Diocese of Green Bay

Mathematics

Understanding that mathematics is helpful in describing the physical world of patterns God created, mathematics is an area of academics designed to prepare individuals for our global society that is increasing in moral and technological complexity. To meet these demands, the students in Diocese of Green Bay Catholic schools will develop problem solving skills in light of Catholic faith and doctrine, with an understanding that Mathematics reflects order and unity in God's universe and describes real life consistencies which God created and sustains.

These standards define concepts and skills a student at particular grade levels will learn during an academic year. Mathematical ideas build on experience and previous knowledge. The skills and concepts build on one another and a students' ability to understand expands with their ability to apply previously taught concepts. Standards do not dictate the curriculum, resources and teaching methods used to teach the concepts but serve continuum of concepts and skills.

The process of mathematics involves problem solving, reasoning and proof, communication and clarification, making connections to real-life situations, and representing concepts in a variety of developmentally appropriate ways including but not limited to pictures, concrete materials, tables and graphs, number and letter symbols and spreadsheet displays.

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NUMBER SYSTEM including FRACTIONS (NSF)

Students develop an understanding of numbers, ways of representing numbers, relationships among numbers and number systems.

Sixth Grade	Seventh Grade	Eighth Grade General Math (Pre Algebra)

1. **Work flexibly with fractions, decimals, and percents to solve problems**
   a. convert between fractions and decimals
 	
   b. convert between fractions or decimals to percents
 	
   c. identify the fraction to the decimal equivalent (and vice versa) for halves, thirds, fourths, and fifths
	1. **Work flexibly with fractions, decimals, and percents to solve problems**
	   a. convert between decimals, fractions and percents
	
	   b. identify the fraction to the decimal equivalent (and vice versa) for halves, thirds, fourths, and fifths
	
	   c. solve problems using scientific notation with positive exponents
	
	   d. solve percent problems for real life situations (mark-ups, discounts, commissions, sales tax, etc.)
	
	   e. calculate percent increase and percent decrease up to 100 percent
		1. **Work flexibly with integers to solve problems**
		   a. develop a deeper understanding of very large and very small numbers and of various representations of them
		   b. define rational and irrational numbers
		   c. convert a decimal expansion which repeats eventually into a rational number
		   d. generate and explain equivalencies of fractions, decimals, and percents

2. Compare and order fractions, decimals and percents efficiently and find their approximate location on a number line
  a. write, compare, and order decimals using place value and number lines
 	
  b. compare and order fractions on a number line (1/2, 1/3, ¼)
	2. Compare and order fractions, decimals and percents efficiently and find their approximate location on a number line
	  a. compare and order fractions and decimals
	
	  b. compare and order percents, fractions, and decimals
	
	  c. develop meaning for percents greater than 100 and less than 1
	  d. develop meaning for percent increase greater than 100%
		2. Compare and order rational and irrational numbers efficiently and find their approximate location on a number line
		  a. order numbers from least to greatest – rational, irrational and integers
		  b. show informally that every number has a decimal expansion
		  c. compare the size of irrational numbers using rational approximations
		  d. estimate the value of expressions involving irrational numbers using rational approximations
		  e. approximate irrational numbers as rational numbers
		  f. approximately locate irrational numbers on a number line

3. Understand and use ratios and proportions to represent quantitative relationships
  a. write ratios
  b. write proportions
  c. identify equal ratios as proportions
  d. find the missing value in a
	3. Understand and use ratios and proportions to represent quantitative relationships
	  a. identify equal ratios and write them as a proportion
	  b. find the unknown in a proportion containing integers or decimals using
		3. Understand the classification of numbers
		  a. describe relationships among subsets of real numbers
		  b. examine absolute value as it relates to real numbers
		  c. understand the real number system as a set of elements,

proportion that contains whole numbers; understand that cross products are equal	cross multiplication c. calculate a unity rate for a given relationship	operations and properties

4. Develop an understanding of large numbers and recognize and appropriately use exponential, scientific, and calculator notation
    a. represent whole numbers in exponential form
    b. write large numbers in scientific notation
	4. Develop an understanding of large numbers and recognize and appropriately use exponential, scientific, and calculator notation
	    a. demonstrate movement of the decimal point to support understanding of the powers of 10
	    b. use scientific calculators to show scientific notation
	    c. use scientific calculators to compute exponents or roots
		4. Develop an understanding of large numbers and recognize and appropriately use exponential, scientific, and calculator notation
		    a. solve problems using exponents, raising to the power and extracting roots and scientific notation
		    b. express numbers as a single digit times an integer power of 10
		    c. use scientific calculators to show scientific notation
		    d. use scientific calculators to compute exponents or roots
		    e. express numbers as a single digit times an integer power of 10
		    f. use scientific notation to estimate very large and/or very small quantities

5. Use factors, multiples, prime factorization, and relatively prime numbers to solve problems
    a. list factors and multiples of whole numbers
    b. find prime factorization by making factor trees
    c. find the greatest common factor (GCF) and least
	5. Use factors, multiples, prime factorization, and relatively prime numbers to solve problems
	    a. state if a value (between 1 and 50) is prime, composite or neither
	    b. write the prime factorization of a number in expanded and exponential form
		5. Understand relationships between numbers
		    a. identify prime and composite numbers
		    b. determine the least common multiple or greatest common factor for pairs of numbers
		    c. use divisibility tests for 2, 3, 4, 5, 8, 9, and 10

common multiple (LCM) of whole numbers **d.** know and use the divisibility rules for the numbers 2,3,4,5,6,9,10 **e.** know the difference between prime and composite numbers **f.** recognize prime numbers between 1 and 50	**c.** use prime factorization to find greatest common factor (GCF) and least common multiple(LCM)	

6. Develop meaning for integers and represent and compare quantities using them
    a. understand opposites of integer values
    b. compare and order integers on a number line
    c. represent everyday values (gains, losses) using integers
	6. Develop meaning for integers and represent and compare quantities using them
	    a. represent everyday values (gains and losses) using integers
	    b. compare an order integers on a number line
	    c. understand and compute absolute value of integers
	    d. understand and find opposites of integers
		6. Reason quantitatively and use units to solve problems
		    a. compute and apply operations with decimals, fractions, and integers including order of operation
		    b. identify and apply ratios as proportions
		    c. write ratios and proportions by using equivalent forms
		    d. find the missing term in a proportion
		    e. compute and apply percentages such as interest, discount, commission
		    f. represent quantities in a circle graph

OPERATIONS and ALGEBRAIC THINKING   (OA)

Students use basic and advanced procedures to understand the meaning of operations in relation to advanced properties of functions and algebra.

Sixth Grade	Seventh Grade	Eighth Grade General Math (Pre Algebra)

1. **Represent, Analyze, and generalize a variety of patterns with tables, graphs, words, and when possible, symbolic rules**
   a. given a multi-step expression in a problem, find the missing values in a function table
   b. find the expression from a given function table
	1. **Represent, Analyze, and generalize a variety of patterns with tables, graphs, words, and when possible, symbolic rules**
	   a. find the expression from a given function table
	   b. Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations
		1. **Analyze and interpret the structure of expressions**
		   a. use factoring to find common denominations in addition and subtraction of fractions
		   b. explain the meaning of absolute value
		   c. convert fractions to decimals and percents

2. **Relate and compare different forms of representation for a relationship**	2. **Relate and compare different forms of representation for a relationship** a. compare the relationships that exist between decimals, fractions, mixed numbers and percents	

3. **Represent and analyze mathematical situations and structures using algebraic symbols and expressions**
   a. write algebraic expressions from words to symbols and symbols to words
   b. write expressions from word problems
	3. **Represent and analyze mathematical situations and structures using algebraic symbols and expressions**
	   a. write algebraic expressions from words to symbols and symbols to words
	   b. write expressions from word problems
	   c. describe what each variable represents in a given formula or problem
	   d. explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of *intercept* and *slope*	

3. **Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships**
   a. write one operation equations to solve word problems
	4. **Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships**
	   a. write simple multi-step equations to solve word problems	

4. **Recognize and generate equivalent forms for simple algebraic expressions and solve linear equations**
   a. Solve one step equations using inverse operations
	5. **Recognize and generate equivalent forms for simple algebraic expressions and solve linear equations**
	   a. combine like-terms to simplify basic algebraic expressions
	   b. evaluate numerical expressions and simplify	

	algebraic expressions by applying the correct order of operations and the use of properties c. state if a given value is a solution for the equation d. solve one step equations using inverse operations	
	6. Use mathematical models to represent and understand quantitative relationships a. model and solve contextualized problems using various representations such as graphs, tables, and equations b. use graphs to analyze the nature of change in quantities in linear relationships	

Geometry (G)

Mathematics is helpful in describing the physical world and the patterns of God's creation, students analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about geometric relationships and specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Sixth Grade	Seventh Grade	Eighth Grade General Math (Pre Algebra)

1. **Precisely describe, classify, and understand relationships among types of two and three – dimensional objects using their defining properties**
  a. classify and describe two dimensional shapes by angle measures/or side lengths
  b. classify and describe three dimensional shapes as prisms, pyramids, cylinders, cones, and spheres
  c. determine the difference between regular and irregular polygons
	1. **Precisely describe, classify, and understand relationships among types of two and three – dimensional objects using their defining properties**
	  a. classify and describe two dimensional shapes by angle measures/or side lengths
	  b. classify and describe three dimensional shapes as prisms, pyramids, cylinders, cones, and spheres
	  c. determine the difference between regular and irregular polygons
		1. **Precisely describe, classify, and understand relationships among types of two and three – dimensional objects using their defining properties**
		  a. define dilations as a reduction or enlargement of a figure
		  b. identify the scale factor of a dilation

2. **Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects**
  a. compare similar objects to determine how the attributes are affected by changing in the dimensions of figures
	2. **Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects**
	  a. compare similar objects to determine how the attributes are affected by changing in the dimensions of figures
		2. **Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects**
		  a. identify corresponding sides and corresponding angles
		6-8 Geometry
		  of rotation
		  d. identify line of reflection

3. **Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationships.**
  a. identify congruent figures and angles.
  b. identify complementary and supplementary angles
  c. find the missing complementary or supplementary angle measurement
  d. identify vertical and adjacent angles
  e. identify and compare similar figures.
  f. find the length of a side in a right triangle using Pythagorean Theorem
	3. **Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationships.**
	  a. identify congruent figures and angles.
	  b. identify complementary and supplementary angles
	  c. find the missing complementary or supplementary angle measurement
	  d. identify vertical and adjacent angles
	  e. identify and compare similar figures.
	  f. find the length of a side in a right triangle using Pythagorean Theorem
	  g. use angle relationships (supplementary/complementary angles, vertical/adjacent angles) to find missing angles when parallel lines are cut by a transversal
		3. **Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationships.**
		  a. apply the concept of congruency to write congruent statements
		  b. define similar triangles
		  c. identify angles created when a parallel line is cut by a transversal
		  d. recall Pythagorean Theorem and its converse
		  e. apply Pythagorean Theorem in solving real-world problems dealing with two and three dimensional shapes

4. **Use coordinate geometry to represent and examine the properties of geometric shapes**
  a. locate and graph points on a coordinate plane
  b. use coordinate geometry to examine special geometric
	4. **Use coordinate geometry to represent and examine the properties of geometric shapes**
	  a. locate and graph points on a coordinate plane and state the axis or quadrant on which they lie
		4. **Apply geometric concepts in modeling**
		  a. utilize ratios and proportions in reading and constructing scale drawings
		  b. justify that the sum of interior angles equals 180

shapes such as regular polygons or those with pairs of parallel or perpendicular sides c. use Cartesian coordinates and other coordinate systems, such as navigational, polar or spherical systems to analyze geometric situations	b. use coordinate geometry to examine special geometric shapes such as regular polygons or those with pairs of parallel or perpendicular sides c. determines the coordinates of missing vertices of geometric figures in the first quadrant given the coordinate of the other vertices	c. use angle-angle criterion to prove similarity among triangles d. explain a proof of the Pythagorean Theorem e. determine how to create a right triangle from two pints on a coordinate graph f. identify the legs and hypotenuse of a right triangle g. determines the coordinates of one endpoint of a line segment given the coordinates of the midpoint and the other endpoint
5. **Apply transformations and use symmetry to analyze mathematical situations** a. describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling b. recognize transformations as translations, reflections, and rotations c. use translations, reflections, and rotations to transform geometric shapes d. use scale to determine actual measurements e. use actual measurements to	5. **Apply transformations and use symmetry to analyze mathematical situations** a. describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling b. recognize transformations as translations, reflections, and rotations c. use translations, reflections, and rotations to transform geometric shapes d. use scale to determine actual measurements e. use actual measurements to	5. **Apply transformations and use symmetry to analyze mathematical situations** h. define and identify rotations, reflections and translations i. understand prime notation to describe an image after a translation, reflection, or rotation j. use physical models, transparencies or geometry software to verify the properties of rotations, reflections, and translations k. describe the sequence of rotations, reflections, translations that exhibits the

construct a scale model	construct a scale model f. calculate the scale factor of two similar figures	congruence between 2-D figures using coordinates **l.** solve basic mathematical Pythagorean Theorem problems and its converse to find missing lengths of sides of triangles in two or three dimensions

6. Examine the congruence, similarity , and line or rotational symmetry of objects using transformations
   a. identify line symmetry and rotational symmetry in a variety of figures
   b. identify tessellations and shapes that can tessellate
	6. Examine the congruence, similarity , and line or rotational symmetry of objects using transformations
	   a. identify line symmetry and rotational symmetry in a variety of figures
	   1. identify tessellations and shapes that can tessellate
		6. Examine the congruence, similarity , and line or rotational symmetry of objects using transformations
		   a. identify symbols for congruency
		   b. apply the concept of congruency to write congruent statements
		   c. recognize the symbol for similar
		   d. determine the coordinates of the vertices of a polygon after a translation or a series of translations
		   e. apply the concept of similarity to write similarity statements
		   f. determine the image of a polygon on a coordinate plane after a reflection or a series of reflections
		   g. identify the degree of rotation that will map one figure onto another without the coordinate plane

7. Use visualization, spatial reasoning, and geometric modeling to solve problems	7. Use visualization, spatial reasoning, and geometric modeling to solve problems	7. Determine and apply appropriate volume formulas in order to solve mathematical and real-world problems for the given shape
a. draw polygons using given specified properties such as, side lengths or angle measures b. use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume c. use nets to compose and decompose three dimensional shapes d. use given formulas to find perimeter, circumference, and area e. break a polygon into simpler shapes to find its area	a. use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume b. use nets to compose and decompose three dimensional shapes c. use given formulas to find perimeter, circumference, and area d. break a polygon into simpler shapes to find its area	a. know formulas for volume of cones, cylinders and spheres b. compare the volume of cones, cylinders, and spheres c. given the volume of a cone, cylinder, or sphere, find the radii, height, or approximate using pi
8. Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life	8. Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life	8. Define and explain key vocabulary
a. use indirect measurement to solve problems	a. use indirect measurement to solve problems	a. square root b. Pythagorean Theorem c. right triangle d. legs *a & b* e. hypotenuse f. sides g. right angle h. converse i. base j. height k. proof l. cone

		m. cylinder **n.** sphere **o.** radius **p.** diameter **q.** circumference **r.** area **s.** volume **t.** pi **u.** base **v.** height
		9. **Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life**

Measurement   (M)

Students understand measurable attributes of objects and the units, systems, and processes of measurement

Sixth Grade	Seventh Grade	Eighth Grade Geometric Measurement

1. **Understand and use both metric and customary systems of measurement**
   a. use the metric system and its units
   b. use the customary measurement system and its units
	1. **Understand and use both metric and customary systems of measurement**
	   a. use the metric system and its units
	   b. use the customary measurement system and its units
		1. **Apply geometric measurement for angles, area, capacity, circles, conic sections**
		   a. identify and estimate angle measures
		   b. measure non-right angles using a protractor
		   c. solve one-step word problems involving angles
		   d. describe the effect on area when dimensions of a rectangle are changed
		   e. determine the area of a polygon when the formula is given
		   f. determine the area of a polygon when the formula is not given
		   g. solve problems involving area and perimeter of rectangles within a real-world or mathematical context
		   h. writes the equation of a circle given the center and radius

2. **Understand relationships among units and convert from one unit to another within the same system**
   a. make conversions with the customary system
   b. make conversions within the metric system
	2. **Understand relationships among units and convert from one unit to another within the same system**
	   a. make conversions with the customary system
	   b. make conversions within the metric system
		2. **Solves problems with units**
		   a. Solves elapsed time word problems
		   b. solves problems involving both area and perimeter of rectangles within a real-world or mathematical context
		   c. solves problems involving volumes of rectangular prisms within a real-world or mathematical context

3. **Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume**
   a. select appropriate measurement tools based on the precision and measurement error
   b. use appropriate units to measure objects
   c. select correct label when measuring angles, perimeter, area, surface area, and volume
	3. **Understand, select and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume**	3. **Applies scale factors using rates, ratios, proportions and percents**
		
		   a. Applies scale factors to solve problems involving scale drawings of geometric figures.
		   b. Applies scale factors to solve problems involving scare drawings, maps, and models
		   c. Applies the concept of density to solve problems involving area and volume
		   d. Determines scale factors in problems involving scale drawings of geometric figures

4. **Use common benchmarks to select appropriate methods for estimating measurements**
   d. use estimation to determine
	4. **Use common benchmarks to select appropriate methods for estimating measurements**
	   a. use estimation to determine	

whether a measurement is reasonable **e.** use benchmarks angles (45° angle, right angle, and straight angle) to estimate angle measurement	whether a measurement is reasonable **b.** use benchmarks angles (45° angle, right angle, and straight angle) to estimate angle measurement	
5. Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more complex shapes a. explain and use formulas to determine the area circles, parallelograms and trapezoids b. use formulas to develop strategies to determine the area of complex shapes	**5. Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more complex shapes** a. explain and use formulas to develop strategies to determine the area of complex shapes	
6. Develop strategies to determine the surface area and volume of selected prisms, pyramids, and cylinders a. determine the volume of prisms, pyramids, and cylinders b. determine the surface area of prisms, pyramids, and cylinders	**6. Develop strategies to determine the surface area and volume of selected prisms, pyramids, and cylinders** a. determine the volume of prisms, pyramids, and cylinders b. determine the surface area of prisms, pyramids, and cylinders	
7. Solve problems involving scale factors, using ratio and proportion a. use ratio and proportion to solve scale problems	**7. Solve problems involving scale factors, using ratio and proportion** a. use ratio and proportion to solve scale problems	

	8. **Solve simple problems involving rates and derived measurements for such attributes as velocity and density** a. use ratio and proportion to solve problems involving unit rate	

STATISTICS, PROBABILITY, AND DATA ANALYSIS (SPD)

Design investigations, select, use and appropriate statistical methods to analyze data in order to make inferences and predictions based on data.

Sixth Grade	Seventh Grade	Eighth Grade General Math (Pre Algebra)

1. Formulate questions, design studies, and collect data about characteristics shared by two populations or different characteristics within one population
 	
  a. Formulate questions, design experiments, or survey to collect relevant data to compare characteristics
	1. Formulate questions, design studies, and collect data about characteristics shared by two populations or different characteristics within one population
	
	  a. formulate questions, design experiments or surveys to collect relevant data to compare characteristics
		1. Formulate questions, design studies, and collect data about characteristics shared by two populations or different characteristics within one population
		
		  a. describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association

2. Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatter plots.
 	
  a. given a set of data, select an appropriate
	2. Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatter plots.
	
	  a. given a set of data, select an appropriate
		2. Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatter plots.
		
		  a. construct scatter plots for bivariate

representation	representation b. discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots and scatter plots	measurement data b. interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities c. read and interpret data from a histogram
3. **Select and use appropriate statistical methods to analyze data** a. find, use, and interpret measures of center and spread, including mean and interquartile range b. explain how outliers affect central tendencies	3. **Select and use appropriate statistical methods to analyze data** a. find, use, and interpret measures of center and spread, including mean and interquartile range b. explain how outliers affect central tendencies	3. **Interpret categorical and quantitative data** a. determine whether two quantitative variables have a positive linear, negative linear, or zero association b. distinguish between linear and nonlinear relationships in scatter plots
4. **Develop and evaluate inferences and predictions that are based on data** a. use observations about differences between two or more samples to make conjectures about the populations for	4. **Develop and evaluate inferences and predictions that are based on data** a. use observations about differences between two or more samples to make conjectures about the populations for	4. **Evaluate, analyze, interpret and make predictions based on data** a. Identify the median, quartiles, extreme values, and outliers from a box plot b. Solve multi-step word problems using data

which the samples were taken b. make conjectures about possible relationships between two characteristics of a sample on the basis of scatterplots of the data and approximate lines of fit c. make conjectures to formulate new questions and plan new studies to answer them	which the samples were taken b. make conjectures about possible relationships between two characteristics of a sample on the basis of scatterplots of the data and approximate lines of fit c. make conjectures to formulate new questions and plan new studies to answer them	from line or dot plots with fractional scales
		5. **Use sampling and probability to make decisions** a. analyze data from samples to make inferences about populations b. identify a sampling method that produces the most representational sample c. describe the likelihood of compound events occurring d. determine marginal probabilities using a two-way frequency table e. make predictions based

		on theoretical probabilities of simple events
		f. make predictions based on experimental probabilities of simple events
		g. understand the concept of independence in situations
		h. use the Fundamental Counting Principle to determine the number of possible outcomes