Grade 8 - 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:

- **Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution.**
- **Apply mathematical knowledge and skills routinely in other content areas and practical situations.**
- **Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.**
- **Use precise mathematical language and notations to represent problem situations and mathematical ideas.**
- **Write clearly and coherently about mathematical thinking and ideas.**
- **Communicate mathematical thinking to others and analyze the mathematical thinking and stragegies of others.**
- **Locate and intepret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.**
- **Use deductive thinking to construct informal arguments to support reasoning and to justify solutions to problems.**

Standards II: Number, Number Sense and Operations.

A. Use scientific notation to express large numbers and small numbers between 0 and 1. II-C

B. Recognize that natural numbers, whole numbers, integers, rational numbers and irrational numbers are subsets of the real number system. II-C

C. Apply order of operations to simplify expressions and perform computations involving integers, both positive and negative, exponents and radicals. II-B

D. Explain and use the inverse and identity properties and use inverse relationships (addition/subtraction, multiplication/division, squaring/square roots) in problem solving situations. II-B

E. Determine when an estimate is sufficient and when an exact answer is needed in problem situations, and evaluate estimates in relation to actual answers; e.g., very close, less than, greater than. II-D

F. Estimate, compute and solve problems involving rational numbers, including ratio, proportion and percent, and judge the reasonableness of solutions. II-D

G. Find the square root of perfect squares, and approximate the square root of non-perfect squares as consecutive integers between which the root lies; e.g., $\sqrt{130}$ is between 11 and 12. II-C

H. Add, subtract, multiply, divide and compare numbers written in scientific notation. II-B

I. Develop and analyze algorithms for computing with percents and integers and demonstrate fluency in their use. II-D

Benchmarks for Standard II:

- **Use scientific notation to express large numbers and numbers less than one.**
- **Apply properties of operations and the real number system, and justify when they hold for a set of numbers.**
- **Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.**
- **Compare, order and determine equivalent forms of real numbers.**
- **Find the square root of perfect squares, and approximate the square root of non-perfect squares.**
- **Compute and solve problems involving percents.**
- **Compute with integers.**
- **Use and analyze the steps in standard and non-standard algorithm for computing with fractions, decimals and percents.**

Standard III: Measurement.

A. Compare and order the relative size of common U.S. customary units and metric units; e.g., mile and kilometer, gallon and liter, pound and kilogram. III-B

B. Use proportional relationships and formulas to convert units from one measurement system to another; e.g., degrees Fahrenheit to degrees Celsius. III-C

C. Use appropriate levels of precision when calculating with measurements. III-A

D. Derive formulas for surface area and volume and justify them using geometric models and common materials. For example, find: III-C

1. the surface area of a cylinder as a function of its height and radius;
2. that the volume of a pyramid (or cone) is one-third of the volume of a prism (or cylinder) with the same base area and height.

E. Determine the surface area for pyramids by analyzing their parts. III-C

F. Solve and determine the reasonableness of the results for problems involving rates and derived measurements, such as velocity and density, using formulas, models and graphs. III-C
G. Apply proportional reasoning to solve problems involving indirect measurements or rates. III-C
H. Find the sum of the interior and exterior angles of regular convex polygons with and without measuring the angles with a protractor. III-C
I. Demonstrate understanding of the concepts of perimeter, circumference and area by using established formulas for triangles, quadrilaterals, and circles to determine the surface area and volume of prisms, pyramids, cylinders, spheres and cones. (Note: Only volume should be calculated for spheres and cones.) III-C
J. Use conventional formulas to find the surface area and volume of prisms, pyramids and cylinders and the volume of spheres and cones to a specified level of precision. III-C

Benchmarks for Standard III:

- **Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.**
- **Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume of prisms, cylinders, and pyramids.**
- **Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.**
- **Write and solve real-world problems involving money, elapsed time and temperature, and verify reasonableness of solution.**

Standard IV: <u>Geometry and Spatial Sense.</u>

A. Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-dimensional objects. IV-A
B. Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal. IV-B
C. Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures). IV-I
D. Represent and analyze shapes using coordinate geometry; e.g., given three vertices and the type of quadrilateral, find the coordinates of the fourth vertex. IV-B
E. Draw the results of translations, reflections, rotations and dilations of objects in the coordinate plane, and determine properties that remain fixed; e.g., lengths of sides remain the same under translations. IV-B
F. Draw nets for a variety of prisms, pyramids, cylinders and cones. IV-E
G. Describe and use properties of triangles to solve problems involving angle measures and side lengths of a right triangle.

Benchmark for Standard IV:

- **Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.**
- **Represent and model transformations in a coordinate plane and describe the results.**

Standard V: <u>Patterns, Functions and Algebra.</u>

A. Relate the various representations of a relationship; i.e., relate a table to graph, description and symbolic form. V-D
B. Generalize patterns and sequences by describing how to find the nth term. V-B
C. Identify functions as linear or nonlinear based on information given in a table, graph or equation. V-K
D. Extend the uses of variables to include covariants where y depends on x. V-K
E. Use physical models to add and subtract monomials and polynomials, and to multiply a polynomial by a monomial. V-F
F. Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change and y-intercept in real-world problems. V-K
G. Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems. V-H
H. Write, simplify and evaluate algebraic expressions (including formulas) to generalize situations and solve problems. V-I
I. Solve linear equations and inequalities graphically, symbolically and using technology. V-I,J
J. Interpret the meaning of the solution of a 2 by 2 system of equations; i.e., point, line, no solution. V-J
K. Solve 2 by 2 systems of linear equations graphically and by simple substitution. V-J
L. Solve simple quadratic equations graphically; e.g., $y = x^2 - 16$. V-J
M. Compute and interpret slope, midpoint and distance given a set of ordered pairs. V-L
N. Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, continuous vs. noncontinuous, direct variation vs. inverse variation. V-K
O. Describe and compare how changes in an equation affects the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts. V-K
P. Use graphing calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern. V-K

Benchmark for Standard V:

- **Analyze functional relationships and explain how a change in one quantity results in a change in another.**
- **Solve linear equations and inequalities symbolically, graphically and numerically.**
- **Use rules and variables to describe patterns, functions and other relationships.**

- **Use representations such as tables, graphs and equations to model situations and to solve problems, especially those that involve linear relationships.**
- **Graph linear equations and inequalities using a coordinate plane.**
- **Appromimate and interpret rates of change from graphical and numerical data.**

Standard VI: <u>Data Analysis and Probability.</u>

A. Use, create and interpret scatterplots and other types of graphs as appropriate. VI-B
B. Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose; e.g., line graph for change over time, circle graph for part-to-whole comparison, scatterplot for relationship between two variants. VI-C
C. Continue to use circle graphs, histograms, box-and-whisker plots, stem-and leaf plots. VI-B
D. Differentiate between discrete and continuous data and appropriate ways to represent each. VI-D
E. Compare two sets of data using measures of center (mean, mode, median) and measures of spread (range, quartiles, interquartile range, percentiles). VI-C
F. Explain the mean's sensitivity to extremes and its use in comparison with the median and mode. VI-C
G. Make conjectures about possible relationship in a scatterplot and approximate line of best fit. VI-D
H. Construct convincing arguments based on analysis of data and interpretation of graphs. VI-D
I. Calculate the number of possible outcomes for a situation, recognizing and accounting for when items may occur more than once or when order is important. VI-H
J. Compute probablilities of compound events, independent events, and simple dependent events. VI-H

Benchmarks for Standard VI:

- **Read, create and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plot.**
- **Construct convincing arguments of analysis of data and interpretation of graphs.**
- **Compare the characteristics of the mean, median and mode for a given set of data and explain which measure of center best represents the data.**
- **Find, use and interpret measures of center and spread, such as mean and quartiles and use those measures to compare and draw conclusions about sets of data.**

<u>Key to using this document:</u>

- 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.*