn 37 into 40; then add 40 and 22 to get 62).

(iv) Select and use a variety of appropriate strategies and methods to compute (e.g., objects, mental computation, estimation, paper and pencil, etc.).

Skip-count by 2, 5 and 10 to develop multiplicative reasoning and notational (v) representations (e.g., 5, 10, 15, 20; 4 x 5 = 20; four groups of 5 equal 20).

Grade 3 performance standards: (d)

Choose computational methods based on understanding the base-ten number system, (i) properties of multiplication and division, and number relationships.

> Use strategies (e.g.,  $6 \times 8$  is double  $3 \times 8$ ) to become fluent with the multiplication (ii)

(iii) Compute with basic number combinations (e.g., multiplication pairs up to  $10 \times 10$ and their division counterparts).

(iv) Demonstrate reasonable estimation strategies for measurement, computation and problem solving.

> (e) Grade 4 performance standards:

Demonstrate multiplication combinations through 12 x 12 and related division facts, (i) and use them to solve problems mentally and to compute related problems (e.g.,  $4 \times 5$  is related to  $40 \times 50$ ,  $400 \times 5$ , and 40 x 500).

> Add, subtract and multiply up to two double-digits accurately and efficiently. (ii)

Use a variety of strategies (e.g., rounding and regrouping) to estimate the results of (iii) whole number computations and judge the reasonableness of answers.

Use strategies to estimate computations involving fractions and decimals. (iv)

Strand: Algebra. Content standard 2: Students will understand algebraic concepts and Β. applications.

pairs up to 10 x 10.

Grades K-4 benchmark 1: Understand patterns, relations and functions. (1)

Grade K performance standards: (a)

Identify the attributes of objects (e.g., the ability to identify attributes is a foundational (i) skill for sorting and classifying).

Sort, classify and order objects by size, number and other properties. (ii)

(iii) Recognize, reproduce, describe, extend and create repeating patterns (e.g., color, shape, size, sound, movement, simple numbers).

> Grade 1 performance standards: (b)

Recognize, reproduce, describe, extend and create repeating patterns (e.g., color, (i) shape, size, sound, movement, simple numbers) and translate from one representation to another (e.g., red, red, blue, blue to step, step, clap, clap).

Skip-count on a hundreds chart (e.g., by 2s up to 20 and 5s and 10s up to 100) to (ii) identify, describe and predict number patterns.

Identify number patterns on the hundreds chart. (iii)

Grade 2 performance standards: (c)

(i) Recognize, reproduce, describe, extend and create repeating and growing patterns, and translate from one representation to another.

(ii) Skip-count using calculators or a hundreds chart to identify, describe, predict and make generalizations about number patterns to differentiate rote counting versus the meaning of the numbers.

(iii) Construct and solve open sentences that have variables (e.g., 10 = ? + 7).

(iv) Relate everyday problem situations to number sentences involving addition and subtraction (e.g., 25 students are going to the store. Five students can ride in a car. How many cars will be needed?).

(d) Grade 3 performance standards:

(i) Represent relationships of quantities in the form of mathematical expressions, equations or inequalities.

(ii) Solve problems involving numeric equations.

(iii) Select appropriate operational and relational symbols to make an expression true (e.g., "If 4 ? 3 = 12, what operational symbol goes in the box?").

(iv) Use models of feet and inches to express simple unit conversions in symbolic form (e.g., 36 inches = ? feet x 12) that develop conceptual understanding versus procedural skills.

(v) Recognize and use the commutative property of multiplication (e.g., if  $5 \ge 7 = 35$ ,

then what is  $7 \ge 5$ ?).

patterns.

(vi) Create, describe and extend numeric and geometric patterns including multiplication

(vii) Represent simple functional relationships: solve simple problems involving a functional relationship between two quantities (e.g., find the total cost of multiple items given the cost per unit).

(viii) Extend and recognize a linear pattern by its rules (e.g., the number of legs on a given number of horses may be calculated by counting by 4s, by multiplying the number of horses by 4 or through the use of tables).

(e) Grade 4 performance standards:

(i) Represent and analyze patterns and simple functions using words, tables, and graphs.

(ii) Create and describe numeric and geometric patterns including multiplication and

division patterns.

(iii) Express mathematical relationships using equations.

(iv) Use and interpret variables, mathematical symbols and properties to write and simplify expressions and sentences: use letters, boxes or other symbols to stand for any number in simple expressions or equations (e.g., demonstrate an understanding of the concept of a variable).

(v) Interpret and evaluate mathematical expressions using parentheses.

(vi) Use and interpret formulas (e.g., Area = Length x Width or A = L x W) to answer questions about quantities and their relationships.

(2) Grades K-4 benchmark 2: Represent and analyze mathematical situations and structures using algebraic symbols.

(a) Grade K performance standard: Use concrete, pictorial and verbal representation to develop an understanding of invented and conventional symbols.

(b) Grade 1 performance standards:

(i) Write number sentences that use concrete objects, pictorial, and verbal representations to express mathematical situations using invented and conventional symbols (e.g., +, -, =).

(ii) Demonstrate and describe the concept of equal (e.g., using objects, balance scales).

(iii) Solve open number sentences that have variables representing numbers up to 10

$$(e.g., 10 = ? + 2).$$

ideas and situations.

(c)

Grade 2 performance standards:

(i) Use mathematical language to describe a variety of representations and mathematical

(ii) Explain the concept of equal (e.g., quantities on both sides of equation are the same) by using objects or giving examples.

(iii) Construct and solve open number sentences that have variables representing numbers up to 20 (e.g., 20 = ? + 6).

(iv) Use objects, words, and symbols to explain the concept of addition.

- (d) Grade 3 performance standards:
  - (i) Determine the value of variables in missing part problems (e.g., 139 + ? = 189).

Recognize and use the commutative and associative properties of addition and (ii) multiplication (e.g., "If 5 x 7 = 35, then what is 7 x 5? If 5 x 7 x 3 = 105, then what is 7 x 3 x 5?") (iii) Explore the ways that commutative, distributive, identity and zero properties are useful in computing with numbers. (e) Grade 4 performance standards: Identify symbols and letters that represent the concept of a variable as an unknown (i) quantity. Explore the uses of properties (commutative, distributive, associative) in the (ii) computation of whole numbers. (iii) Express mathematical relationships using equations. Determine the value of variables in simple equations (e.g.,  $80 \times 15 = 40 \times ?$ ). (iv) Develop simple formulas in exploring quantities and their relationships (e.g., A = L x(v) W). Grades K-4 benchmark 3: Use mathematical models to represent and understand quantitative (3) relationships. (a) Grade K performance standard: Model situations that involve whole numbers using objects or pictures. (b) Grade 1 performance standards: (i) Represent equivalent forms of the same number through the use of physical models, diagrams and number expressions to 20 (e.g., 3 + 5 = 8, 2 + 6 = 8). Describe situations that involve addition and subtraction of whole numbers including (ii) objects, pictures, and symbols (e.g., Robert has four apples, Maria has five more). Grade 2 performance standards: (c) Model situations of addition and subtraction of whole numbers using objects, pictures (i) and symbols. Solve problems related to trading (e.g., coin trading, measurement trading). (ii) (iii) Solve addition and subtraction problems by using data from simple charts, picture graphs and number sentences. Grade 3 performance standards: (d) (i) Model problem situations with objects and use representations such as pictures, graphs, tables and equations, to draw conclusions. Solve problems involving proportional relationships including unit pricing (e.g., four (ii) apples cost 80 cents; therefore, one apple costs 20 cents). (iii) Describe relationships of quantities in the form of mathematical expressions, equations or inequalities. Select appropriate operational and relational symbols to make an expression true (iv) (e.g., "If 4 ? 3 = 12, what operational symbol goes in the box?"). Grade 4 performance standards: (e) Solve problems involving proportional relationships (including unit pricing and map (i) interpretations (e.g., one inch = five miles; therefore, five inches = ? miles). (ii) Model problem situations and use graphs, tables, pictures and equations to draw conclusions (e.g., different patterns of change). Use and interpret formulas (e.g., area = length x width or  $A = L \times W$ ) to answer (iii) questions about quantities and their relationships. Grades K-4 benchmark 4: Analyze changes in various contexts. (4)Grade K performance standard: Verbally describe changes in various contexts (e.g., plants (a) or animals growing over time). (b) Grade 1 performance standard: Describe qualitative change (e.g., a student growing taller, trees getting bigger, ice melting). Grade 2 performance standard: Describe quantitative change (e.g., a student growing two (c) inches in one year, water heating up to boil). (d) Grade 3 performance standard: Demonstrate how change in one variable can relate to a change in a second variable (e.g., input-output machines, data tables). Grade 4 performance standards: (e) Identify and describe situations with constant or varying rates of change and compare (i) them.

(ii) Determine how a change in one variable relates to a change in a second variable (e.g., data tables, input-output machines).

(iii) Find and analyze patterns using data tables (e.g., T tables).

(iv) Demonstrate and describe varying rates of change in relation to real-world situations (e.g., plant growth, students' heights).

C. Strand: Geometry. Content standard 3: Students will understand geometric concepts and applications.

(1) Grades K-4 benchmark 1: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

(a) Grade K performance standard: Identify common objects in their environments and describe their geometric features: describe, identify, model and draw common geometric objects (e.g., circle, triangle, square, rectangle, cube, sphere, cone); compare familiar plane and solid objects by common attributes (e.g., shape, size, number of corners).

(b) Grade 1 performance standards:

(i) Identify common geometric figures and classify them by common attributes: recognize, name, build and draw both polygonal (up to six sides) and curved shapes.

(ii) Sort two- and three-dimensional shapes into categories based on common attributes.

(iii) Use the attributes of shapes to analyze and identify examples and non-examples of

(iv) Participate in discussions comparing, identifying and analyzing attributes to develop the vocabulary needed to describe two- and three-dimensional geometric shapes and their attributes (e.g., sides, corners, edges, faces).

(c) Grade 2 performance standards:

(i) Identify and describe the attributes of common figures in a plane and common objects in space: sort, describe and analyze plane and solid geometric shapes (e.g., circle, triangle, square, rectangle, sphere, pyramid, cube, rectangular prism) based on various attributes (e.g., faces, edges, and corners).

(ii) Put shapes together and take them apart to form other shapes (e.g., two congruent right triangles can be arranged to form a rectangle).

(iii) Explore lines of symmetry in two-dimensional shapes.

(d) Grade 3 performance standards:

(i) Describe and compare the attributes of plane and solid geometric figures to show relationships and solve problems: identify, describe, and classify polygons (e.g., pentagons, hexagons and octagons).

(ii) Identify lines of symmetry in two-dimensional shapes.

(iii) Explore attributes of quadrilaterals (e.g., parallel and perpendicular sides for the parallelogram, right angles for the rectangle, equal sides and right angles for the square).

(iv) Identify right angles.

(v) Identify, describe and classify common three-dimensional geometric objects (e.g., cube, rectangular solid, sphere, prism, pyramid, cone, cylinder).

(e) Grade 4 performance standards:

(i) Identify, compare and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes: build, draw, create and describe geometric objects; identify lines that are parallel or perpendicular; identify and compare congruent and similar figures.

(ii) Classify two- and three-dimensional shapes according to their properties and develop definitions of classes like triangles and pyramids: visualize, describe and make models of geometric solids in terms of the number of faces, edges and vertices; interpret two-dimensional representations (nets) of three-dimensional objects.

(iii) Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

(2) Grades K-4 benchmark 2: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

- Grade K performance standards:
  - (i) Follow simple directions to find a specific location in space.
- (ii) Use spatial vocabulary (e.g., left, right, above, below) to describe relative position.
- (b) Grade 1 performance standards:

(i) Participate in group and individual activities based on the concepts of space and location: describe direction, location, space and shape (e.g., left, right, over, under, near, far, between).

(a)

geometric shapes.

(ii) Visualize, describe and record directions for navigating from one location to another to develop the vocabulary needed to describe direction, distance, location and representation.

(iii) Use materials to create representations of the surrounding environment (e.g., threedimensional models, maps of the classroom).

(iv) Develop estimates and measure distances using nonstandard measurements.

(c) Grade 2 performance standards:

(i) Find and name locations with simple relationships like "near to" and apply ideas

about relative position.

- (ii) Describe, name and interpret direction in navigating space and apply ideas about
- direction and distance.
- (iii) Use maps to locate points and navigate through mazes or maps.
- (iv) Visualize, justify and create paths using landmarks, space, shapes and descriptive

language.

- (v) Make and draw rectangular arrays of squares.
- (d) Grade 3 performance standards:
- (i) Describe location and movement using common language and geometric vocabulary (e.g., directions from classroom to gym).

(ii) Use ordered pairs to graph, locate specific points, create paths and measure distances within a coordinate grid system.

(iii) Use a two-dimensional grid system (e.g., a map) to locate positions representing

actual places.

paper, using mirrors).

(b)

- (e) Grade 4 performance standards:
  - (i) Describe location and movement using common language and geometric vocabulary.
- (ii) Use ordered pairs to graph, locate, identify points and describe paths in the first quadrant of the coordinate plane.
- (iii) Use a variety of methods for measuring distances between locations on a grid.
   (3) Grades K-4 benchmark 3: Apply transformation and use symmetry to analyze mathematical situations.
  - (a) Grade K Performance Standards:

(i) Use manipulatives (e.g., puzzles, tangrams, blocks) to demonstrate rotation (i.e., turns), translations (i.e., slides) and reflection (i.e., flips).

- (ii) Investigate the symmetry of two-dimensional shapes (e.g., by folding or cutting
- Grade 1 performance standards:
- (i) Predict the results of changing a shape's position or orientation by using rotation (i.e.,
- turns), reflection (i.e., flips) and translations (i.e., slides).
  - (ii) Create simple symmetrical shapes and pictures.
- (iii) Recognize and describe the symmetric characteristics of designs (e.g., geometric designs made with pattern blocks).
  - (c) Grade 2 performance standards:
    - (i) Use systematic thinking to solve geometric puzzles (e.g., pentominoes).
    - (ii) Use materials to investigate rotational and line symmetry and create shapes that have

symmetry.

- (d) Grade 3 performance standards:
  - (i) Predict and describe the results of sliding, flipping and turning two-dimensional

shapes.

- (ii) Identify and describe the line of symmetry in two- and three-dimensional shapes.
- (e) Grade 4 performance standards:
  - (i) Create and describe rotational designs using language of transformational symmetry.
  - (ii) Describe a motion or set of motions that will show that two shapes are congruent.

(4) Grades K-4 benchmark 4: Use visualization, spatial reasoning and geometric modeling to solve

problems.

- (a) Grade K performance standards:
  - (i) Describe how to get from one location to another (e.g., how to get to the library).
  - (ii) Find and describe geometric shapes in nature or architecture.
- (b) Grade 1 performance standards:

(i) Use combinations of shapes to make a new shape to demonstrate relationships between shapes (e.g., a hexagon can be made from six triangles).

(ii) Create three-dimensional shapes based on two-dimensional representations.

(iii) Participate in activities to develop mental visualization and spatial memory (e.g., "quick image" activities that require students to recall or reproduce a configuration of dots on a card or to determine the number of dots without counting.

(iv) Describe how to get from one location to another by visualizing the landmarks along

(v) Identify structures from different views or match views of the same structure portrayed from different perspectives.

Grade 2 performance standards:

(i) Demonstrate relationships of different attributes with concrete materials (e.g., change one characteristic of a shape while preserving others such as increasing number of sides while perimeter stays the same).

- (ii) Select and use visualization skills to create mental images of geometric shapes.
- (iii) Describe geometric shapes and structures from different perspectives.

addition).

the route.

(iv) Relate geometric ideas to numbers (e.g., seeing rows in array as a model of repeated

location.

(v) Recognize geometric shapes and structures in the environment and specify their

(d) Grade 3 performance standards:

(i) Visualize, build and draw geometric objects.

(ii) Create and describe mental images of objects, patterns and paths.

(iii) Recognize geometric shapes and structures (e.g., in the environment).

(iv) Use geometric models to solve problems in other areas of mathematics (e.g., using of multiplication or area).

arrays as models of multiplication or area).

(c)

(v) Identify and build three-dimensional objects from two-dimensional representations of that object.

(vi) Investigate two-dimensional representations of three-dimensional shapes.

(vii) Explore geometric ideas and relationships as they apply to other disciplines and to problems that arise in the classroom or in everyday life.

(e) Grade 4 performance standards:

(i) Develop and use mental images of geometric shapes to solve problems (e.g., represent three-dimensional shapes in two dimensions - net).

(ii) Use geometric models such as number lines, arrays and computer simulations to investigate number relationships (e.g., patterns).

(iii) Explore relationships involving perimeter and area: measure area of rectangular shapes and use appropriate units; recognize that area can have the same perimeter but different areas, and vice versa; use models and formulas to solve problems involving perimeter and area of rectangles and squares (e.g., arrays).

D. Strand: Measurement. Content standard 4: Students will understand measurement systems and applications.

(1) Grades K-4 benchmark 1: Understand measurable attributes of objects and the units, systems and process of measurement.

(a) Grade K performance standards:

(i) Describe and compare, using appropriate concepts and vocabulary, the measurable properties of length (e.g., shorter, longer, taller), volume (e.g., full, empty), weight (e.g., heavy, light) and time (e.g., before, after, morning, afternoon, days of week).

(ii) Use tools to make predictions (e.g., using a balance scale, predicting how many cups a container will hold and then filling it to check the prediction).

(iii) Measure using non-standard units of measurement (e.g., use pencils to measure desk top, use different lengths of rope to measure distance in classroom).

(iv) Use digital and analog (face) clocks to tell time to the hour.

(b) Grade 1 performance standards:

(i) Develop an understanding of measurable properties (e.g., length, volume, weight, area and time) using appropriate concepts and vocabulary: length by measuring and estimating (e.g., longer, shorter, meter, centimeter, inch, yard); weight by measuring, estimating, and weighing (e.g., heavy [-ier], light [-er]); volume

by measuring, estimating, and weighing (e.g., full, empty); area by measuring and estimating (e.g., perimeter, rectangles, squares); time by estimating (e.g., minutes, hours, days, weeks).

- (ii) Use digital and analog (face) clocks to tell time to the half hour.
- (c) Grade 2 performance standards:

(ii)

(i) Identify a unit of measure (e.g., nearest inch) and repeat that unit comparing it to the

item being measured.

area.

units.

- (iii) Measure and compare common objects using standard and non-standard units of
- length.
- in) Measure and compare common objects using standard and non-standard units of

Use direct comparison to compare and order objects according to length, mass and

(iv) Find and represent the value of a collection of coins and dollars up to \$5.00, using

appropriate notation.

- (v) Identify and use time intervals (e.g., hours, days, weeks, months).
- (vi) Select and use appropriate measurement tools (e.g., ruler, yardstick, meter stick).
- (vii) Tell time to the nearest quarter hour.
- (d) Grade 3 performance standards:

(i) Demonstrate understanding of the need for measuring with standard units and become familiar with standard units in the U.S. customary system.

(ii) Choose and use the appropriate units and measurement tools to quantify the properties of objects [e.g., length (ruler), width (ruler), or mass (balance scale)].

- (iii) Identify time to the nearest minute (elapsed time) and relate time to everyday events.
- (iv) Identify and use time intervals (e.g., hours, days, weeks, months, years).
- (v) Identify properties (e.g., length, area, weight, volume) and select the appropriate type of unit for measuring each property.

(vi) Demonstrate understanding that measurements are approximations, investigate differences in units and their effect on precision, and consider the degree of accuracy for different situations.

(e) Grade 4 performance standards:

- (i) Select the appropriate type of unit for measuring perimeter and size of an angle.
- (ii) Understand the need for measuring with standard units and become familiar with the

standard units in customary and metric system.

(iii) Identify the inverse relationship between the size of the units and the number of

(iv) Develop formulas to determine the surface areas of rectangular solids.

(v) Develop, understand and use formulas to find the area of rectangles and related triangles and parallelograms.

(vi) Carry out simple conversions within a system of measurement (e.g., hours to minutes, meters to centimeters).

(2) Grades K-4 benchmark 2: Apply appropriate techniques, tools and formulas to determine measurements.

(a) Grade K performance standard: Explore measuring objects using a repeating non-standard unit of measurement (e.g., paper clips, cubes, etc.).

(b) Grade 1 performance standards:

(i) Measure with multiple copies of units the same size (e.g., paper clips).

(ii) Use repetition of a single unit to measure something larger than the unit (e.g., a

yardstick/meterstick to measure a room).

(c) Grade 2 performance standards:

(i) Develop common referents to make comparisons and estimates of length, volume, weight, area and time.

(ii) Develop an understanding that different measuring tools will yield different

numerical measurements of the same object (e.g., ruler, yardstick, meterstick, paper clip).

- (iii) Estimate measurements and develop precision in measuring objects.
- (d) Grade 3 performance standards:
  - (i) Find the area of rectangles using appropriate tools (e.g., grid paper, tiles).
  - (ii) Estimate measurements.

(iii) Use appropriate standard units and tools to estimate, measure and solve problems (e.g., length, area, weight).

angles.

a quarter-turn).

- (iv) Recognize a 90-degree angle and use it as a strategy to estimate the size of other
- (e) Grade 4 performance standards:
  - (i) Estimate perimeters, areas of rectangles, triangles and irregular shapes.
  - (ii) Find the area of rectangles, related triangles and parallelograms.
  - (iii) Estimate, measure and solve problems involving length, area, mass, time and

temperature using appropriate standard units and tools.

- (iv) Identify common measurements of turns (e.g., 360 degrees in one turn, 90 degrees in
- (v) Compute elapsed time and make and interpret schedules.
- (vi) Use tools to measure angles (e.g., protractor, compass).

E. Strand: Data analysis and probability. Content standard 5: Students will understand how to formulate questions, analyze data, and determine probabilities.

(1) Grades K-4 benchmark 1: Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.

(a) Grade K performance standard: Collect data about objects and events in the environment to answer simple questions (e.g., brainstorm questions about self and surroundings, collect data and record the results using objects, pictures and pictographs).

(b) Grade 1 performance standards:

(i) Collect, organize, represent and compare data by category on graphs and charts to answer simple questions: answer questions about "how" data can be gathered.

- (ii) Gather data by interviewing, surveying and making observations.
- (iii) Organize data into appropriate categories by sorting based on shared properties.
- (iv) Participate in discussions about selecting an appropriate way to display the data.
- (v) Represent data using objects, pictures, tables and simple bar graphs.

(c) Grade 2 performance standards:

- (i) Collect numerical data systematically.
- (ii) Represent data by using concrete objects, pictures, tables, numbers, tallies and graphs

(e.g., pictographs).

(iii) Pose questions about students' selves and their surroundings and gather data by interviewing, surveying and making observations to answer the questions posed.

(iv) Identify patterns and explain the relationships of the units in the pattern (e.g., the number of ears on one dog, two dogs, etc., or linear numerical patterns).

(d) Grade 3 performance standards:

- (i) Collect and organize data using observations, measurements, surveys or experiments.
- (ii) Represent data using tables and graphs (e.g., line plots, bar graphs and line graphs).
- (iii) Conduct simple experiments by determining the number of possible outcomes and

make simple predictions: identify whether events are certain, likely, unlikely or impossible; record the outcomes for a simple event and keep track of repetitions; summarize and record the results in a clear and organized way; use the results to predict future events.

(e) Grade 4 Performance Standards:

(i) Organize, represent and interpret numerical and categorical data and clearly

communicate findings: choose and construct representations that are appropriate for the data set; recognize the differences in representing categorical and numerical data.

(ii) Design investigations and represent data using tables and graphs (e.g., line plots, bar graphs, line graphs).

(2) Grades K-4 benchmark 2: Select and use appropriate statistical methods to analyze data.

- (a) Grade K performance standards:
  - (i) Describe simple data.
  - (ii) Pose questions about the data.

(b) Grade 1 performance standards: Analyze simple data: interpret what the graph or other representation shows; determine whether or not the data gathered helps answer the specific question that was posed; compare parts of the data (e.g., "How many students have lost none, one, two, or three teeth?") to make statements about the data as a whole (e.g., "Most students in the class have lost only two teeth.").

(c) Grade 2 performance standards:

the data collected.

- Describe and interpret data by drawing conclusions and making conjectures based on (i)
- (ii) Display data in a variety of formats.

(d) Grade 3 performance standard: Apply and explain the uses of sampling techniques (e.g., observations, polls, tally marks) for gathering data.

> Grade 4 performance standards: (e)

> > (i) Compare and describe related data sets.

(ii) Use the concepts of median, mode, maximum, minimum and range and draw conclusions about a data set.

Use data analysis to make reasonable inferences and predictions and to develop (iii) convincing arguments from data described in a variety of formats (e.g. bar graphs, Venn diagrams, charts, tables,

line graphs and pictographs).

Grades K-4 benchmark 3: Develop and evaluate inferences and predictions that are based on (3)

data.

(a) Grade K performance standard: Make simple predictions.

(b) Grade 1 performance standard: Make conclusions based on data (e.g., whether or not other groups would reach similar conclusions based on the same data).

- (c) Grade 2 performance standards:
  - (i) Discuss events related to students' experiences as "likely" or "unlikely" and "possible"

or "certain".

- Recognize appropriate conclusions generated from the data collected. (ii)
- Recognize inappropriate descriptions of the data set. (iii)

Grade 3 performance standards: Analyze data displayed in a variety of formats to make (d) reasonable inferences and predictions, answer questions and make decisions.

- Grade 4 performance standards: (e)
  - (i) Propose and justify conclusions and predictions based on data.
  - (ii) Develop convincing arguments from data displayed in a variety of formats.
- Grades K-4 benchmark 4: Understand and apply basic concepts of probability. (4)
- Grade K performance standard: Answer questions that relate to the possibility of familiar (a) events happening or not.
  - Grade 1 performance standards: (b)

Discuss the likelihood of events (based on student experiences or from books) using (i) terminology such as "more likely", "less likely", "possible", or "certain".

(ii) Observe, explore and discuss whether some events occur more often than others (e.g., tossing two die and recording the sum after each toss to explore whether or not certain sums occur more frequently than others).

- Grade 2 performance standards: (c)
  - Investigate concepts of chance (e.g., outcomes of a simple experiment). (i)
  - (ii) Investigate whether outcomes of a simple event are equally likely to occur.
- (d) Grade 3 performance standards:
  - Discuss the degree of likelihood of events and use terminology such as "certain," (i)

"likely," "unlikely".

(ii) Predict the outcomes of simple experiments (e.g., coin tossing) and test the predictions using concrete objects (e.g., coins, counters, number cubes, spinners).

Record the probability of a specific outcome for a simple probability situation (e.g., (iii) probability is three out of seven for choosing a black ball: 3/7).

Grade 4 performance standards:

Describe events as "likely," "unlikely" or "impossible" and quantify simple (i) probability situations: represent all possible outcomes for a simple probability situation in an organized way (e.g., tables, grids, tree diagrams); and express outcomes of experimental probability situations verbally and numerically (e.g., three out of four: 3/4).

(ii) List all the possible combinations of objects from three sets (e.g., spinners, number of outfits from three different shirts, two skirts and two hats).

[6.29.7.8 NMAC - Rp, 6.30.2.14 NMAC, 6-30-2009]

(e)

# 6.29.7.9 CONTENT STANDARDS WITH BENCHMARKS AND PERFORMANCE STANDARDS FOR MATHEMATICS, Grades 5-8:

A. Strand: Number and operations. Content standard 1: Students will understand numerical concepts and mathematical operations.

(1) Grades 5-8 benchmark 1: Understand numbers, ways of representing numbers, relationships among numbers and number systems.

(a) Grade 5 performance standards:

(i) Compare and order using concrete or illustrated models: whole numbers (to millions), common fractions (halves, thirds, fourths, eighths), decimals (thousandths).

- (ii) Demonstrate understanding of the magnitude of the value of numbers from thousandths to millions, including common fractions.
  - (iii) Represent place value using concrete or illustrated models up to one billion

(1,000,000,000).

(iv) Interpret percents as part of a hundred (i.e., find decimal and percent equivalents for common fractions, explain how they represent the same value, and compute a given percent of a whole number).

- (v) Identify and represent on a number line decimals, fractions and mixed numbers.
- (vi) Identify prime and composite numbers to 50.
- (b) Grade 6 performance standards:
  - (i) Compare and order rational numbers.

(ii) Use equivalent representations for rational numbers (e.g., integers, decimals,

fractions, percents, ratios, numbers with whole-number exponents).

(iii) Use appropriate representations of positive rational numbers in the context of real-

life applications.

(iv) Identify greatest common factor and least common multiples for a set of whole

numbers.

- (v) Identify and represent on a number line decimals, fractions, mixed numbers and
- positive and negative integers.
  - (c) Grade 7 performance standards:
    - (i) Determine the absolute value of rational numbers.

(ii) Illustrate the relationships among natural (i.e., counting) numbers, whole numbers, integers, rational and irrational numbers.

(iii) Use properties of the real-number system to explain reasoning and to formulate and solve real-world problems.

(iv) Read, write and compare rational numbers in scientific notation (e.g., positive and negative powers of 10) with approximate numbers using scientific notation.

- (v) Simplify numerical expressions using order of operations.
- (d) Grade 8 performance standards:
  - (i) Classify numbers by their properties (e.g., prime, composite or perfect square).
  - (ii) Demonstrate the magnitude of rational numbers (e.g., trillions to millions).

(2) Grades 5-8 benchmark 2: Understand the meaning of operations and how they relate to one

another.

(a) Grade 5 performance standards:

(i) Explain and perform whole number division and express remainders as a whole number or a fractional part as appropriate to the context of real-life problems.

- (ii) Add and subtract decimals.
- (iii) Add and subtract fractions and mixed numbers without regrouping and express

answers in simplest form.

- (iv) Find the factors and multiples of whole numbers.
- (v) Use arithmetic operations and inverse relationships to represent and solve real-world

problems.

- (vi) Identify and represent on a number line decimals, fractions and mixed numbers.
- (vii) Demonstrate proficiency with division, including one- and two-digit divisors.
- (viii) Solve simple problems involving the addition and subtraction of fractions and

mixed numbers.

- (ix) Represent and use fractions and decimals in equivalent forms.
- (b) Grade 6 performance standards:

(i) Calculate multiplication and division problems using contextual situations.

(ii) Factor a whole number into a product of its primes.

(iii) Demonstrate the relationship and equivalency among ratios and percents.

(iv) Use proportions to solve problems.

(v) Explain and perform: whole number division and express remainders as decimals or appropriately in the context of the problem; addition, subtraction, multiplication and division with decimals; addition and subtraction with integers; addition, subtraction and multiplication with fractions and mixed numerals.

(vi) Determine the least common multiple and the greatest common divisor of whole numbers and use them to solve problems with fractions.

(c) Grade 7 performance standards:

(i) Add, subtract, multiply and divide rational numbers (e.g., integers, fractions,

terminating decimals) and take positive rational numbers to whole-number powers.

(ii) Convert terminating decimals into reduced fractions.

(iii) Calculate given percentages of quantities and use them to solve problems (e.g., discounts of sales, interest earned, tips, markups, commission, profit, simple interest).

(iv) Add and subtract fractions with unlike denominators.

(v) Multiply, divide and simplify rational numbers by using exponent rules.

(vi) Understand the meaning of the absolute value of a number: interpret the absolute value as the distance of the number from zero on a number line; determine the absolute value of real numbers.

(vii) Find square roots of perfect whole-number squares.

(viii) Simplify and evaluate positive rational numbers raised to positive whole number

powers.

(ix) Solve addition, subtraction, multiplication and division problems that use positive and negative integers and combinations of these operations.

(d) Grade 8 performance standards:

(i) Use real number properties (e.g., commutative, associative, distributive) to perform various computational procedures.

(ii) Perform arithmetic operations and their inverses (e.g., addition/subtraction,

multiplication/division, square roots of perfect squares, cube roots of perfect cubes) on real numbers.

(iii) Find roots of real numbers using calculators.

- (3) Grades 5-8 benchmark 3: Compute fluently and make reasonable estimates.
  - (a) Grade 5 performance standards:
    - (i) Add, subtract, multiply and divide whole numbers.
    - (ii) Add and subtract decimals.
    - (iii) Use estimation strategies to verify the reasonableness of calculated results.
    - (iv) Explain how the estimation strategy impacts the result.
    - (v) Relate the basic arithmetic operations to one another (e.g., multiplication and division

are inverse operations).

(vi) Simplify numerical expressions using order of operations.

(vii) Recognize and explain the differences between exact and approximate values.

(b) Grade 6 performance standards:

(i) Estimate quantities involving rational numbers using various estimations.

(ii) Use estimates to check reasonableness of results and make predictions in situations

involving rational numbers.

(iii) Determine if a problem situation calls for an exact or approximate answer and perform the appropriate computation.

(iv) Compare and order positive and negative fractions, decimals and mixed numbers, and place them on a number line.

(v) Convert fractions to decimals and percents and use these representations in estimations, computations and applications.

(vi) Interpret and use ratios in different contexts.

(vii) Compute and perform multiplication and division of fractions and decimals, and apply these procedures to solving problems.

(c) Grade 7 performance standards:

(i) Use estimation to check reasonableness of results, and use this information to make predictions in situations involving rational numbers, pi and simple algebraic equations.

	(ii) Convert fractions to decimals and percents and use these representations in			
estimations, computation	ons and applications.			
nagative newsons of 10)	(iii) Read, write and compare rational numbers in scientific notation (e.g., positive and with approximate numbers using acientific notation in approximate contaction is approximate activities.			
negative powers of 10)	(iv) Colculate the percentage of increases and decreases of a quentity			
	(iv) Calculate the percentage of increases and decreases of a quantity.			
	(v) Add and subtract fractions with diffice denominators.			
parfact square integer	(vi) Use the inverse relationship between fishing to a power and extracting the root of a			
(d)	Crada & parformance standards:			
(u)	(i) Formulate algebraic expressions that include real numbers to describe and solve real			
world problems	(1) Formulate argebraic expressions that include real numbers to describe and solve real-			
world problems.	(ii) Use a variety of computational methods to estimate quantities involving real			
numbers	(ii) Use a variety of computational methods to estimate qualitates involving real			
numbers.	(iii) Differentiate between rational and irrational numbers			
	(iv) Use real number properties to perform various computational procedures and explain			
how they were used	(iv) Use real number properties to perform various computational procedures and explain			
now they were used.	(v) Perform and explain computations with rational numbers ni and first-degree			
algebraic expressions in	(v) reform and explain computations with rational numbers, pr and mist degree			
uigeoraie expressions n	(vi) Select and use appropriate forms of rational numbers to solve real-world problems			
including those involvi	ng proportional relationships			
including those in orth	(vii) Approximate (mentally and with calculators) the value of irrational numbers as they			
arise from problem situ	ations.			
F	(viii) Express numbers in scientific notation (including negative exponents and			
significant figures) in a	ppropriate problem situations involving multiplication and division using a calculator.			
	(ix) Estimate answers and use formulas to solve application problems involving surface			
area and volume.				
B. Stran	d: Algebra. Content standard 2: Students will understand algebraic concepts and			
applications.				
(1) Grad	es 5-8 benchmark 1: Understand patterns, relations, and functions.			
(a)	Grade 5 performance standards:			
	(i) Identify and graph ordered pairs in the first quadrant of the coordinate plane.			
	(ii) Describe, represent and analyze patterns and relationships.			
	(iii) Identify, describe and continue patterns presented in a variety of formats (e.g.,			
numeric, visual, oral, written, kinesthetic, pictorial).				
	(iv) Generate a pattern using a written description.			
(b)	Grade 6 performance standards:			
	(i) Solve problems involving proportional relationships.			
	(ii) Graph ordered pairs in the coordinate plane.			
	(iii) Explain and use symbols to represent unknown quantities and variable relationships.			
	(iv) Explain and use the relationships among ratios, proportions, and percents.			
	(v) Make generalizations based on observed patterns and relationships.			
(c)	Grade 7 performance standards:			
	(i) Identify and continue patterns presented in a variety of formats.			
	(ii) Represent a variety of relationships using tables, graphs, verbal rules and possible			
symbolic notation, and	recognize the same general pattern presented in different representations.			
	(iii) Simplify numerical expressions by applying properties of rational numbers, and			
justify the process used				
	(iv) Interpret and evaluate expressions involving integer powers and simple roots.			
	(v) Graph and interpret linear functions.			
	(vi) Solve problems involving rate, average speed, distance and time.			

- (d) Grade 8 performance standards:
  - (i) Move between numerical, tabular and graphical representations of linear

relationships.

(ii) Use variables to generalize patterns and information presented in tables, charts and graphs: graph linear functions noting that the vertical change per unit of horizontal change (the slope of the graph) is

always the same; plot the values of quantities whose ratios are always the same, fit a line to the plot, and understand that the slope of the line equals the quantities.

(2) Grades 5-8 benchmark 2: Represent and analyze mathematical situations and structures using algebraic symbols.

- (a) Grade 5 performance standards:
  - (i) Compute the value of the expression for specific numerical values of the variable.
  - (ii) Use a letter to represent an unknown number.

(iii) Understand the differences between the symbols for "less than," "less than or equal to," "greater than," and "greater than or equal to."

(b) Grade 6 performance stan

- Grade 6 performance standards:
  - (i) Solve problems involving proportional relationships.
  - (ii) Use letters to represent an unknown in an equation.
  - (iii) Solve one-step linear equations and inequalities in one variable with positive whole-

number solutions.

- (iv) Demonstrate that a variable can represent a single quantity that changes.
- (v) Demonstrate how changes in one variable affect other variables.
- (c) Grade 7 performance standards:

(i) Write verbal expressions and sentences as algebraic expressions and equations: evaluate algebraic expressions; solve simple linear equations; graph and interpret results.

(ii) Use variables and appropriate operations to write an expression, an equation, or an inequality that represents a verbal description.

- (iii) Use the order of operations to evaluate algebraic expressions.
- (iv) Simplify numerical expressions by applying properties of rational numbers.
- (v) Graph linear functions and identify slope as positive or negative.

(vi) Use letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes.

(d) Grade 8 performance standards:

- (i) Demonstrate the difference between an equation and an expression.
- (ii) Solve two-step linear equations and inequalities in one variable with rational

solutions.

- (iii) Evaluate formulas using substitution.
- (iv) Demonstrate understanding of the relationships between ratios, proportions and percents and solve for a missing term in a proportion.
  - (v) Graph solution sets of linear equations in two variables on the coordinate plane.

(vi) Formulate and solve problems involving simple linear relationships, find percents of a given number, variable situations and unknown quantities.

(vii) Use symbols, variables, expressions, inequalities, equations, and simple systems of equations to represent problem situations that involve variables or unknown quantities.

(3) Grades 5-8 benchmark 3: Use mathematical models to represent and understand quantitative relationships.

- (a) Grade 5 performance standards:
  - (i) Use mathematical models to represent and explain mathematical concepts and

procedures.

(ii) Understand and use mathematical models such as: the number line to model the relationship between rational numbers and rational number operations; pictorial representation of addition and subtraction of rational numbers with regrouping; manipulatives or pictures to model computational procedures; graphs, tables and charts to describe data; diagrams or pictures to model problem situations.

(iii) Demonstrate how a situation can be represented in more than one way.

(b) Grade 6 performance standards:

(i) Develop and use mathematical models to represent and justify mathematical relationships found in a variety of situations.

(ii) Create, explain and use mathematical models, such as: Venn diagrams to show the relationships between the characteristics of two or more sets; equations and inequalities to model numerical relationships; three-dimensional geometric models; graphs, tables and charts to interpret and analyze data.

- (c) Grade 7 performance standards:
  - (i) Create scale models and use them for dimensional drawings.

- Understand and use the coordinate plane to graph ordered pairs and linear equations. (ii)
- (iii) Select and use an appropriate model for a particular situation.

(d) Grade 8 performance standard: Generate different representations to model a specific numerical relationship given one representation of data (e.g., a table, a graph, an equation, a verbal description). Grades 5-8 benchmark 4: Analyze changes in various contexts. (4)

> Grade 5 performance standards: (a)

> > Recognize and create patterns of change from everyday life using numerical or (i)

pictorial representations. Generalize patterns of change and recognize the same general patterns presented in (ii) different representations.

Grade 6 performance standards:

- Represent and explain changes using one-step equations with one variable. (i)
- Solve problems that involve change using proportional relationships. (ii)
- Use ratios to predict changes in proportional situations. (iii)

Use tables and symbols to represent and describe proportional and other (iv) relationships involving conversions, sequences and perimeter.

(v) Generate formulas to represent relationships involving changes in perimeter.

(c) Grade 7 performance standards:

(i) Use variables and appropriate operations to write an expression, an equation and an inequality that represents a verbal description involving change.

Interpret and evaluate expressions involving integer powers and simple roots as they (ii) relate to change.

(b)

(iii) Graph and interpret linear functions as they are used to solve problems.

Solve two-step equations and inequalities with one variable over the rational (iv) numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.

> (d) Grade 8 performance standards:

Use graphs, tables and algebraic representations to make predictions and solve (i) problems that involve change.

(ii) Estimate, find and justify solutions to problems that involve change using tables, graphs and algebraic expressions.

Use appropriate problem-solving strategies (e.g., drawing a picture, looking for a (iii) pattern, systematic guessing and checking, acting it out, making a table or graph, working a simpler problem, writing an algebraic expression or working backward) to solve problems that involve change.

> Solve multi-step problems that involve changes in rate, average speed, distance and (iv)

time.

Analyze problems that involve change by identifying relationships, distinguishing (v) relevant from irrelevant information, identifying missing information, sequencing, and observing patterns.

(vi) Generalize a pattern of change using algebra and show the relationship among the equation, graph and table of values.

(vii) Recognize the same general pattern of change presented in different representations.

C. Strand: Geometry. Content standard 3: Students will understand geometric concepts and applications.

Grades 5-8 benchmark 1: Analyze characteristics and properties of two- and three-dimensional (1)geometric shapes and develop mathematics arguments about geometric relationships.

Grade 5 performance standards: (a)

(i) Identify, describe, and classify two-dimensional shapes and three-dimensional figures

by their properties. Recognize and describe properties of regular polygons having up to ten sides. (ii)

- Identify faces, edges and bases on three-dimensional objects. (iii)
- Grade 6 performance standards: (b)

(i) Identify, describe and classify the properties of, and the relationships between, plane and solid geometric figures: measure, identify, and draw angles, perpendicular and parallel lines, rectangles and triangles by using appropriate tools (e.g., straightedge, ruler, compass, protractor, drawing software); understand that the sum of angles of any triangle is 180 degrees and the sum of the angles of any quadrilateral is 360 degrees and

use this information to solve problems; visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids.

(ii) Classify angles as right, acute, obtuse or straight.

(iii) Describe the properties of geometric figures that include regular polygons, circles, ellipses, cylinders, cones, spheres and cubes.

- (iv) Classify polygons as regular or irregular.
- and obtuse).
- (vi) Identify angle, line, segment and ray and use the symbols for each.
- (vi) Identify angle, fine, segment and ray and use the symbols for each.(vii) Describe the relationship between radius, diameter and circumference of a circle.

Classify triangles as scalene, isosceles or equilateral and by angles (i.e., right, acute

- (c) Grade 7 performance standards:
  - (i) Classify geometric figures as similar or congruent.
  - (ii) Understand the concept of a constant (e.g., pi) and use the formulas for the

circumference and area of a circle.

(v)

- (iii) Explain and use the Pythagorean theorem.
- (iv) Determine the radius, diameter and circumference of a circle and explain their

relationship.

- (v) Use properties to classify solids including pyramids, cones, prisms and cylinders.
- (d) Grade 8 performance standards:
  - (i) Recognize, classify and discuss properties of all geometric figures including point,

line and plane.

- (ii) Identify arc, chord and semicircle and explain their attributes.
- (iii) Use the Pythagorean theorem and its converse to find the missing side of a right
- triangle and the lengths of the other line segments.

(2) Grades 5-8 benchmark 2: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

- (a) Grade 5 performance standard: Recognize perpendicular and parallel lines.
- (b) Grade 6 performance standards:
  - (i) Use coordinate geometry to describe location on a plane.
  - (ii) Recognize skewed lines in space.

(c) Grade 7 performance standard: Construct and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine the image under translations and reflections.

- (d) Grade 8 performance standard: Represent, formulate, and solve distance and geometry problems using the language and symbols of algebra and the coordinate plane and space (e.g., ordered triplets).
- (3) Grades 5-8 benchmark 3: Apply transformations and use symmetry to analyze mathematical situations.
  - (a) Grade 5 performance standard: Identify line of symmetry in simple geometric figures.
  - (b) Grade 6 performance standard: Identify line of symmetry with rotation and scaling.
  - (c) Grade 7 performance standard: Determine how perimeter and area are affected by changes

of scale.

- (d) Grade 8 performance standards:
  - (i) Describe the symmetry of three-dimensional figures.
  - (ii) Describe and perform single and multiple transformations that include rotation,

reflection, translation and dilation (i.e., shrink or magnify) to two-dimensional figures.

- (4) Grades 5-8 benchmark 4: Use visualization, spatial reasoning and geometric modeling to solve problems.
  - (a) Grade 5 performance standards:
    - (i) Understand and compute the perimeter of regular polygons.
    - (ii) Identify and explain circumference, radius and diameter.

(b) Grade 6 performance standard: Use appropriate technology, manipulatives, constructions or drawings to recognize or compare geometric figures.

(c) Grade 7 performance standards:

(i) Compute the perimeter and area of common geometric shapes and use the results to find measures of less common objects.

(ii) Identify and describe the properties of two-dimensional figures: identify angles as vertical, adjacent, complementary or supplementary and provide descriptions of these terms; use the properties of

complementary and supplementary angles and the sum of the angles of a triangle to solve problems involving an unknown angle; draw quadrilaterals and triangles from given information.

(d) Grade 8 performance standards:

(i) Understand angle relationships formed by parallel lines cut by a transversal.

(ii) Recognize and apply properties of corresponding parts of similar and congruent triangles and quadrilaterals.

(iii) Represent and solve problems relating to size, shape, area and volume using

(iv) Develop and use formulas for area, perimeter, circumference and volume.

(v) Construct two-dimensional representations (nets) for three-dimensional models (e.g.,

cylinders, prisms, cones).

geometric models.

D. Strand: Measurement. Content standard 4: Students will understand measurement systems and applications.

(1) Grades 5-8 benchmark 1: Understand measurable attributes of objects and the units, systems, and processes of measurement.

(a) Grade 5 performance standards:

(i) Understand properties (e.g., length, area, weight, volume) and select the appropriate type of unit for measuring each using both U.S. customary and metric systems.

(ii) Select and use appropriate units and tools to measure according to the degree of accuracy required in a particular problem-solving situation.

(iii) Solve problems involving linear measurement, weight and capacity (e.g., measuring to the nearest sixteenth of an inch or nearest millimeter; using ounces, milliliters or pounds and kilograms) to the appropriate degree of accuracy.

(iv) Perform one-step conversions within a system of measurement (e.g., inches to feet, centimeters to meters).

(b) Grade 6 performance standards:

(i) Perform multi-step conversions of measurement units to equivalent units within a given system (e.g., 36 inches equals 3 feet or 1 yard).

(ii) Estimate measurement in both U.S. customary and metric units.

(iii) Select and use units of appropriate size and type to measure angles; e.g., degrees, radians; perimeter; area and capacity in both U.S. customary and metric systems.

(iv) Use standard units of linear measurement to the nearest sixteenth of an inch; metric measurements to the nearest millimeter.

(c) Grade 7 performance standards:

(i) Choose appropriate units of measure and ratios to recognize new equivalences (e.g., 1 square yard equals 9 square feet) to solve problems.

(ii) Select and use the appropriate size and type of unit for a given measurement situation.

(iii) Compare masses, weights, capacities, geometric measures, times and temperatures within measurement systems.

(iv) Approximate the relationship between standard and metric measurement systems (e.g., inches and centimeters, pounds and kilograms, quarts and liters).

(v) Use measures expressed as rates and measures expressed as products to solve problems, check the units of the solutions, and analyze the reasonableness of the answer.

(d) Grade 8 performance standards:

(i) Understand the concept of volume and use the appropriate units in common

measuring systems (e.g., cubic centimeter, cubic inch, cubic yard) to compute the volume of rectangular solids. (ii) Use changes in measurement units (e.g., square inches, cubic feet) to perform

conversions from one-, two-, and three-dimensional shapes.

(2) Grades 5-8 benchmark 2: Apply appropriate techniques, tools, and formulas to determine measurements.

(a) Grade 5 performance standards:

(i) Solve measurement problems using appropriate tools involving length, perimeter, weight, capacity, time and temperature.

(ii) Select and use strategies to estimate measurements including length, distance, capacity and time.

#### (i)

Grade 6 performance standards:

(iii)

(b)

Apply various measurement techniques and tools, units of measure, and degrees of accuracy to find accurate rational number representations for length, liquid, weight, perimeter, temperature and time.

- Select and use formulas for perimeters of squares and rectangles. (ii)
- Select and use strategies to estimate measurements including angle measure and (iii)

Apply strategies and use tools for estimating and measuring the perimeter of regular

capacity.

Select and justify the selection of measurement tools, units of measure and degrees (iv) of accuracy appropriate to the given situation.

Grade 7 performance standards: (c)

> Apply strategies and formulas to find missing angle measurements in triangles and (i)

quadrilaterals.

and irregular shapes.

(ii) Select and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids and circles.

> (iii) Solve problems involving scale factors, ratios and proportions.

- (d) Grade 8 performance standards:
  - (i) Use ratios and proportions to measure hard-to-measure objects.
  - (ii) Use estimation to solve problems.
  - Use proportional relationships in similar shapes to find missing measurements. (iii)
  - Apply strategies to determine the surface area and volume of prisms, pyramids and (iv)

cylinders.

Perform conversions with multiple terms between metric and U.S. standard (v)

measurement systems.

(vi) Estimate volume in cubic units.

(vii) Solve simple problems involving rates and derived measurements for such

properties as velocity and density.

Strand: Data analysis and probability. Content standard 5: Students will understand how E. formulate questions, analyze data, and determine probabilities.

Grades 5-8 benchmark 1: Formulate questions that can be addressed with data and collect, (1)organize, and display relevant data to answer them.

- Grade 5 performance standards: (a)
  - (i) Construct, read, analyze and interpret tables, charts, graphs and data plots.

(ii) Construct, interpret and analyze data from graphical representations and draw simple conclusions using bar graphs, line graphs, circle graphs, frequency tables and Venn diagrams.

Display, analyze, compare and interpret different data sets, including data sets of (iii)

different sizes.

Organize and display single-variable data in appropriate graphs and representations. (iv)

Organize, read and display numerical (quantitative) and non-numerical (qualitative) (v)

data in a clear, organized and accurate manner including correct titles, labels and intervals or categories including: frequency tables; stem and leaf plots; bar, line and circle graphs; Venn diagrams; pictorial displays; charts and tables.

Formulate questions and identify data to be collected to correctly answer a question. (vi) Grade 6 performance standards: (b)

- Use statistical representations to analyze data. (i)
- Draw and compare different graphical representations of the same data. (ii)
- Use mean, median, mode and range to describe data. (iii)
- (iv) Sketch circle graphs to display data.

Solve problems by collecting, organizing, displaying and interpreting data. (v)

Compare different samples of a population with the entire population and determine (vi) the appropriateness of using a sample.

(vii) Conduct and explain sampling techniques such as observations, surveys and random sampling for gathering data.

Determine the median for a rational number data set containing an odd number of (viii) data points.

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	(ix)	Calculate and explain the median for a whole number data set containing an even
number of data points	3.	
	(x)	Explain advantages and disadvantages of using various display formats for a specific
data set.	<i>(</i> .)	
data	(X1)	Formulate and solve problems by collecting, organizing, displaying and interpreting
data.	Grade	a 7 parformance standards:
(C)	(i)	Describe how data representations influence interpretation
	(i) (ii)	Select and use appropriate representation for presenting collected data and justify the
selection.	(11)	server and use appropriate representation for presenting concered and and justify and
	(iii)	Use measures of central tendency and spread to describe a set of data.
	(iv)	Choose between median and mode to describe a set of data and justify the choice for
a particular situation.		
	(v)	Determine the quartiles of a data set.
	(vi)	Identify ordered pairs of data from a graph and interpret the data in terms of the
situation depicted by	the graph	1.
	(vii)	Use various scales and formats to display the same data set.
	(viii)	Identify and explain the misleading representations of data.
	(ix)	Collect, organize and represent data sets that have one or more variables and identify
relationships among v	ariables	within a data set.
_	(x)	Compute the minimum, lower quartile, median, upper quartile and maximum of a
data set.		
	(X1)	Identify and explain the effects of scale and interval changes on graphs of whole
number data sets.	( ···)	
and the state of the set	(X11)	Use and explain sampling techniques (e.g., observations, surveys and random
sampling) for gatherin		Analyza mahlama huidantifying relationshing distinguishing relayant from
implement information	(XIII) idontifi	Analyze problems by identifying relationships, distinguishing relevant from
address the problem	i, identii	ying missing mormation, and selecting, concerning and displaying appropriate data to
(d)	Grade	e 8 performance standards.
(u)	(i)	Represent two numerical variables on a plot describe how the data points are
distributed and identi	ifv relatio	onships that exist between the two variables
distributed, and identi	(ii)	Generate organize and interpret real numbers in a variety of situations
	(iii)	Organize, analyze and display appropriate quantitative and qualitative data to
address specific quest	tions incl	luding: frequency distributions: plots: histograms: bar, line and pie graphs: diagram
and pictorial displays	; charts a	and tables.
	(iv)	Select the appropriate measure of central tendency to describe a set of data for a
particular problem sit	uation.	
	(v)	Simulate an event selecting and using different models.
	(vi)	Develop an appropriate strategy using a variety of data from surveys, samplings,
estimations and inferen	ences to a	address a specific problem.
(2) Gra	ades 5-8	benchmark 1: Select and use appropriate statistical methods to analyze data.
(a)	Grade	e 5 performance standards:
	(i)	Organize and display single-variable data in appropriate graphs and representations
and determine which	types of	graphs are appropriate for various data sets.
	(ii)	Use fractions and percentages to compare data sets of different sizes.
	(111)	Correctly rank the values of a numerical data set containing simple fractions and
decimals, identify ma	ximum a	and minimum data values, and calculate the range for a data set.
(b)	Grade	e o performance standards:
	(1)	Choose an appropriate graphical format to organize and represent data.
	(11)	Describe the effects of missing or incorrect data.
additional data added	(111) to data =	Compute and analyze statistical measurements for data sets: understand now
auditional data added	io uala s	icis may anect the computations of central tendency; understand now the inclusion of
provides the most use	ful infor	mation in a given context
provides the most use	au moi	

	(iv) Use data samples of a population and describe the characteristics and limitations of
the sample.	
4 · · · · · · · · · · · · · · · · · · ·	(v) Identify different ways of selecting a sample (e.g., convenience sampling, responses
to a survey, random sam	(iii) Explain how the way a question is asked in a survey might influence the results
obtained	(vi) Explain now the way a question is asked in a survey hight influence the results
obtained.	(vii) Identify data that represent sampling errors and explain why the sample and the
display might be biased.	(vii) Identify data that represent sampling errors and explain with the sample and the
uisping inight of olused.	(viii) Identify claims based on statistical data and, in sample cases, evaluate the validity
and usefulness of the cla	ims.
(c)	Grade 7 performance standards:
	(i) Choose and justify appropriate measures of central tendencies (e.g., mean, median,
mode, range) to describe	given or derived data.
	(ii) Know various ways to display data sets (e.g., stem and leaf plot, box and whisker
plot, scatter plots) and u	se these forms to display a single set of data or to compare two sets of data.
	(iii) Use the analysis of data to make convincing arguments.
	(iv) Use appropriate technology to gather and display data sets and identify the
relationships that exist a	mong variables within the data set.
	(v) Use data samples of a population and describe the characteristics and limitations of
the sample.	
	(vi) Identify data that represent sampling errors and explain why the sample and the
display might be biased.	
	(vii) Identify claims based on statistical data and evaluate the validity of the claims.
(d)	Grade 8 performance standards:
	(i) Use changes in scales, intervals or categories to help support a particular
interpretation of data.	
	(ii) Generate, organize and interpret real number and other data in a variety of situations.
	(iii) Analyze data to make decisions and to develop convincing arguments from data
displayed in a variety of	formats that include: plots, distributions, graphs, scatter plots, diagrams, pictorial displays,
charts and tables, Venn	liagrams.
	(iv) Interpret and analyze data from graphical representations and draw simple
conclusions (e.g., line of	best fit).
	(v) Evaluate and defend the reasonableness of conclusions drawn from data analysis.
	(vi) Use appropriate central tendency and spread as a means for effective decision-
making in analyzing dat	a and outliers.
	(vii) Identify simple graphic misrepresentations and distortions of sets of data (e.g.,
unequal interval sizes, o	mission of parts of axis range, scaling).
	(viii) Use appropriate technology to display data as lists, tables, matrices, graphs and
plots and to analyze the	relationships of variables in the data displayed.
(3) Grade	s 5-8 benchmark 3: Develop and evaluate inferences and predictions that are based on data.
(a)	Grade 5 performance standards:
	(i) Make and justify valid inferences, predictions and arguments based on statistical
analysis.	
	(ii) Compare a given prediction with the results of an investigation.
a	(iii) Use counting strategies to determine all the possible outcomes of a particular
familiar event.	
	(iv) Find all possible outcome sets involving four or more sets of objects.
	(v) Evaluate the reasonableness of inferences that are based on data in the context of the
original solution.	
	(v1) Identify the method used to make an inference or a prediction on a given data set and
solve similar problems.	
	(vii) Determine the accuracy of a prediction or an inference based on the accuracy of the
data in a given data set.	
	(viii) List all possible outcomes of simple events.
(b)	Grade 6 performance standards:
	(1) Identify claims based on statistical data and evaluate the validity of the claim.

(ii) Conduct observations, surveys, experiments and simulations, record the results in charts, tables or graphs, and use the results to draw conclusions and make predictions.

(iii) Find all possible combinations in a given set (e.g., the number of ways a set of books can be arranged on a shelf).

(iv) Compare expected results with actual results in a simple experiment.

(c) Grade 7 performance standards:

(i) Formulate and justify mathematical conjectures based on data and a general description of the mathematical question or problem posed.

(ii) Analyze data to make accurate inferences, predictions and to develop convincing arguments from data displayed in a variety of forms.

(iii) Approximate a line of best fit for a data set in a scatter plot form and make predictions using the simple equation of that line.

(d) Grade 8 performance standards:

(i) Describe how changes in scale, intervals or categories influence arguments for a particular interpretation of the data.

(ii) Describe how reader bias, measurement errors and display distortion can affect the interpretation of data, predictions and inferences based on data.

(iii) Conduct simple experiments and simulations, record results in charts, tables or graphs, and use the results to draw conclusions and make predictions.

(iv) Compare expected results with experimental results and information used in predictions and inferences.

(4) Grades 5-8 benchmark 4: Understand and apply basic concepts of probability.

(a) Grade 5 performance standards:

(i) Determine probabilities through experiments and/or simulations and compare the results with mathematical expressions.

(ii) Make predictions from the results of student-generated experiments of single events.

(iii) Identify simple experiments where the probabilities of all outcomes are equal.

(iv) Describe and predict the results of a probability experiment.

(v) Use fractions to describe the results of an experiment.

(vi) Use probability to generalize from a simple pattern or set of examples and justify why the generalization is reasonable.

(b) Grade 6 performance standards:

(i) List all possible outcomes for a compound event composed of two independent events and recognize whether an outcome is certain, impossible, likely or unlikely.

(ii) Determine and compare experimental (empirical) and mathematical (theoretical) probabilities (e.g., flipping two color counters).

(iii) Determine theoretical and experimental probabilities and use them to make predictions about events.

(iv) Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, tree diagrams) and express the theoretical probability of each outcome.

(v) Use data to estimate the probability of future events (e.g., batting averages).

(vi) Represent probabilities as ratios, proportions, decimals between 0 and 1, and

percentages between 0 and 100 and verify that the probabilities computed are reasonable; know that if P is the probability of an event, 1- P is the probability of the event not occurring.

(vii) Describe the difference between independent and dependent events, and identify situations involving independent or dependent events.

(c) Grade 7 performance standards:

(i) Determine the probability of a compound event composed of two independent events.

(ii) Identify examples of events having the probability of one or zero.

(iii) Describe the probability of events using fractions, decimals and percents.

(iv) Express probability as a fraction, zero, or one.

(v) Use probability to generate convincing arguments, draw conclusions and make decisions in a variety of situations.

(vi) Make predictions based on theoretical probabilities of compound events.

(vii) Determine the probability of a simple event or a compound event composed of simple, independent events.

(d) Grade 8 performance standards:

(i) Calculate the odds of a desired outcome in a simple experiment.

(ii) Design and use an appropriate simulation to estimate the probability of a real-world event (e.g., disk toss, cube toss).

(iii) Explain the relationship between probability and odds and calculate the odds of a desired outcome in a simple experiment.

(iv) Use theoretical or experimental probability to make predictions about real-world events.

(v) Use probability to generate convincing arguments, draw conclusions and make decisions in a variety of situations.

(vi) Understand that the probability of two unrelated events occurring is the sum of the two individual possibilities and that the probability of one event following another, in independent trials, is the product of the two probabilities.

[6.29.7.9 NMAC - Rp, 6.30.2.14 NMAC, 6-30-2009]

#### 6.29.7.10 CONTENT STANDARDS WITH BENCHMARKS AND PERFORMANCE STANDARDS FOR MATHEMATICS, Grades 9-12: Note: For this section, standards, benchmarks and performance standards

are applicable to all grades (9-12).

A. Strand: Algebra, functions and graphs. Content standard 1: Students will demonstrate understanding of algebraic concepts and applications.

(1) Grades 9-12 benchmark 1-A: Represent and analyze mathematical situations and structures using algebraic symbols.

(a) Use the special symbols of mathematics correctly and precisely.

(b) Classify and use equivalent representations of natural, whole, integer, rational, irrational and complex numbers and choose which type of number is appropriate in a given context.

(c) Determine the relative position on the number line and the relative magnitude of integers, decimals, rationals, irrationals and numbers in scientific notation.

(d) Explain that the distance between two numbers on the number line is the absolute value of their difference.

(e) Use a variety of computational methods, recognize when an estimate or approximation is more appropriate than an exact answer and understand the limits on precision of approximations.

(f) Simplify numerical expressions using the order of operations, including integer exponents.

- (g) Translate verbal statements into algebraic expressions or equations.
- (h) Solve formulas for specified variables.
- (i) Solve quadratic equations in one variable.
- (j) Solve radical equations involving one radical.
- (k) Describe the properties of rational exponents and apply these properties to simplify

algebraic expressions.

(1) Explain and use equivalent representations for algebraic expressions (e.g., simplify using the distributive property).

(m) Simplify rational expressions by factoring and reducing to lowest terms.

(n) Evaluate polynomial, rational, radical and absolute value expressions for one or more

variables.

(o) Compare and order polynomial expressions by degree.

(p) Factor polynomials of various types (e.g., difference of squares, perfect square trinomials, sum and difference of cubes).

(q) Solve linear equations and inequalities in one variable, including those involving the absolute value of a linear function.

(r) Use the four basic operations  $(+,-,x,\div)$  with linear, polynomial and rational expressions in contextual situations.

(s) Use the four basic operations  $(+,-,x,\div)$  in contextual situations with numbers in scientific notation and express the results with the appropriate number of significant figures.

- (2) Grades 9-12 benchmark 1-B: Demonstrate understanding of patterns, relations, functions and graphs.
  - (a) Distinguish between the concept of a relation and a function.

(b) Determine whether a relation defined by a graph, a set of ordered pairs, a table of values, an equation or a rule is a function.

(c) Translate among tabular, symbolic and graphical representations of functions and relations.

(d) Construct a linear function that represents a given graph.

(e) Explain and use function notation in both abstract and contextual situations and evaluate a function at a specific point in its domain.

(f) Graph a linear equation and demonstrate that it has a constant rate of change.

(g) Graph a linear inequality in two variables.

(h) Graph a quadratic function and understand the relationship between its real zeros and the x-graph.

intercepts of its graph.

(i) Graph exponential functions and identify their key characteristics as related to contextual

situations.

situations.

(j) Identify and describe symmetries of graphs.

(k) Use the quadratic formula and factoring techniques to determine whether the graph of a quadratic function will intersect the x-axis in zero, one or two points (include quadratic functions that represent real phenomena).

(1) Explain the meaning of the real and complex roots of quadratic functions in contextual

(m) Read information and draw conclusions from graphs, and identify properties of a graph that provide useful information about the original problem.

(n) Demonstrate understanding of the relationship between the coefficients of a linear equation and the slope and x- and y- intercepts of its graphs.

(o) Evaluate estimated rate of change in a contextual situation.

(3) Grades 9-12 benchmark 1-C: Use mathematical models to represent and understand quantitative relationships.

(a) Model real-world phenomena using linear equations and linear inequalities, interpret

resulting solutions and use estimation to detect errors. (b) Model real-world phenomena using quadratic equations, interpret resulting solutions and use estimation to detect errors.

(c) Model real-world phenomena using exponential equations, interpret resulting solutions and use estimation to detect errors.

(d) Solve systems of linear equations in two variables algebraically and graphically.

(e) Solve applications involving systems of two equations in two variables.

(f) Write an equation of the line that passes through two given points.

(g) Verify that a point lies on a line (given an equation of the line), and be able to derive linear equations given a point and a slope.

(h) Determine whether the graphs of two given linear equations are parallel, perpendicular, coincide or none of these.

B. Strand: Geometry and trigonometry. Content standard 2: Students will demonstrate understanding of geometric concepts and applications.

(1) Grades 9-12 benchmark 2-A: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

(a) Demonstrate understanding that numerical values associated with measurements of physical quantities must be assigned units of measurement or dimensions; apply such units correctly in expressions, equations and problem solutions that involve measurements; and convert a measurement (using one unit of measurement) to another unit of measurement.

(b) Find the area and perimeter of a geometric figure composed of a combination of two or more rectangles, triangles or semicircles with just edges in common.

(c) Draw three-dimensional objects and calculate the surface areas and volumes of these figures (e.g. prisms, cylinders, pyramids, cones, spheres) as well as figures constructed from unions of prisms with faces in common, given the formulas for these figures.

(d) Identify the hypothesis and conclusion in examples of conditional statements.

(e) Use definitions in making logical arguments.

(f) Use counter-examples to show that an assertion is false and recognize that a single counterexample is sufficient to refute a universal statement.

each.

(g) Explain the difference between inductive and deductive reasoning and provide examples of

(h) For inductive reasoning, explain why showing that a statement is true for a finite number of examples does not show it is true for all cases, unless the cases verified are all possible cases.

(i) Write geometric proofs, including proofs by contradiction, and perform and explain basic geometric constructions related to: theorems involving the properties of parallel and perpendicular lines, circles and polygons; theorems involving complementary, supplementary and congruent angles; theorems involving congruence and similarity; and the Pythagorean theorem.

(j) Recognize that there are geometries, other than Euclidean geometry, in which the parallel postulate is not true.

(2) Grades 9-12 benchmark 2-B: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

(a) Identify the origin, coordinate axes and four quadrants on the Cartesian coordinate plane, and draw and label them correctly.

(b) Determine the midpoint and distance between two points within a coordinate system and relate these ideas to geometric figures in the plane (e.g., find the center of a circle given two end points of a diameter of the circle).

(c) Use basic geometric ideas (e.g., the Pythagorean theorem, area and perimeter) in the context of the Cartesian Plane (e.g., calculate the perimeter of a rectangle with integer coordinates and with sides parallel to the coordinate axes, and of a rectangle with sides not parallel).

(3) Grades 9-12 benchmark 2-C: Apply transformations and use symmetry to analyze mathematical situations.

(a) Use rigid motions (compositions of reflections, translations and rotations) to determine whether two geometric figures are congruent in a coordinate plane.

(b) Sketch a planar figure that is the result of given transformations (i.e., translation, reflection, rotation or dilation).

(c) Identify similarity in terms of transformations.

(d) Determine the effects of transformations on linear and area measurements of the original planar figure.

(4) Grades 9-12 benchmark 2-D: Use visualization, spatial reasoning and geometric modeling to solve problems.

(a) Solve contextual problems using congruence and similarity relationships of triangles (e.g., find the height of a pole, given the length of its shadow).

(b) Solve problems involving complementary, supplementary and congruent angles.

(c) Know that the effect of a scale factor k on length, area and volume is to multiply each by k, k\_ and k\_, respectively.

(d) Solve problems using the Pythagorean theorem.

(e) Demonstrate understanding of how similarity of right triangles allows the trigonometric functions (sine, cosine and tangent) to be defined as ratios of sides and be able to use these functions to solve problems.

(f) Apply basic trigonometric functions to solve right-triangle problems.

(g) Use angle and side relationships in problems with special right triangles (e.g., 30-60-90 and 45-45-90 degree triangles).

(h) Describe the intersections of a line and a plane, intersections of lines in the plane and in space, or of two planes in space.

C. Strand: Data analysis and probability. Content standard 3: Students will demonstrate understanding of how to formulate questions, analyze data and determine probabilities.

(1) Grades 9-12 benchmark 3-A: Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.

(a) Explain the differences between the various methods of data collection.

(b) Describe the characteristics of a well-designed and well-conducted survey by differentiating between sampling and census; and between a biased and an unbiased sample.

(c) Describe the characteristics of a well-designed and well-conducted experiment by differentiating between experiments and observational studies, and by recognizing sources of bias in poorly designed experiments.

(d) Explain the role of randomization in well-designed surveys and experiments.

(2) Grades 9-12 benchmark 3-B: Select and use appropriate statistical methods to analyze data and make predictions.

(a) Distinguish measurement data from categorical data, and define the term "variable."

(b) Explain the meaning of "univariate" and "bivariate" data.

(c) Display the distribution of univariate data, describe its shape using appropriate summary statistics and demonstrate understanding of the distinction between a statistic and a parameter.

(d) Calculate and apply measures of variability (e.g., standard deviation).

(e) Compare distributions of univariate data using back-to-back stem and leaf plots and parallel box and whisker plots.

(f) Describe the characteristics of a normal distribution.

(g) Compare and draw conclusions between two or more sets of univariate data using basic data analysis techniques and summary statistics.

(h) Describe the shape of a scatterplot.

(i) Use linear patterns in data to make predictions.

(i) Use technological tools to find the line of best fit.

(k) Describe the relationship between two variables and determine its strength with and without ls.

technological tools.

(1) Explain why correlation does not imply a cause-and-effect relationship.

(m) Use the results of simulations to explore the variability of sample statistics from a known population and construct sampling distributions.

(n) Describe how sample statistics, including the law of large numbers, reflect the values of population parameters and use sampling distributions as the basis for informal inference.

(o) Evaluate published reports that are based on data by examining the design of the study, the appropriateness of the data analysis and the validity of conclusions.

(3) Grades 9-12 benchmark 3-C: Demonstrate understanding of and apply basic concepts of probability.

(a) Explain the concept of a random variable.

(b) Explain how the relative frequency of a specified outcome of an event can be used to estimate the probability of the outcome.

(c) Use the results of simulations to compute the expected value and probabilities of random variables in simple cases.

(d) Compute the probability of an event using the complement rule, addition rule for disjoint and joint events, multiplication rule for independent events, and rules for conditional probability. [6.29.7.10 NMAC - Rp, 6.30.2.14 NMAC, 6-30-2009]

#### HISTORY OF 6.29.7 NMAC:

**Pre-NMAC HISTORY:** The material in this part is derived from that previously filed with the State Records Center:

SDE 74-17, (Certificate No. 74-17), Minimum Educational Standards for New Mexico Schools, filed April 16, 1975.

SDE 76-9, (Certificate No. 76-9), Minimum Education Standards for New Mexico Schools, filed July 7, 1976. SDE 78-9, Minimum Education Standards for New Mexico Schools, filed August 17, 1978.

SBE 80-4, Educational Standards for New Mexico Schools, filed September 10, 1980.

SBE 81-4, Educational Standards for New Mexico Schools, filed July 27, 1981.

SBE 82-4, Educational Standards for New Mexico Schools, Basic and Vocational Program Standards, filed November 16, 1982.

SBE Regulation No. 83-1, Educational Standards for New Mexico Schools, Basic and Vocational Program Standards, filed June 24, 1983.

SBE Regulation 84-7, Educational Standards for New Mexico Schools, Basic and Vocational Program Standards, filed August 27, 1984.

SBE Regulation 85-4, Educational Standards for New Mexico Schools, Basic, Special Education, and Vocational Programs, filed October 21, 1985.

SBE Regulation No. 86-7, Educational Standards for New Mexico Schools, filed September 2, 1986.

SBE Regulation No. 87-8, Educational Standards for New Mexico Schools, filed February 2, 1988.

SBE Regulation No. 88-9, Educational Standards for New Mexico Schools, filed October 28, 1988.

SBE Regulation No. 89-8, Educational Standards for New Mexico Schools, filed November 22, 1989.

SBE Regulation No. 90-2, Educational Standards for New Mexico Schools, filed September 7, 1990. SBE Regulation No. 92-1, Standards for Excellence, filed January 3, 1992.

#### History of Repealed Material:

6.30.2 NMAC, Standards for Excellence, filed November 2, 2000 - Repealed effective June 30, 2009.

#### **NMAC History:**

6 NMAC 3.2, Standards for Excellence, filed October 17, 1996.

6.30.2 NMAC, Standards for Excellence, November 2, 2000, replaced by 6.29.1 NMAC, General Provisions; 6.29.2 NMAC, Arts Education; 6.29.3 NMAC, Career and Technical Education; 6.29.4 NMAC, English Language Arts; 6.29.5 NMAC, English Language Development; 6.29.6 NMAC, Health Education; 6.29.7 NMAC, Mathematics; 6.29.8 NMAC, Modern, Classical and Native Languages; 6.29.9 NMAC, Physical Education; 6.29.10 NMAC, Science; 6.29.11 NMAC, Social Studies; effective June 30, 2009.