# Diocese of Greensburg Curriculum
# Math Grade 8

| Unit | Standards | Content | Skills |
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| **Rational and Irrational Numbers** | **CCSS: Mathematics**<br>**CCSS: Grade 8**<br>**The Number System**<br>**8.NS.A. Know that there are numbers that are not rational, and approximate them by rational numbers.**<br><br>8.NS.A.1. Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.<br><br>8.NS.A.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions<br><br>**NCTM: Mathematics**<br>**NCTM: Grades 6 - 8**<br>**Number & Operations**<br>**Compute fluently and make reasonable estimates**<br><br>develop and use strategies to estimate the results of rational-number computations and judge the reasonableness of the results;<br><br>**NCTM: Grades 9 - 12**<br>**Number & Operations**<br>**Understand numbers, ways of representing numbers, relationships among numbers, and number systems**<br><br>compare and contrast the properties of numbers and number systems, including the rational and real numbers, and understand complex numbers as solutions to quadratic equations that do not have real solutions; | • The relationship between decimals, fractions and mixed numbers<br>• Vocabulary: Rational number, irrational numbers, repeating decimal, terminating decimal. | The students will be able to:<br><br>• Distinguish between rational and irrational numbers using their properties.<br>• Convert a terminating or repeating decimal into a rational number.<br>• Convert between decimals and fractions and mixed numbers.<br>• Use rational approximations of irrational numbers to compare the size of irrational numbers.<br>• Locate numbers on a number line<br>• Develop strategies to solve problems. |

| Unit | Standards | Content | Skills |
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| **Expressions** | **CCSS: Mathematics**<br><br>**CCSS: Grade 8**<br><br>**The Number System**<br><br>**8.NS.A. Know that there are numbers that are not rational, and approximate them by rational numbers.**<br><br>8.NS.A.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions<br><br>**Expressions & Equations**<br>**8.EE.A. Work with radicals and integer exponents.**<br><br>8.EE.A.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.<br><br>8.EE.A.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that ____is irrational.<br><br>8.EE.A.3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.<br><br>8.EE.A.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities | • Expressions<br>• Square roots<br>• Cube roots<br>• Exponents<br>• Scientific notation | The students will be able to:<br><br>• Apply concepts of integer exponents to generate equivalent expressions.<br>• Evaluate expressions with exponents<br>• Understand negative exponents<br>• Multiply and divide with exponents<br>• Multiply and divide monomials<br>• Use and evaluate square roots and cube roots<br>• Identify equivalent expressions using exponents.<br>• Calculate square roots of perfect squares.<br>• Evaluate radical expressions.<br>• Convert between standard and scientific notation.<br>• Multiply and divide numbers in scientific notation.<br>• |

| Unit | Standards | Content | Skills |
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| | (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.<br><br>**NCTM: Mathematics**<br> **NCTM: Grades 6 - 8**<br>  **Algebra**<br>**Represent and analyze mathematical situations and structures using algebraic symbols**<br><br>explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of intercept and slope;<br><br>recognize and generate equivalent forms for simple algebraic expressions and solve linear equations<br><br> | | |
| **Linear Equations** | **CCSS: Mathematics**<br> **CCSS: Grade 8**<br>  **Expressions & Equations**<br>**8.EE.B. Understand the connections between proportional relationships, lines, and linear equations.**<br><br>8.EE.B.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.<br><br>**8.EE.C. Analyze and solve linear equations and pairs of simultaneous linear equations.**<br><br>8.EE.C.7. Solve linear equations in one variable.<br><br>8.EE.C.7a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into | • Linear Equations<br>• Slope of a line<br>• Systems of Equations | The students will be able to:<br><br>• Analyze and describe linear relationships between two variables, using slope<br>• Make connections between slope, lines and linear equations.<br>• Interpret solutions to a linear equation and systems of two linear equations.<br>• Analyze, model and solve linear equations.<br>• Analyze and solve pairs of simultaneous equations.<br>• Calculate slope.<br>• Graph linear equations.<br>• Solve equations, including multi-step.<br>• Find solutions to systems of equations. |

| Unit | Standards | Content | Skills |
|------|-----------|---------|--------|
| | simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).<br><br>8.EE.C.7b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.<br><br>8.EE.C.8. Analyze and solve pairs of simultaneous linear equations.<br><br>8.EE.C.8a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.<br><br>8.EE.C.8b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.<br><br>8.EE.C.8c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.<br><br>**NCTM: Mathematics**<br>**NCTM: Grades 6 - 8**<br><br>**Algebra**<br>**Understand patterns, relations, and functions**<br><br>identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.<br><br>**Represent and analyze mathematical situations and structures using algebraic symbols**<br><br>recognize and generate equivalent forms for simple algebraic expressions and solve linear equations<br><br> | | • Solve system of equations using substitution, elimination, and graphing. |

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| **Functions** | **CCSS: Mathematics**<br><br>**CCSS: Grade 8**<br><br>**Functions**<br><br>**8.F.A. Define, evaluate, and compare functions.**<br><br>8.F.A.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.<br><br>8.F.A.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.<br><br>8.F.A.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.<br><br>**8.F.B. Use functions to model relationships between quantities.**<br><br>8.F.B.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.<br><br>8.F.B.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. | • Functions<br>• Linear and nonlinear functions | The students will be able to:<br><br>• Define, interpret, and compare functions displayed algebraically, graphically, numerically in tables, or by verbal descriptions.<br>• Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values<br>• Identify functions<br>• Identify linear and nonlinear functions |

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| | **NCTM: Mathematics**<br><br>  **NCTM: Grades 6 - 8**<br><br>   **Algebra**<br>**Understand patterns, relations, and functions**<br><br>represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules;<br><br>relate and compare different forms of representation for a relationship;<br><br>identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.<br><br>© Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved. | | |
| **Cylinders, Cones, Spheres** | **CCSS: Mathematics**<br><br>  **CCSS: Grade 8**<br><br>   **Geometry**<br>**8.G.C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.**<br><br>8.G.C.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.<br><br>**NCTM: Mathematics**<br><br>  **NCTM: Grades 6 - 8**<br><br>   **Geometry**<br>**Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships**<br><br>precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties; | • 3-D Objects<br>• Volume of an Object<br>• Application of Formulas | The students will be able to:<br><br>• Apply concepts of volume of cylinders, cones, and spheres to solve real-world and mathematical problems.<br>• Know formulas for volume of cylinders, cones, spheres<br>• Calculate volume of cylinders, cones, spheres |

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|---|---|---|---|
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| **Congruence and Similarity** | **CCSS: Mathematics**<br><br>**CCSS: Grade 8**<br><br>**Geometry**<br><br>**8.G.A. Understand congruence and similarity using physical models, transparencies, or geometry software.**<br><br>8.G.A.1. Verify experimentally the properties of rotations, reflections, and translations:<br><br>8.G.A.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.<br><br>8.G.A.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.<br><br>8.G.A.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.<br><br>**NCTM: Mathematics**<br><br>**NCTM: Grades 6 - 8**<br><br>**Geometry**<br><br>**Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships**<br><br>create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship. | • Geometric Transformations<br>• Similar Figures<br>• Congruent Figures | The students will be able to:<br><br>• Use transformations to demonstrate congruence and similarity of geometric figures.<br>• Use various tools to understand and apply geometric transformations to geometric figures.<br>• Identify reflections, rotations, and translations.<br>• Identify similar and congruent figures. |

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|---|---|---|---|
| | **Apply transformations and use symmetry to analyze mathematical situations**<br><br>examine the congruence, similarity, and line or rotational symmetry of objects using transformations.<br><br> | | |
| **Pythagorean Theorem** | **CCSS: Mathematics**<br>**CCSS: Grade 8**<br>⎯⎯⎯⎯⎯⎯<br>**Geometry**<br>**8.G.B. Understand and apply the Pythagorean Theorem.**<br><br>8.G.B.6. Explain a proof of the Pythagorean Theorem and its converse.<br><br>8.G.B.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.<br><br>8.G.B.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.<br><br> | • Right Triangles<br>• Application of Pythagorean theorem | The students will be able to:<br><br>• Apply the Pythagorean Theorem and its converse to solve mathematical problems in two and three dimensions.<br>• Apply the Pythagorean Theorem to determine unknown sides. |
| **Data and Distributions** | **CCSS: Mathematics**<br>**CCSS: Grade 8**<br>⎯⎯⎯⎯⎯⎯<br>**Statistics & Probability**<br>**8.SP.A. Investigate patterns of association in bivariate data.**<br><br>8.SP.A.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative | • Display of Data<br>• Analysis of Data<br>• Patterns<br>• Linear Models for Data | The students will be able to;<br><br>• Construct, analyze, and interpret bivariate data displayed in scatter plots.<br>• Identify and use linear models to describe bivariate measurement data.<br>• Use frequencies to analyze patterns of association seen in bivariate data. |

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|---|---|---|---|
| | association, linear association, and nonlinear association.<br><br>8.SP.A.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.<br><br>**NCTM: Mathematics**<br>**NCTM: Grades 6 - 8**<br>**Data Analysis & Probability**<br>**Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them**<br><br>formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population;<br><br>select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots.<br><br>© Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved. | | • Construct and interpret scatter plots. |