

## Grade 7 - Mathematics

### Standards I: Mathematical Processes.

- A. *Use a variety of tools and strategies in problem solving. I-A*
- B. *Apply mathematical knowledge and skills routinely in other content areas and practical situations. I-B*
- C. *Recognize and use connections between equivalent representations and related procedures. I-C*
- D. *Evaluate the reasonableness of predictions, estimations and solutions. I-D*
- E. *Use a variety of mathematical representations to organize, record, and communicate mathematical ideas. I-E*
- F. *Use mathematical language and symbols to explain, analyze, and justify mathematical ideas, strategies, and solutions. I-F*
- G. *Write clearly and coherently about mathematical thinking and ideas. I-G*

### Benchmarks for Standard I:

- **Use inductive thinking to generalize a pattern of observations for particular cases, make conjectures, and provide supporting arguments for conjectures.**
- **Relate mathematical ideas to one another and to other content areas; e.g., use models for adding fractions, interpret graphs in reading, science and social studies.**
- **Select, apply, and translate among mathematical representations to solve problems; e.g., representing a number as a fraction, decimal or percent as appropriate for a problem.**
- **Communicate mathematical thinking to others and analyze the mathematical thinking and strategies of others.**
- **Recognize and use mathematical language and symbols when reading, writing and conversing with others.**
- **Apply and adapt problem-solving strategies to solve a variety of problems, including unfamiliar and non-routine problem situations.**

- **Use more than one strategy to solve a problem, and recognize there are advantages associated with various methods.**

### Standards II: Number, Number Sense and Operations.

- A. Demonstrate an understanding of place value using powers of 10. II-
- B. Write large numbers in scientific notation. II-C
- C. Continue the use of prime factorization. II-C
- D. Explain the meaning of exponents that are negative or 0. II-B
- E. Describe differences between rational and irrational numbers; e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals. II-C
- F. Use order of operations and properties to simplify numerical expressions involving integers, fractions and integers.
- G. Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value. II-B
- H. Simplify numerical expressions involving integers and use integers to solve real-life problems. II-B
  - I. Solve problems using the appropriate form of a rational number (fraction, decimal or percent). II-C
  - J. Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares). II-A
  - K. Determine the percent of a number and solve related problems; e.g. find the percent markdown if the original price was \$140, and the sale price is \$100. II-B

### Benchmarks for Standard II:

- **Use models and pictures to relate concepts of ratio, proportion and percent.**

- **Use order of operations, including use of parenthesis and exponents to solve multi-step problems, and verify and interpret the results.**
- **Apply number system properties when performing computations.**
- **Use a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents.**
- **Relate mathematical ideas to one another and to other content areas; e.g. use area models for adding fractions interpret graphs in reading, science and social studies.**

### Standard III: Measurement Standard

- A. Select appropriate units for measuring derived measurements; e.g., miles per hour, revolutions per minute. III-B
- B. Convert units of area and volume within the same measurement system using proportional reasoning and a reference table when appropriate; e.g., square feet to square yards, cubic meters to cubic centimeters. III-E
- C. Estimate a measurement to a greater degree of precision than the tool provides. III-C
- D. Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system. III-C
- E. Analyze problem situations involving measurement concepts, select appropriate strategies, and use an organized approach to solve narrative and increasingly complex problems. III-C
- F. Use strategies to develop formulas for finding area of trapezoids and volume of cylinders and prisms. III-C
- G. Develop strategies to find the area of composite shapes using the areas of triangles, parallelograms, circles and sectors. III-C

- H. Understand the difference between surface area and volume and demonstrate that two objects may have the same surface area, but different volumes or may have the same volume, but different surface areas. III-D
- I. Describe what happens to the surface area and volume of a three-dimensional object when the measurements of the object are changed; e.g., length of sides are doubled. III-C

#### Benchmarks for Standard III:

- **Select appropriate tools and units to measure angles, circumference, surface area, mass and volume using: U.S. customary units; e.g. degrees, square feet, pounds and other units as appropriate; metric units; e.g. square meters, kilograms and other units as appropriate.**
- **Convert units of length, area, volume, mass and time within the same measurement systems.**
- **Identify appropriate formula and apply appropriate techniques for measuring composite shapes and surface area and volume of prisms and cylinders.**
- **Understand and demonstrate the independence of surface area and volume for three-dimensional shapes.**
- **Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature.**
- **Analyze and explain what happens to surface area and volume when the dimensions of an object are changed.**

#### Standard IV: Geometry and Spatial Sense.

- A. Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures. IV-A
- B. Determine sufficient (not necessarily minimal) properties that define a specific two-dimensional figure or three-dimensional object. For example: IV-A
1. Determine when one set of figures is a subset of another; e.g., all squares are rectangles.

2. Develop a set of properties that eliminates all but the desired figure; e.g., only squares are quadrilaterals with all sides congruent and all angles congruent.

- C. Use and demonstrate understanding of the properties of triangles. For example: IV-A
1. Use Pythagorean Theorem to solve problems involving right triangles.
  2. Use triangle angle sum relationships to solve problems.
- D. Determine necessary conditions for congruence of triangles. IV-A
- E. Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures. IV-I
- F. Determine and use scale factors for similar figures to solve problems using proportional reasoning. IV-I
- G. Identify the line and rotation symmetries of two-dimensional figures to solve problems. IV-I
- H. Perform translations, reflections, rotations and dilations of two-dimensional figures using a variety of methods (paper folding, tracing, graph paper). IV-F
1. Draw representations of three-dimensional geometric objects from different views. IV-E

#### Benchmarks for Standard IV:

- **Specify locations and plot ordered pairs on a coordinate plane.**
- **Identify, describe and classify types of line pairs, angles, two-dimensional figures and three-dimensional objects using their properties.**
- **Use proportions to express relationships among corresponding parts of similar figures.**
- **Describe and use the concepts of congruence, similarity and symmetry to solve problems.**
- **Identify and draw three-dimensional objects from different views (top, side, front and perspective).**
- **Apply properties of equality and proportionality to solve problems involving congruent or similar figures; e.g., create a scale drawing.**

- **Describe and use properties of triangles to solve problems involving angle measurement and side lengths of right triangles.**

#### Standard V: Patterns, Functions and Algebra.

- A. Represent and analyze patterns, rules and functions with words, tables, graphs and simple variable expressions. V-D
- B. Generalize patterns by describing in words how to find the next term. V-B
- C. Recognize and explain when numerical patterns are linear or nonlinear progressions; e.g., 1, 3, 5, 7... is linear and 1, 3, 4, 8, 16... is nonlinear. V-B
- D. Create visual representations of equation-solving processes that model the use of inverse operations. V-H, I-E
- E. Represent linear equations by plotting points in the coordinate plane. V-D
- F. Represent inequalities on a number line or a coordinate plane. V-D
- G. Justify that two forms of an algebraic expression are equivalent, and recognize when an expression is simplified; e.g.,  $4m = m + m + m + m$  or  $a \cdot 5 + 4 = 5a + 4$ . V-I
- H. Use formulas in problem-solving situations. V-L
1. Recognize a variety of uses for variables; e.g., placeholder for an unknown quantity in an equation, generalization for a pattern, formula. V-G
- J. Analyze linear and simple nonlinear relationships to explain how a change in one variable results in the change of another. V-K

#### Benchmarks for Standard V:

- **Describe, extend and determine the rule for patterns and relationships occurring in numeric patterns, computation, geometry, graphs and other applications.**
- **Use variables to create and solve equations and inequalities representing problem situations.**
- **Use representations, such as tables, graphs and equations, to model situations and to solve problems.**
- **Write, simplify and evaluate algebraic expressions.**
- **Solve linear equations and inequalities symbolically and numerically.**

- Explain how inverse operations are used to solve linear equations.
- Graph linear equations and inequalities on a number line.

**Standard VI: Data Analysis and Probability.**

- A. Read, create and interpret box-and-whisker plots, stem-and-leaf plots, and other types of graphs, when appropriate. VI-B
- B. Analyze how decisions about graphing affect the graphical representation; e.g., scale, size of classes in a histogram, number of categories in a circle graph. VI-C
- C. Analyze a set of data by using and comparing combinations of measures of center (mean, mode, median) and measures of spread (range, quartile, interquartile range), and describe how the inclusion or exclusion of outliers affects those measures. VI-C
- D. Construct opposing arguments based on analysis of the same data, using different graphical representations. VI-D
- E. Compare data from two or more samples to determine how sample selection can influence results. VI-C
- F. Identify misuses of statistical data in articles, advertisements, and other media. VI-I
- G. Identify different ways of selecting samples, such as survey response, random sample, representative sample and convenience sample. VI-E
- H. Describe how the relative size of a sample compared to the target population affects the validity of predictions. VI-I
  - I. Compute probabilities of compound events; e.g., multiple coin tosses or multiple rolls of number cubes, using such methods as organized lists, tree diagrams and area models. VI-H
- J. Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results to predicted results, and explain differences. VI-G

**Benchmarks for Standard VI:**

- Read, create and use circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate.

- Compare increasingly complex displays of data such as multiple sets of data on the same graph.
- Evaluate conjectures and predictions based upon data presented in tables and graphs, and identify misuses of statistical data and displays.
- Make and justify predictions based on experimental and theoretical probabilities.
- Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.
- Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.

**Key to using this document:**

- Items in bold with Roman numerals are COS standards.

- Items in bold without Roman numerals are benchmarks.

- Items in regular print are state grade level indicators with the COS letter/number correlation.

- Items in italics are in the diocesan course of study, not in state standards.