

August 2018

Dear Catholic school families, educators, leaders and supporters,

The Office of Catholic Schools in the Diocese of Grand Rapids is pleased to present new curriculum standards outlining the academic expectations throughout our alliance of Catholic schools. By our definition, curriculum standards express the skills and content students are expected to demonstrate within courses and across grade levels. These standards provide normative targets for student performance. When a student has successfully completed a course or grade level, he or she will have demonstrated competence in the knowledge, skills, or attitudes required of that course or grade level. We have created these new curriculum standards in order to express the Catholic identity within our curriculum and to articulate the profile of a graduate of our diocesan schools. Developing these curriculum standards has been a two-year process involving educators, administrators and clergy. Like all curriculum revisions, this process is never entirely finished, and an annual review will allow us to update these documents to reflect what is best for our schools.

The sources used to create our diocesan curriculum standards vary by content area, but each is rooted in the Catechism of the Catholic Church and the Cardinal Newman Society's [Catholic Curriculum Standards](#). Additionally, the curriculum standards from various dioceses and national organizations of educators; curriculum guidelines from Michigan and other states; material from professional organizations, such as College Board, which produces the Scholastic Assessment Test (SAT) suite and the Advanced Placement (AP) assessments; and Northwest Evaluation Association (NWEA), which produces the Measure of Academic Progress (MAP) assessments, were used as references. Each of these sources is referenced in the acknowledgements following each content area document. Importantly, we also accounted for the cultures and communities of our local schools, as no standards should be adopted without consideration of the unique and specific desires of the Catholic families in the diocese.

Hundreds of diocesan teachers and administrators worked tirelessly to produce the content and wording of these curriculum standards over eighteen months, from summer 2016 through winter 2017. The curriculum standards were then reviewed by local experts in theology, including diocesan priests and Aquinas College professors. This combination of experts ensures that the curriculum is rooted in our Catholic faith, is interculturally appropriate for our diocese, and provides educational best practices to inspire excellence in Catholic education. The final review was completed by Most Reverend David J. Walkowiak, bishop of Grand Rapids and Mr. David Faber, superintendent of Catholic schools in the Diocese of Grand Rapids.

In sharing these documents with you, we invite you to explore how our alliance of Catholic schools strives to provide our students with an outstanding education that allows them to grow in faith and grace, achieve more in school and life, develop creativity and character, and feel welcome and cherished.

In Christ,



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**Diocese of Grand Rapids
Office of Catholic Schools
Curriculum Standards
for **Mathematics**
in grades **K-12****

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**Diocese of Grand Rapids
Office of Catholic Schools
Curriculum Standards
for **Mathematics**
in grades **K-12****

Program Goal

All logic and order have come from the existence of God and the human capacity to organize and classify God's earthly creation (CCC 299). The study of mathematics provides a foundation of logic, reasoning and calculation skills and an experience in current technology to enable students to succeed in their earthly vocations, whether or not they are within the mathematical field. Students exhibit appreciation for the ongoing nature of mathematical inquiry, as well as humility at knowing that as human beings we can only grasp a portion of the truths of the universe. Students also experience challenges and methods of operating which serve to increase their problem solving capabilities and critical thinking skills.

**Diocese of Grand Rapids
Office of Catholic Schools
Curriculum Standards
for Mathematics
in grades K-12**

K-12 Mathematical Process Standards

The mathematical process standards describe ways all K-12 students in all courses ought to engage with the mathematics content standards. Students who demonstrate grade-level understanding of the K-12 mathematical process standards are able to --

Problem Solving
<ul style="list-style-type: none"> ● Exhibit appreciation for the ongoing nature of mathematical inquiry and the process of discovering meanings and truth existing with the solution of the problem and not just arriving at an answer. ● Apply and adapt a variety of appropriate strategies to solve mathematical problems. ● Monitor and reflect on the process of mathematical problem solving.
Reasoning and Proof
<ul style="list-style-type: none"> ● Develop the mental habits of precise, determined, careful, and accurate questioning, inquiry, and reasoning in the pursuit of transcendent truths. ● Exhibit humility at knowing that as human beings we can only grasp a portion of the truths of the universe. ● Recognize reasoning and proof as fundamental aspects of mathematics. ● Make and investigate mathematical conjectures. ● Develop and evaluate mathematical arguments and proofs. ● Select and use various types of reasoning and methods of proof.
Communication
<ul style="list-style-type: none"> ● Organize and consolidate mathematical thinking through communication. ● Communicate mathematical thinking coherently and clearly to peers, teachers, and others.

- Analyze and evaluate the mathematical thinking and strategies of others.
- Use sound logical arguments and the language of mathematics to express mathematical ideas precisely.

Connections

- Recognize and use connections among mathematical ideas.
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- Recognize and apply mathematics in contexts outside of mathematics.

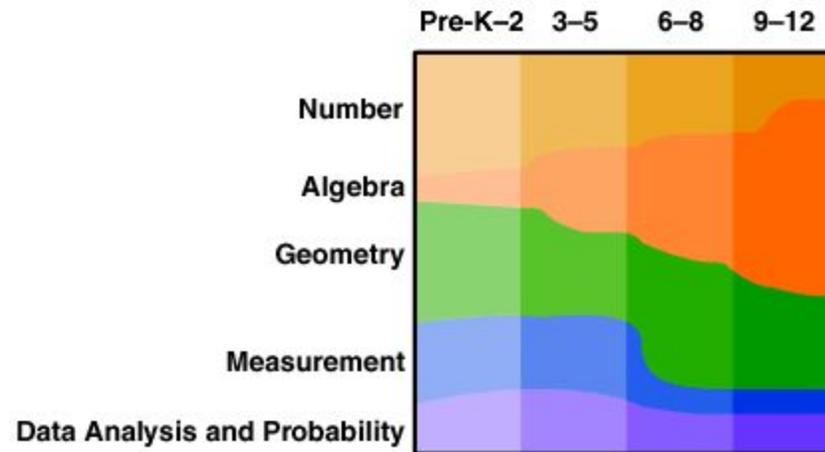
Representation

- Use mathematical representations to solve problems, support reasoning, and enable communication.
- Create and use representations to organize, represent, and interpret mathematical ideas.
- Select, apply, and translate among mathematical representations to solve problems.
- Use representations to model and interpret physical, social, and mathematical phenomena.

**Diocese of Grand Rapids
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Curriculum Standards
for **Mathematics**
in grades **K-12****

Content Standards Progression by Grade Band

The content standards for mathematics are broken by grades: K, 1, 2, 3, 4, 5, 6-8, 9-12. They are also broken by category of mathematical content: Numbers, Algebra, Geometry, Measurement, and Data Analysis and Probability. The emphasis of these categories is shown in the following visual:



Kindergarten Mathematics Curriculum Standards

Students who demonstrate understanding of kindergarten mathematics are able to --

	Full Standard	Report Card Wording
	Number	
K.Math.N.1	Count up to 100 in a correct sequence, both orally and in written form.	Count up to 100, both orally and in written form.
K.Math.N.2	Identify how many are represented in sets of objects or figures, up to 20.	Identify how many are represented in sets, up to 20.
K.Math.N.3	Use models to describe place value with whole numbers up to 20.	Use models to describe place value up to 20.
K.Math.N.4	Connect the terms <i>half</i> and <i>whole</i> to the quantities they represent using various models and representations.	Connect half/whole to quantities they represent.
K.Math.N.5	Identify if one group is larger, smaller, or equal to another with quantities up to 20.	Identify larger, smaller, or equal, up to 20.
K.Math.N.6	Represent and use numbers that combine to make 10, in flexible ways.	Represent numbers that combine to make 10.
	Algebra	
K.Math.A.1	Model situations that involve the addition and subtraction of whole numbers up to 10, using objects and pictures.	Model situations of +/-, up to 10.
K.Math.A.2	Recognize and extend patterns such as sequences of sounds, shapes, and colors or simple numeric patterns.	Recognize/extend patterns.
	Geometry	
K.Math.G.1	Recognize, name, and sort 2D and 3D shapes.	Recognize/name/sort 2D/3D shapes.

K.Math.G.2	Recognize geometric shapes in the environment.	Recognize geometric shapes in environment.
Measurement		
K.Math.M.1	Measure length using nonstandard units, and use repetition to measure something larger than the unit.	Measure length using nonstandard units.
K.Math.M.2	Recognize and name coins and their values.	Recognize/name coins and their values.
Data Analysis		
K.Math.D.1	Gather and represent data using concrete objects, pictures, and bar graphs.	Gather/represent data using objects/pictures/bar graphs.

First Grade Mathematics Curriculum Standards

Students who demonstrate understanding of first grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
1.Math.N.1	Determine “how many” are represented in sets of objects or figures with up to 120 items.	Determine “how many” in sets of up to 120 items.
1.Math.N.2	Use multiple models, such as pictures and physical objects, to describe orally and in written form, place values with whole numbers up to 120.	Use multiple models to describe place values up to 120.
1.Math.N.3	Recognize and represent common fractions, including $\frac{1}{2}$ and $\frac{1}{4}$.	Recognize/represent common fractions.
1.Math.N.4	Identify if a number or a visual representation of a number is greater than, less than, or equal to another, using whole numbers up to 120.	Identify if a number is $</>/=$ to another, up to 120.
1.Math.N.5	Develop fluency with basic number combinations for addition and subtraction of quantities up to 10.	Develop fluency with basic number combinations for +/- up to 10.
1.Math.N.6	Use various strategies to solve problems with multiple steps that involve the addition or subtraction of whole numbers up to 20.	Use various strategies with multiple steps to +/- up to 20.
	Algebra	
1.Math.A.1	Apply the commutative and associative properties of operations with whole numbers up to 20.	Apply commutative and associative properties of operations, up to 20.
1.Math.A.2	Model situations that involve the addition or subtraction of whole numbers up to 120 using objects, pictures, and symbols.	Model situations that involve +/- up to 120 using objects/pictures/symbols.
1.Math.A.3	Recognize, describe, and extend patterns such as sequences of shapes and numbers.	Recognize/describe/extend patterns.

1.Math.A.4	Analyze the patterns generated when counting by two, fives, and tens.	Analyze patterns generated when counting by 2/5/10.
Geometry		
1.Math.G.1	Identify, sort, and describe the characteristics of 2D and 3D shapes.	Identify/sort/describe characteristics of 2D/3D shapes.
1.Math.G.2	Create 2D shapes that have symmetry.	Create 2D shapes that have symmetry.
1.Math.G.3	Recognize and apply slides, flips, and turns using 2D shapes.	Recognize/apply slides/flips/turns using 2D shapes.
Measurement		
1.Math.M.1	Measure, compare, and order the lengths and weights of objects using nonstandard and standard units.	Measure/compare/order lengths/weights of objects using nonstandard/standard units.
1.Math.M.2	Tell and write time in half and full hours.	Tell/write time in half/full hours.
1.Math.M.3	Add and subtract using various money denominations.	+/- using various money denominations.
Data Analysis		
1.Math.D.1	Gather, organize, and represent data using pictures, tables, and graphs.	Gather/organize/represent data using pictures/tables/graphs.
1.Math.D.2	Pose questions and use data to answer questions.	Pose questions/use data to answer questions.

Second Grade Mathematics Curriculum Standards

Students who demonstrate understanding of second grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
2.Math.N.1	Use multiple models, such as pictures and physical objects, to describe orally and in written form places with whole numbers up to 1,000.	Use multiple models to describe places up to 1,000.
2.Math.N.2	Recognize, represent, and use common fractions, including $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, and $\frac{1}{12}$.	Recognize/represent/use common fractions, including $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, and $\frac{1}{12}$.
2.Math.N.3	Identify if a number is greater than, less than, or equal to another, using whole numbers up to 1,000.	Identify if number is $</>=$ up to 1,000.
2.Math.N.4	Develop fluency with basic number combinations for addition and subtraction of quantities up to 20.	Develop fluency with combinations for +/- up to 20.
2.Math.N.5	Use various strategies to solve problems with multiple steps that involve the addition or subtraction of numbers up to 1,000.	Use various strategies to solve problems with multiple steps that involve +/- up to 1,000.
	Algebra	
2.Math.A.1	Apply the commutative and associative properties of operations with whole numbers up to 100.	Apply commutative/associative properties up to 100.
2.Math.A.2	Model situations that involve the addition and subtraction of whole numbers up to 1,000 using objects, pictures, and symbols.	Model situations that involve +/- up to 1,000 using objects/pictures/symbols.
2.Math.A.3	Analyze the patterns generated by odd and even numbers.	Analyze patterns generated by odd/even numbers.
2.Math.A.4	Recognize, describe, extend, and create patterns of shapes and numbers.	Recognize/describe/extend/create patterns of shapes/numbers.

2.Math.A.5	Translate a pattern from one representation to another.	Translate pattern from one representation to another.
Geometry		
2.Math.G.1	Sort, classify, and compare 2D and 3D shapes.	Sort/classify/compare 2D/3D shapes.
2.Math.G.2	Predict the results of putting together and taking apart 2D and 3D shapes, and draw or build the resulting shapes.	Predict results of putting together/taking apart 2D/3D shapes, and draw/build the resulting shapes.
2.Math.G.3	Recognize and create 2D shapes that have equal parts and/or symmetry.	Recognize/create 2D shapes that have equal parts and/or symmetry.
Measurement		
2.Math.M.1	Estimate and measure length and weight using standard units.	Estimate/measure length/weight using standard units.
2.Math.M.2	Develop common referents for measures to make comparisons and estimates.	Develop common referents for measures to make comparisons/estimates.
2.Math.M.3	Create and use a number line from zero to 20 as a measurement of length.	Create/use number line as measurement of length.
2.Math.M.4	Select an appropriate unit and tool for the attribute being measured.	Select appropriate unit/tool for attribute being measured.
2.Math.M.5	Tell and write time to the nearest 5 minute interval.	Tell/write time to nearest 5 minute interval.
2.Math.M.6	Use accurate money denominations to solve word problems.	Use accurate money denominations to solve word problems.
Data Analysis		
2.Math.D.1	Pose questions, and gather, organize, represent and interpret relevant data to answer them.	Pose questions and gather/organize/represent/interpret

		relevant data.
2.Math.D.2	Discuss events in students' experiences as likely or unlikely.	Discuss events as likely/unlikely.

Third Grade Mathematics Curriculum Standards

Students who demonstrate understanding of third grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
3.Math.N.1	Use a number line to locate and compare (less than, greater than, equal to) whole numbers and commonly used fractions.	Use number line to locate/compare whole numbers/common fractions.
3.Math.N.2	Develop and use strategies to estimate computations involving fractions relevant to students' experience.	Develop/use strategies to estimate computations using fractions.
3.Math.N.3	Use whole numbers rounded to the nearest 10 or 100 to determine the reasonableness of a whole number computation.	Use whole numbers to determine reasonableness of a computation.
3.Math.N.4	Use inverse operations to solve problems.	Use inverse operations to solve problems.
3.Math.N.5	Develop fluency of multiplication and division of whole numbers within 100.	Develop fluency of multiplication/division within 100.
3.Math.N.6	Use basic number combinations for multiplication and division to mentally compute related problems.	Use number combinations for multiplication/division to mentally compute related problems.
3.Math.N.7	Select and apply the best method to solve word problems.	Select/apply best method to solve word problems.
3.Math.N.8	Solve problems with multiple steps involving any combination of addition, subtraction, multiplication, and division, including those with solutions that are not whole numbers.	Solve problems with multiple steps of addition/subtraction/multiplication/division.
3.Math.N.9	Create and use models and drawings to describe multiplication and division of whole numbers up to 100.	Create/use models to describe multiplication/division up to 100.
	Algebra	

3.Math.A.1	Apply the commutative, associative, and distributive properties of operations to compute with whole numbers.	Apply commutative/associative/distributive properties of operations.
3.Math.A.2	Describe and extend geometric and numeric patterns.	Describe/extend geometric/numeric patterns.
Geometry		
3.Math.G.1	Identify, compare, and analyze properties of 2D and 3D shapes to classify them.	Identify/compare/analyze properties of 2D/3D shapes to classify them.
3.Math.G.2	Identify and describe line and rotational symmetry in 2D and 3D shapes and designs.	Identify/describe line/rotational symmetry in 2D/3D shapes/designs.
3.Math.G.3	Describe the results of subdividing, combining, and transforming shapes.	Describe results of subdividing/combining/transforming shapes.
Measurement		
3.Math.M.1	Determine the perimeter and area of regular shapes using standard units.	Determine perimeter/area of regular shapes using standard units.
3.Math.M.2	Describe what happens to measurements of a 2D shape, such as its perimeter and area, when the shape is changed in some way.	Describe what happens to measurements when a shape is changed.
3.Math.M.3	Show how differences in units affect precision.	Show how differences in units affect precision.
3.Math.M.4	Solve problems involving perimeters of 2D shapes, including various non-regular polygons.	Solve problems involving perimeters of 2D shapes.
Data Analysis		
3.Math.D.1	Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.	Compare different representations of the same data.

3.Math.D.2	Describe events as likely or unlikely using words such as certain, equally likely, and impossible.	Describe events as likely/unlikely using certain/equally likely/impossible.
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Fourth Grade Mathematics Curriculum Standards

Students who demonstrate understanding of fourth grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
4.Math.N.1	Identify the place on a number line for whole numbers, fractions, and decimals to the hundredths place, and explore values less than zero on the number line.	Identify place on number line for whole numbers/fractions/decimals to hundredths place.
4.Math.N.2	Compare (greater than, less than, equal to) whole numbers, commonly used fractions, and decimals to the hundredths place using a number line.	Compare <, >, = whole numbers/fractions/decimals.
4.Math.N.3	Use familiar applications to describe the role of numbers less than zero.	Describe role of numbers < 0.
4.Math.N.4	Use multiple models such as pictures and physical objects to describe orally and in written form place value with decimals to the hundredths place.	Use multiple models to describe place value with decimals to hundredths place.
4.Math.N.5	Recognize and generate equivalent forms of commonly used fractions, decimals, and percents.	Recognize/generate equivalent forms of common fractions/decimals/percents.
4.Math.N.6	Describe groups of numbers according to their characteristics, such as the nature of their factors and multiples within 100.	Describe groups of numbers according to characteristics.
4.Math.N.7	Develop and use strategies to estimate the results of whole number computations involved in story problems, including rounding to the nearest whole number and justifying the reasonableness of the estimate.	Develop/use strategies to estimate results of whole number computations in story problems.
4.Math.N.8	Use models and drawings to describe the effects of the multiplication and division of two-digit whole numbers.	Use models to describe effects of multiplication/division of two-digit whole numbers.
4.Math.N.9	Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions.	Use models/benchmarks/equivalent forms to +/- common fractions.

Algebra		
4.Math.A.1	Represent the idea of a variable as an unknown quantity using a letter or symbol.	Represent variable using letter/symbol.
4.Math.A.2	Solve multiplication and division problems involving two-digit numbers.	Solve multiplication/division problems of two-digit numbers.
4.Math.A.3	Describe, extend, and make generalizations about geometric and numeric patterns.	Describe/extend/make generalizations about geometric/numeric patterns.
Geometry		
4.Math.G.1	Describe 2D shapes using the terms line segment, parallel, perpendicular, angle, right angle, and line of symmetry.	Describe 2D shapes.
4.Math.G.2	Build a 3D object from a 2D representation of that object.	Build 3D object from 2D representation of object.
4.Math.G.3	Create a 2D representation of a 3D object.	Create 2D representation of 3D object.
4.Math.G.4	Describe a motion or a series of motions that will show that two shapes are congruent.	Describe motion to show two shapes are congruent.
Measurement		
4.Math.M.1	Develop strategies for estimating the perimeters and areas of irregular shapes.	Develop strategies for estimating perimeters/areas of irregular shapes.
4.Math.M.2	Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, and temperature.	Select/apply appropriate standard units/tools to measure.
4.Math.M.3	Develop strategies to determine the surface areas of rectangular solids.	Develop strategies to determine surface areas of rectangular solids.

4.Math.M.4	Describe the relationships among perimeter, area, and surface area.	Describe relationships among perimeter/area/surface area.
Data Analysis		
4.Math.D.1	Represent and interpret data using graphs and tables that include whole numbers, fractions, and decimals.	Represent/interpret data using graphs/tables that include whole numbers/fractions/decimals.
4.Math.D.2	Use measures of center (mean, median, mode) while interpreting data.	Use measures of center to interpret data.
4.Math.D.3	Predict the probability of outcomes of simple experiments and test the predictions.	Predict probability of outcomes/test predictions.

Fifth Grade Mathematics Curriculum Standards

Students who demonstrate understanding of fifth grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
5.Math.N.1	Use the number line to locate, describe, and compare numbers less than zero.	Use number line to compare numbers < 0 .
5.Math.N.2	Use characteristics of numbers such as their factors, multiples, prime factorizations and relatively prime numbers to solve problems.	Use characteristics of numbers to solve problems.
5.Math.N.3	Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to real world experiences.	Develop/use strategies to estimate computations of fractions/decimals.
5.Math.N.4	Estimate the results of computations involving fractions and decimals by using common fractions as comparison.	Estimate results of computations involving fractions/decimals by using comparison.
5.Math.N.5	Use visual models, benchmarks, and equivalent forms to add and subtract decimals.	Use visual models/benchmarks/equivalent forms to +/- decimals.
5.Math.N.6	Develop fluency with two-digit multiplication and division.	Develop fluency with two-digit multiplication/division.
5.Math.N.7	Add and subtract fractions, including those with uncommon denominators.	+/- fractions.
5.Math.N.8	Determine multiple strategies to use in solving complex problems.	Determine multiple strategies in solving complex problems.
5.Math.N.9	Solve problems that involve any combination of addition, subtraction, multiplication and division, including problems that may have multiple solutions.	Solve problems that involve combinations.
	Algebra	
5.Math.A.1	Express mathematical relationships using equations, including those with	Express mathematical relationships

	variables and parentheses.	using equations.
5.Math.A.2	Represent and analyze patterns and functions using words, tables, and graphs.	Represent/analyze patterns/functions.
5.Math.A.3	Describe how a change in one variable relates to a change in a second variable.	Describe how change in one variable relates to change in second variable.
Geometry		
5.Math.G.1	Make and use coordinate systems to specify locations and to describe paths, using the terms ordered pair, x-axis, y-axis, x-coordinate, y-coordinate as appropriate.	Make/use coordinate systems to specify locations/describe paths.
5.Math.G.2	Develop a model to describe the area of a triangle.	Develop model to describe area of triangle.
5.Math.G.3	Find the distance between points along horizontal and vertical lines of a coordinate system.	Find distance between points along lines of coordinate system.
5.Math.G.4	Describe 2D shapes based on their geometric properties, including measurements and characteristics of sides and angles and comparisons of shapes for congruence and similarity.	Describe 2D shapes based on geometric properties.
Measurement		
5.Math.M.1	Convert measurements of distance, weight, and volume from one standard unit to another.	Convert measurements of distance/weight/volume.
5.Math.M.2	Develop and use formulas to find the areas of rectangles and related triangles and parallelograms.	Develop/use formulas to find areas of rectangles/parallelograms.
5.Math.M.3	Develop strategies to determine the surface areas and volumes of rectangular solids.	Develop strategies to determine surface areas/volumes of rectangular solids.

	Data Analysis	
5.Math.D.1	Represent and interpret data using tables and graphs including line plots, bar graphs, and line graphs.	Represent/interpret data using tables/line plots/bar graphs/line graphs.
5.Math.D.2	Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.	Compare different representations of the same data.
5.Math.D.3	Describe events as likely or unlikely and discuss the likelihood of using a number from 0 to 1.	Describe events as likely/unlikely and discuss likelihood from 0 to 1.

Sixth, Seventh, and Eighth Grade Mathematics Curriculum Standards
(Compiled list of all standards for all Mathematics courses 6-8)

Students who demonstrate understanding of eighth grade mathematics are able to --

	Full Standard	Report Card Wording
	Number	
6-8.Math.N.1	Use a number line to locate, describe, and compare rational and irrational numbers.	Locate/describe/compare rational/irrational numbers.
6-8.Math.N.2	Solve real-world problems using fractions, decimals and percents.	Solve real-world problems using fractions/decimals/percents.
6-8.Math.N.3	Describe and explain percents greater than 100 and less than 1.	Describe/explain % > 100 and < 1.
6-8.Math.N.4	Develop models to compare relationships among percents, fractions, and decimals.	Develop models to compare percents/fractions/decimals.
6-8.Math.N.5	Recognize, represent, and perform operations with numbers in standard, exponential, scientific, and expanded forms.	Recognize/represent/perform operations in various forms.
6-8.Math.N.6	Compare the effects of using arithmetic operations with rational numbers.	Compare effects of using arithmetic operations with rational numbers.
6-8.Math.N.7	Simplify computations with rational numbers through the use of the associative and commutative properties of addition and multiplication and the distributive property of multiplication.	Simplify computations with rational numbers.
6-8.Math.N.8	Use inverse relationships: addition and subtraction, multiplication and division, squaring and finding square roots, cubing and finding cube roots, to simplify computations and solve problems.	Use inverse relationships to simplify computations/solve problems.

6-8.Math.N.9	Select appropriate methods and tools for computing with rational numbers from among mental computation, estimation, technology application, and paper and pencil, depending on the situation, and apply the selected methods.	Select appropriate methods/tools for computing with rational numbers.
6-8.Math.N.10	Develop and use strategies of estimation to determine the reasonableness of the results of rational-number computations.	Develop/use strategies of estimation.
6-8.Math.N.11	Recognize proportionality and use ratios and proportions to represent unknowns in quantitative relationships.	Use ratios/proportions to represent unknowns.
6-8.Math.N.12	Analyze real world situations to determine proportionality, and solve using multiple methods such as scaling, finding equivalent ratios, and using the means-extremes property.	Analyze real world situations to determine proportionality.
Algebra		
6-8.Math.A.1	Identify and describe different purposes for variables in mathematics.	Identify/describe purposes for variables in mathematics.
6-8.Math.A.2	Write and use algebraic equations and inequalities in order to represent situations and solve problems involving linear relationships.	Write/use algebraic equations/inequalities.
6-8.Math.A.3	Identify functions as linear or nonlinear, and contrast their properties in tables, graphs, or equations.	Identify functions as linear/nonlinear, and contrast properties in tables/graphs/equations.
6-8.Math.A.4	Identify linear functions as proportional or nonproportional and describe the difference.	Identify linear functions as proportional/nonproportional and describe the difference.
6-8.Math.A.5	Identify and describe relationships among equations, graphs, and tables of a function.	Identify/describe relationships among equations/graphs/tables of a function.

6-8.Math.A.6	Interpret the specific meaning of intercepts and slopes on graphs used in real world problems.	Interpret meaning of intercepts/slopes.
6-8.Math.A.7	Apply properties of integer exponents to numerical and algebraic expressions.	Apply properties of integer exponents to numerical/algebraic expressions.
6-8.Math.A.8	Identify and create equivalent forms for algebraic expressions.	Identify/create equivalent forms for algebraic expressions.
6-8.Math.A.9	Model and solve real-world problems using various representations, such as graphs, tables, and equations.	Model/solve real-world problems using various representations.
6-8.Math.A.10	Use various algebraic methods to solve systems of equations.	Use various algebraic methods to solve systems of equations.
Geometry		
6-8.Math.G.1	Describe, classify, and recognize relationships among types of 2D and 3D objects using their defining properties.	Describe/classify/recognize relationships among 2D/3D objects.
6-8.Math.G.2	Determine relationships among the angles, side lengths, perimeters, areas, surface areas and volumes of similar objects.	Determine relationships among similar objects.
6-8.Math.G.3	Create and critique inductive and deductive arguments concerning geometric ideas and relationships, including congruence, similarity, and the Pythagorean theorem.	Create/critique inductive/deductive arguments concerning geometric ideas.
6-8.Math.G.4	Use coordinate geometry to represent and describe the properties of geometric shapes, including regular polygons and those with pairs of parallel or perpendicular sides.	Represent/describe properties of geometric shapes.
6-8.Math.G.5	Translate, reflect, rotate, and dilate objects in the coordinate plane.	Translate/reflect/rotate/dilate objects in coordinate plane.

6-8.Math.G.6	Explain the congruence, similarity, and line or rotational symmetry of objects using transformations.	Explain congruence/similarity/line or rotational symmetry of objects.
6-8.Math.G.7	Draw geometric objects with specified properties, such as side lengths or angle measures.	Draw geometric objects with specified properties.
6-8.Math.G.8	Solve problems, such as those involving area, surface area, and volume, by composing/decomposing and by using 2D representations of 3D objects.	Solve problems by composing/decomposing.
6-8.Math.G.9	Create and use geometric models to represent and explain numerical and algebraic relationships, such as the solving of systems of equations.	Create models to represent/explain numerical/algebraic relationships.
6-8.Math.G.10	Apply relationships among angles: supplementary, complementary, vertical, adjacent angles, alternate (interior and exterior) angles, and corresponding, in real-world situations and mathematical problems.	Apply relationships among angles.
6-8.Math.G.11	Recognize and apply geometric ideas and relationships in areas such as art, science, and everyday life.	Recognize/apply geometric ideas in art/science/life.
Measurement		
6-8.Math.M.1	Select appropriate methods for estimating measurements.	Select appropriate methods for estimating measurements.
6-8.Math.M.2	Convert from one unit to another within the same system, both metric and customary.	Convert from one unit to another within the same system.
6-8.Math.M.3	Select and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.	Select/use units of appropriate size/type.
6-8.Math.M.4	Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision.	Accurately find measures.

6-8.Math.M.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 2D shapes.	Develop/use formulas to determine circumference/area.
6-8.Math.M.6	Develop strategies to determine the surface area and volume of selected prisms, pyramids, cylinders, cones, and spheres.	Develop strategies to determine surface area/volume.
6-8.Math.M.7	Solve problems involving scale factors, using ratios and proportions.	Solve problems involving scale factors.
6-8.Math.M.8	Solve problems involving rates and derived measurements for such attributes as velocity and density.	Solve problems involving rates and derived measurements.
Data Analysis and Probability		
6-8.Math.D.1	Select, create, and use appropriate graphical representations of data, including histograms, box plots, dot (or line) plots, stem-and-leaf plots, and scatterplots.	Select/create/use appropriate graphical representations of data.
6-8.Math.D.2	Find, use, and interpret measures of center and spread, including mean, median, mode, range and interquartile range.	Find/use/interpret measures of center and spread.
6-8.Math.D.3	Describe and discuss the correspondence between data sets and their graphical representations.	Describe/discuss correspondence between data sets/graphical representations.
6-8.Math.D.4	Use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken.	Make conjectures about populations from multiple samples.
6-8.Math.D.5	Form opinions about possible relationships between two characteristics of a sample on the basis of the scatterplot of the data and the approximate lines of fit.	Form opinions about possible relationships between two characteristics of sample.
6-8.Math.D.6	Identify events as complementary, independent, dependent, and mutually exclusive and describe what that means in the context of the data.	Identify events as complementary/independent/depen

		dent/mutually exclusive and describe in context.
6-8.Math.D.7	Compute probabilities for simple and compound events, using such methods as organized lists, tree diagrams, and area models.	Compute probabilities for simple/compound events.

Cross Content Literacy		
6-8.CL.1	Solve authentic problems through open-ended inquiry and ideation to build problem-solving techniques and learning in various contexts.	Solve authentic problems through open-ended inquiry/ideation.
6-8.CL.2	Summarize content-specific traditional texts and digital media in simpler but still accurate terms.	Summarize in simpler/accurate terms.
6-8.CL.3	Determine whether an author's perspective is in accord or discord with Catholic teaching.	Determine whether perspective of author is in accord/discord with Catholic teaching.
6-8.CL.4	Identify omitted information in a piece of published work and infer reasons for such omissions.	Identify omitted information in published work and infer reasons for omissions.
6-8.CL.5	Identify an author's claim, evidence, reasoning, and anticipated counterclaim in a published work.	Identify claim, evidence, reasoning, anticipated counterclaim.
6-8.CL.6	Explain a published work's purpose, tone, and structure in relation to the author's perspective and the intended audience.	Explain purpose/tone/structure.
6-8.CL.7	Determine the meanings of key terms and content-specific vocabulary as used in texts and media.	Determine meanings of key terms and content-specific vocabulary.
6-8.CL.8	Use content-specific vocabulary in the creation of texts or media.	Use content-specific vocabulary.

6-8.CL.9	Compare various domain-specific texts or media (i.e. historical primary sources, scientific research, videos, websites, etc.) in their structural features and design.	Compare various texts/media.
6-8.CL.10	Compare the claims, evidence, and reasoning of various arguments.	Compare claims/evidence/reasoning of various arguments.
6-8.CL.11	Present a clear understanding of a complex topic through the use of multiple relevant and useful sources of information.	Present a clear understanding of a complex topic.
6-8.CL.12	Accurately cite sources of information for use as evidence and reasoning to support an argument.	Accurately cite sources of information.
6-8.CL.13	Construct an argument using a claim, evidence, reasoning, and counterclaim to demonstrate understanding of a content-specific topic of inquiry.	Construct argument using claim, evidence, reasoning, counterclaim
6-8.CL.14	Use collaboration to connect with peers and experts to explore various topics.	Connect with peers/experts to explore topics.
6-8.CL.15	Inform and influence audiences, through verbal communication and the creation of media and writing, in order to proclaim the Word of God, share the teachings of Jesus Christ, and to promote the greater good of the community.	Inform/influence audiences to proclaim Word of God/promote greater good.
6-8.CL.16	Self-reflect, using metacognitive strategies, on the specific and individual processes and techniques used to complete academic tasks in order to assess progress toward academic goals.	Assess progress toward academic goals.

9-12 Mathematics Department Curriculum Standards
(combined list of all standards for all courses)

Students who demonstrate understanding of high school mathematics are able to --

Number	
HS.Math.N.1	Describe very large and very small numbers and use various representations of them.
HS.Math.N.2	Compare and contrast the properties of numbers and number systems, including the rational and real numbers, and use complex numbers as solutions to quadratic equations that do not have real solutions.
HS.Math.N.3	Use vectors as systems that have some of the properties of the real-number system.
HS.Math.N.4	Use matrices as systems that have some of the properties of the real-number system.
HS.Math.N.5	Use number-theory arguments to describe relationships involving whole numbers.
HS.Math.N.6	Describe the effects of multiplication, division, and computing powers and roots on the magnitudes of quantities.
HS.Math.N.7	Explain the properties of, and representations for, the addition and multiplication of vectors and matrices.
HS.Math.N.8	Use permutations and combinations as counting techniques.
HS.Math.N.9	Use mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases to develop fluency in operations with real numbers.
HS.Math.N.10	Use mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases to develop fluency in operations with matrices.
HS.Math.N.11	Decide the reasonableness of numerical computations and their results.
Algebra	
HS.Math.A.1	Identify and describe patterns using explicitly defined and recursively defined functions.
HS.Math.A.2	Select, convert, and use various representations for relations and functions.

HS.Math.A.3	Analyze functions of one variable by identifying rates of change, intercepts, zeros, asymptotes, and local and global behavior.
HS.Math.A.4	Perform transformations such as arithmetically combining, composing, and inverting commonly used functions, using technology to perform such operations on more-complicated symbolic expressions.
HS.Math.A.5	Compare the properties of classes of functions, including exponential, polynomial, rational, logarithmic, and periodic functions.
HS.Math.A.6	Interpret representations of functions of two variables.
HS.Math.A.7	Explain equivalent forms of expressions, equations, inequalities, and relations.
HS.Math.A.8	Write equivalent forms of equations, inequalities, and systems of equations and solve mentally or with paper and pencil in simple cases, and using technology in all cases.
HS.Math.A.9	Use symbolic algebra to represent and explain mathematical relationships.
HS.Math.A.10	Use a variety of symbolic representations, including recursive, for functions and relations.
HS.Math.A.11	Determine the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.
HS.Math.A.12	Identify essential quantitative relationships in a situation and determine the class or classes of functions that might model the relationships.
HS.Math.A.13	Use symbolic expressions, including iterative and recursive forms, to represent relationships arising from various contexts.
HS.Math.A.14	Determine reasonable conclusions about a situation being modeled.
HS.Math.A.15	Approximate and interpret rates of change from graphical and numerical data.
Geometry	
HS.Math.G.1	Identify properties and determine attributes of 2D and 3D objects.

HS.Math.G.2	Identify and describe relationships (including congruence and similarity) among classes of 2D and 3D geometric objects, make and test conjectures about them, and solve problems involving them.
HS.Math.G.3	Design a logical argument using properties, postulates, definitions, and theorems to prove something to be true, and critique similar arguments designed by others.
HS.Math.G.4	Use trigonometric relationships to determine lengths and angle measures.
HS.Math.G.5	Use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to describe geometric situations.
HS.Math.G.6	Explain conjectures and solve problems involving 2D and 3D objects represented with Cartesian coordinates.
HS.Math.G.7	Translate, reflect, rotate, and dilate objects in the plane by using sketches, coordinates, vectors, function notation, and matrices.
HS.Math.G.8	Describe the effects of simple transformations and their compositions using various representations or models.
HS.Math.G.9	Create representations of 2D and 3D geometric objects using a variety of tools.
HS.Math.G.10	Classify 3D objects and spaces from different perspectives based on their properties and determine their cross sections.
HS.Math.G.11	Use vertex-edge graphs to model and solve problems.
Measurement	
HS.Math.M.1	Make appropriate decisions about units and scales for problems and situations involving measurement.
HS.Math.M.2	Use precision and accuracy and determine approximate error in measurement situations.
HS.Math.M.3	Develop and use formulas for the area, surface area, and volume of geometric figures, including cones, spheres, cylinders, pyramids, cubes, and prisms.
HS.Math.M.4	Check measurement computations through the use of unit analysis.

	Data Analysis and Probability
HS.Math.D.1	Describe the differences among various kinds of studies and determine which types of inferences can legitimately be drawn from each.
HS.Math.D.2	Recall the characteristics of well-designed studies, including the role of randomization in surveys and experiments.
HS.Math.D.3	Recall the meaning of the following terms: measurement data, categorical data, univariate data, and bivariate data.
HS.Math.D.4	Use histograms, parallel box plots, and scatterplots to display data.
HS.Math.D.5	Compute basic statistics and make distinctions between a statistic and a parameter.
HS.Math.D.6	Display the distribution, describe the shape, and select and calculate summary statistics for univariate measurement data.
HS.Math.D.7	Display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients for bivariate measurement data using technological tools.
HS.Math.D.8	Display and discuss bivariate data where at least one variable is categorical.
HS.Math.D.9	Describe how linear transformations of univariate data affect shape, center, and spread.
HS.Math.D.10	Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled.
HS.Math.D.11	Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions.
HS.Math.D.12	Describe how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference.

HS.Math.D.13	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 the conclusions.
HS.Math.D.14	Construct sample spaces and probability distributions in simple cases.
HS.Math.D.15	Construct empirical probability distributions using simulations.
HS.Math.D.16	Compute and interpret the expected value of random variables in simple cases.
HS.Math.D.17	Describe the concepts of conditional probability and independent events.
HS.Math.D.18	Compute the probability of a compound event.
Calculus	
Calculus: Reasoning with definitions and theorems	
HS.Math.MPAC.1.a	Use definitions and theorems to build arguments, to justify conclusions or answers, and to prove results.
HS.Math.MPAC.1.b	Confirm that hypotheses have been satisfied in order to apply the conclusion of a theorem.
HS.Math.MPAC.1.c	Apply definitions and theorems in the process of solving a problem.
HS.Math.MPAC.1.d	Interpret quantifiers in definitions and theorems (e.g., "for all," "there exists").
HS.Math.MPAC.1.e	Develop conjectures based on exploration with technology.
HS.Math.MPAC.1.f	Produce examples and counterexamples to clarify understanding of definitions, to investigate whether converses of theorems are true or false, or to test conjectures.
Calculus: Connecting concepts	
HS.Math.MPAC.2.a	Relate the concept of a limit to all aspects of calculus.

HS.Math.MPAC.2.b	Use the connection between concepts (e.g., rate of change and accumulation) or processes (e.g., differentiation and its inverse process, antidifferentiation) to solve problems.
HS.Math.MPAC.2.c	Connect concepts to their visual representations with and without technology.
HS.Math.MPAC.2.d	Identify a common underlying structure in problems involving different contextual situations.
	Calculus: Implementing algebraic/computation processes
HS.Math.MPAC.3.a	Select appropriate mathematical strategies.
HS.Math.MPAC.3.b	Sequence algebraic/computational procedures logically.
HS.Math.MPAC.3.c	Complete algebraic/computational processes correctly.
HS.Math.MPAC.3.d	Apply technology strategically to solve problems.
HS.Math.MPAC.3.e	Attend to precision graphically, numerically, analytically, and verbally and specify units of measure.
HS.Math.MPAC.3.f	Connect the results of algebraic/computational processes to the question asked.
	Calculus: Connecting multiple representations
HS.Math.MPAC.4.a	Associate tables, graphs, and symbolic representations of functions.
HS.Math.MPAC.4.b	Develop concepts using graphical, symbolical, verbal, or numerical representations with and without technology.
HS.Math.MPAC.4.c	Identify how mathematical characteristics of functions are related in different representations.
HS.Math.MPAC.4.d	Extract and interpret mathematical content from any presentation of a function (e.g., utilize information from a table of values).
HS.Math.MPAC.4.e	Construct one representational form from another (e.g., a table from a graph or a graph from given information).

HS.Math.MPAC.4.f	Consider multiple representations (graphical, numerical, analytical, and verbal) of a function to select or construct a useful representation for solving a problem.
Calculus: Building notational fluency	
HS.Math.MPAC.5.a	Know and use a variety of notations.
HS.Math.MPAC.5.b	Connect notation to definitions (e.g., relating the notation for the definite integral to that of the limit of a Riemann sum).
HS.Math.MPAC.5.c	Connect notation to different representations (graphical, numerical, analytical, and verbal).
HS.Math.MPAC.5.d	Assign meaning to notation, accurately interpreting the notation in a given problem and across different contexts.
Calculus: Communicating	
HS.Math.MPAC.6.a	Clearly present methods, reasoning, justifications, and conclusions.
HS.Math.MPAC.6.b	Use accurate and precise language and notation.
HS.Math.MPAC.6.c	Explain the meaning of expressions, notations, and results in terms of a context (including units).
HS.Math.MPAC.6.d	Explain the connections among concepts.
HS.Math.MPAC.6.e	Critically interpret and accurately report information provided by technology.
HS.Math.MPAC.6.f	Analyze, evaluate, and compare the reasoning of others.

Cross-Content Literacy	
HS.CL.1	Solve authentic problems through open-ended inquiry and ideation in various contexts.

HS.CL.2	Paraphrase complex content-specific texts and media in simpler but still accurate terms.
HS.CL.3	Determine to what extent an author's work is in accord or discord with Catholic teaching.
HS.CL.4	Identify important issues that remain unresolved in a traditional text or digital media.
HS.CL.5	Identify the perspective, potential bias, and credibility of primary and secondary sources based on their maker, date, place of origin, intended audience, and intended purpose.
HS.CL.6	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as used in content-rich texts.
HS.CL.7	Use content-specific vocabulary in the creation of texts and media.
HS.CL.8	Identify and evaluate the claim, evidence, reasoning and counterclaims in a piece of published work, and verify or challenge the position by using other sources of information.
HS.CL.9	Analyze and compare the elements and structures of domain-specific published work (i.e. historical primary sources, scientific research, videos, websites, etc.).
HS.CL.10	Synthesize information from a range of sources to demonstrate a clear understanding of a complex topic.
HS.CL.11	Precisely and appropriately cite sources of information for use as evidence and reasoning to enhance an argument.
HS.CL.12	Construct an argument using precise claims, counterclaims, reasoning, and evidence to demonstrate understanding of a complex topic of inquiry.
HS.CL.13	Use collaboration to connect with peers and experts to explore various points of view on particular topics in various contexts.

HS.CL.14	Inform and influence audiences, through verbal communication and the creation of media and writing, for a variety of specific purposes, including to proclaim, defend, and share the teachings of our Catholic faith and to promote the greater good of society.
HS.CL.15	Use metacognitive strategies to examine the specific and individual processes and techniques used in completing various academic tasks in order to assess one's progress toward academic goals.

**Diocese of Grand Rapids
Office of Catholic Schools
Curriculum Standards
for Mathematics
in grades K-12**

Acknowledgements for Curriculum Standards for Mathematics

The Diocese of Grand Rapids Office of Catholic Schools Curriculum Standards for Mathematics in grades K-12 were drafted in reflection of

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Guernsey, Dan, and Denise Donohue. *Catholic Curriculum Standards*. The Cardinal Newman Society, 2016.

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Acknowledgements for Curriculum Standards for Cross-Content Literacy

The Diocese of Grand Rapids Curriculum Standards for Cross-Content Literacy in grades six through twelve were drafted in reflection of

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AP Chemistry Course Description. College Board, 2014.

AP Environmental Science Course Description. College Board, 2013.

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Seven Themes of Catholic Social Teaching. United States Conference of Catholic Bishops. 2005.

Standards for the English Language Arts. International Reading Association and National Council of Teachers of English, 1996.

Test Specifications for the Redesigned SAT. College Board, 2015.

Van Andel Education Institute (VAEI), 2017.

Note on **Shared-Time Teachers**

Shared-time teachers employed by local public school districts must comply with the curriculum guidelines of the local public school districts. Each is a Michigan public school as those terms are defined within the 1998 Public Act 339. The curriculum provided in those programs shall comply with all regulations required by Public Act 339.