The Diocese of Birmingham in Alabama
Catholic Schools Office

CATHOLIC SCHOOLS
DIOCESE OF BIRMINGHAM IN ALABAMA

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The Diocese of Birmingham in Alabama
Catholic Schools Office

Introduction to the Diocese of Birmingham
Mathematics Course of Study

Pope Benedict XVI, in his address to Catholic Educators in Washington, DC on April 17, 2008, stated that "Catholic schools are an outstanding apostolate of hope… addressing the material, intellectual and spiritual needs of three million children." He also said, "Education is integral to the mission of the Church to proclaim the good news." The United States Conference of Catholic Bishops, in their document, *Renewing our Commitment to Catholic Elementary and Secondary Schools in the Third Millennium* (2005), said "Our vision is clear: our Catholic schools are a vital part of the teaching mission of the Church…We must respond to challenging times with faith, vision and the will to succeed because the Catholic school's mission is vital to the future of our young people, our nation, and most especially to the Church."

The National Standards and Benchmarks for Effective Catholic Elementary and Secondary Schools (2012) was created to define the characteristics of Catholic schools and develop performance benchmarks to assist and support all those involved in Catholic education to assess, refine and continue with the Catholic Church's mission. The Nine Defining Characteristics of a Catholic school are:

1. Centered in the Person of Jesus Christ.
2. Contributing to the Evangelizing Mission of the Church.
3. Distinguished by Excellence.
4. Committed to Educate the Whole Child.
5. Steeped in a Catholic Worldview.
6. Sustained by Gospel Witness.
7. Shaped by Communion and Community.
8. Accessible to All Students.
9. Established by the Expressed Authority of the Bishop.

What do we mean by "Distinguished by Excellence?" "The academic program should be rigorous and doctrinally sound with curricular experiences that are rigorous, relevant, research-based, and infused with Catholic faith and traditions."(National Standards and Benchmarks for Effective Catholic Elementary and Secondary Schools, 2012.) Specifically, our instructional program must prepare students to live in the 21st century with all the skills and knowledge necessary to be successful. Benchmark 7.1 states "The curriculum adheres to appropriate, delineated standards, and is vertically aligned to ensure that every student successfully completes a rigorous and coherent sequence of academic courses based on the standards and rooted in Catholic values. "

The Diocesan Standards and Benchmarks for Mathematics were developed by teachers across the Diocese who contributed their expertise to this initiative. I would like to personally thank all those whose knowledge and commitment contributed to this document.

Fran Lawlor
Superintendent of Schools

Overview of Diocesan Mathematics Course of Study

The Diocesan Mathematics Course of Study contains the minimal content standards for each grade level or class and is intended to define essential content for each level. Each grade level Course of Study builds upon the previous and therefore it is imperative to understand the content contained in each separate grade/class and recognize it as required content for that grade. Each Course of Study can be enriched and strengthened by attending to the level of knowledge required to apply the content standard or skill in various situations. By strengthening the level of the depth of knowledge we challenge students to apply and transfer knowledge. This process will add rigor to the Course of Study as determined by the needs of the children we serve.

The Diocese of Birmingham in Alabama
Catholic Schools Office

Diocesan Standards of Practice

These standards are based on the *National Standards and Benchmarks for Effective Catholic Elementary and Secondary Schools.* The Diocesan Standards of Practice are gleaned from *Section Two: Academic Excellence Standards 7-9.* Four practice standards have been developed for the students and two for the classroom. These standards are applicable in all subject areas taught in our schools as well as any work that is an extension of our schools as they exemplify the positive Catholic identity for which we strive.

For students:

- Students will make connections to Gospel Values across content areas.
- Students will develop and demonstrate critical thinking, perseverance, and strong work habits.
- Students will be reflective, considerate problem solvers.
- Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

- Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.
- Students will be assessed frequently, fairly and with consideration for the whole child.

INSTRUCTIONS

A Perspective for the Mathematics Domains/Sub-Categories

"*Too often, mathematics instruction gives students the erroneous notion that learning math is all about learning procedures, rather than making sense of ideas…We should be mindful of what our students understand, not merely what they can do." Uncovering the Math Curriculum* by Marilyn Burns (Educational Leadership, October 2014).

Mathematics instruction today is moving away from memorization of facts and formulas to helping students understand the underlying concepts behind the formulas and procedures. The proficiencies students will need to acquire have been discussed in depth from several perspectives:

- The National Council of Teachers of Mathematics process standards include: problem solving, reasoning and proof, communication, representation, and connections. *Principles and Standards for School Mathematics.* Reston, Virginia: National Council of Teachers of Mathematics, 2000.
- The National Research Council's report identifies the following proficiencies: adaptive reasoning, conceptual understanding, procedural fluency, and productive disposition. Kilpatrick, Jeremy, Jane Swafford and Bradford Findell, Eds. *Adding It Up: Helping Children Learn Mathematics.* Washington. D.C.: Mathematics Learning Study Committee, National Research Council (NCR), 2001.
- Standard 7 of the National Catholic Standards and Benchmarks talks about the 21st century skills our students will need: the ability to be creative, reflective, literate, critical, and moral evaluators, problem solvers, decision makers, and socially responsible global citizens. *National Standards and Benchmarks for Effective Catholic Elementary and Secondary Schools.* Center for Catholic School Effectiveness, School of Education, Loyola University Chicago, in partnership with the Barbara and Patrick Roche Center for Catholic Education, Lynch School of Education, Boston College. (2012)

In her article, "*Knowing What We Teach and Teaching What We Know*," (1999, November) NCTM News Bulletin (online newsletter) Glenda Lappan, a past president of the National Council of Teachers of Mathematics, said: "*Our own content knowledge affects how we interpret the content goals we are expected to reach with our students. It affects the way we hear and respond to our students and their questions. It affects our ability to explain clearly and to ask good questions. It affects our ability to approach a mathematical idea flexibly with our students and to make connections. It affects our ability to push each student at that special moment when he or she is ready or curious. And it affects our ability to make those moments happen more often for our students."*

It is our hope that the Diocesan Standards and Benchmarks in Mathematics Guide will be a step in our goal of helping our students acquire the proficiencies and content knowledge necessary to be successful in college and the work place.

INSTRUCTIONS (Continue)

Organization of Mathematics Domains/Sub-Categories

Counting and Cardinality (Kindergarten only)

- Number names and count sequence.
- Counting to tell the number of objects.
- Comparing Numbers

Operations and Algebraic Thinking	K-5
Number and Operations in Base Ten	K-5
Number and Operations- Fractions	3-5
Measurement and Data	K-5
Geometry	K-8
Ratios and Proportional Relationships	6-7
The Number System	6-8
Expressions and Equations	6-8
Statistics and Probability	6-8
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Conceptual Categories for High School Mathematics

Number and Quantity

Algebra

Functions

Modeling

Geometry

Statistics and Probability

KINDERGARTEN
Mathematics Course of Study

The kindergarten mathematics course of study consists of five domains of focused study. The five domains are Counting and Cardinality, Operations and Algebraic Thinking, Number and Operations in Base Ten, Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All kindergarten mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Counting and Cardinality (CC)

- Know number names and the count sequence.
- Count to tell the number of objects.
- Compare numbers.

Operations and Algebraic Thinking (OA)

- Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

Number and Operations in Base Ten (NBT)

- Work with numbers 11-19 to gain foundations for place value.

Measurement and Data (MD)

- Describe and compare measureable attributes.
- Classify objects and count the number of objects in categories.

Geometry (G)

- Indentify and describe shapes.
- Analyze, compare, create, and compose shapes.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

CATHOLIC SCHOOLS

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Kindergarten

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Counting and Cardinality				
Sub-category: Know number names and the count sequence.				
K-CC1	Count to 100 by ones and tens.	Possible Extension: from a given number Ex. By 10's beginning at 40. 		
K-CC2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	Example: …26, 27, 		
K-CC3	Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).			
Sub-category: Count to tell the number of objects.				
K-CC4	Understand the relationship between numbers and quantities; connect counting to cardinality.	Example: Counting collections 		
K-CC4a	When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.			
K-CC4b	Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.	Example/extension: Provide various counting examples with a variety of objects increasing the quantity over time. 		
K-CC4c	Understand that each successive number name refers to a quantity that is one larger.	Example: Play +1 continuation games. 		
K-CC5	Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.	Example: Sort and count activities with various objects and quantities. 		

Kindergarten

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Counting and Cardinality				
Sub-category: Compare numbers.				
K-CC6	Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. (Include groups with up to ten objects.)			
K-CC7	Compare two numbers between 1 and 10 presented as written numerals.			
Domain: Operations and Algebraic Thinking				
Sub-category: Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.				
K-OA1	Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations. (Drawings need not show details, but should show the mathematics in the problem. This applies wherever drawings are mentioned in the Standards.)			
K-OA2	Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.			
K-OA3	Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation.	5 = 2+ 3 and 5 = 4 + 1		
K-OA4	For any number from 1 to 9, find the number that makes 10			
K-OA5	Fluently add and subtract within 6.			

Kindergarten

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Number and Operations in Base Ten				
Sub-category: Work with numbers 11-19 to gain foundations for place value.				
K-NBT1	Compose and decompose numbers from 11 to 19 into ten	By using objects or drawings, and record each composition		
Domain: Measurement and Data				
K-MD1	Describe measurable attributes of objects such as length or weight. Describe several measurable attributes of a single object.			
K-MD2	Directly compare two objects, with a measurable attribute in common, to see which object has "more of" or "less of" the attribute, and describe the difference.	Directly compare the heights of two children, and describe one child as taller or shorter.		
Classify objects and count the number of objects in each category.				
K-MD3	Classify objects into given categories; count the number of			
Domain: Geometry				
Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).				
K-G1	Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above, below, beside, in front of, behind,* and *next to*.			
K-G2	Correctly name shapes regardless of their orientations or overall size.			
K-G3	Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").			
Analyze, compare, create, and compose shapes.				
K-G4	Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts, and other attributes.	Number of sides and vertices or "corners" Having sides of equal length		
K-G5	Model shapes in the world by building shapes from components and drawing shapes.	Components = sticks and clay balls		
K-G6	Compose simple shapes to form larger shapes.	*Can you join these two triangles with full sides touching to make a rectangle?*		

FIRST GRADE
Mathematics Course of Study

The first grade mathematics course of study consists of four domains of focused study. The four domains are Operations and Algebraic Thinking, Number and Operations in Base Ten, Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All first grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Operations and Algebraic Thinking (OA)

- Represent and solve problems involving addition and subtraction.
- Understand and apply properties of operations and the relationship between addition and subtraction.
- Add and subtraction within 20.
- Work with addition and subtraction equations.

Number and Operations in Base Ten (NBT)

- Extend the counting sequence.
- Understand place value.
- Use place value understanding and properties of operations to add and subtract.

Measurement and Data (MD)

- Measure lengths indirectly and by iterating length units.
- Tell and write time.
- Represent and interpret data.

Geometry (G)

- Reason with shapes and their attributes.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

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First Grade

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
Sub-Category: Represents and solve problems involving addition and subtraction.				
1-OA1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	See Appendix A, Table 1		
1-OA2	Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20.	By using objects, drawings, and equations with a symbol for the unknown number to represent the problem.		
Sub-Category: Understand and apply properties of operations and the relationship between addition and subtraction.				
1-OA3	Apply properties of operations as strategies to add and subtract. (Students need not use formal terms for these properties.)	If 8+3= 11 is known, then 3 + 8= 11 is also known as Commutative property of addition. To add 2+ 6+ 4 , the second two numbers can be added to make a ten, so 2 + 6 + 4=2 +10 = 12 (Associative property of addition).		
1-OA4	Understand subtraction as an unknown-addend problem.	Subtract 10-8 by finding the number that makes 10 when added to 8.		
Sub-Category: Add and subtract within 20.				
1-OA5	Relate counting to addition and subtraction.	By counting on 2 to add 2.		

First Grade

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
1-OA6	Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten; decomposing a number leading to a ten; using the relationship between addition and subtraction; and creating equivalent but easier or known sums.	Examples: making tens 8+6 = 8+2 + 4= 10 + 4= 14; decomposing a number leading to ten 13-4= 13-3 -1 = 10-1= 9; using the relationship between addition and subtraction knowing that 8 + 4 = 12, one know 12-8 = 4; creating equivalent but easier or known sums adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13		
Sub-Category: Work with addition and subtraction equations.				
1-OA7	Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.	Which of the following equations are true and which are false: 6 =6, 7 = 8-1, 5 + 2 =2 + 5, 4 + 1 = 5 + 2?		
1-OA8	Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.	Determine the number that makes the equation true in each of the equations, 8 + ? = 11, 5 = _ -3, and 6 + 6 = _		
Domain: Number and Operation in Base Ten				
Sub-Category: Extend the counting sequence.				
1-NBT1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.			
1-NBT2	Skip Count by 2's to 30 and 5's to 100.			
1-NBT3	Count backwards from a given number to zero			
1-NBT4	Identify position using ordinal number through 10th	Possible Extension: Identify position using ordinal number through 20th		
1-NBT5	Differentiate between odd and even numbers			
1-NBT6	Represent numbers with multiple models.			
1-NBT7	Estimate the number of objects in sets that contain up to 100 objects.			
Sub-Category: Understand place value.				
1-NBT8	Understand that the two digits of a two-digit number represent amounts of tens and ones.	Possible Extension: Understand that three digit numbers represent hundreds, tens, and ones.		

First Grade

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
1-NBT8a	10 can be thought of as a bundle of ten ones, called a "ten."			
1-NBT8b	The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.			
1-NBT8c	The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).			
1-NBT9	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.			
Use place value understanding and properties to add and subtract.				
1-NBT10	Add within 100, including adding a two-digit number and a one-digit number and adding a two- digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations.			
1-NBT11	Understand the relationship between addition and subtraction; relate the strategy to a written method, and explain the reasoning used; create fact families using related facts.			
1-NBT12	Understand that in adding two-digit numbers, add tens and tens, ones and ones; and sometimes it is necessary to compose a ten.			
1-NBT13	Given a two-digit number, mentally find 10 more or 10 less than the number without having to count; explain the reasoning used.	Possible Extension: Identify a number before, after, and between a given number.		

First Grade

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taug
1-NBT14	Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method, and explain the reasoning used.			
Measurement and Data				
1-MD1	Order three objects by length; compare the lengths of two objects indirectly by using a third object using both standard and non-standard units of measurement.			
1-MD2	Express the length of an object as a whole number of length units by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.	*Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*		
1-MD3	Tell and write time in hours and half-hours using analog and digital clocks.			
Geometry				
Reason with shapes and their attributes.				
1-MD4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.			

First Grade

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taug
1-MD5	Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non- defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.	Possible Extension: Identify two dimensional shapes as faces of three dimensional figures.		
1-MD6	Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. (Students do not need to learn formal names such as "right rectangular prism.")			
MD7	Identify real-life examples of line of symmetry. 			
1-MD8	Partition circles and rectangles into two and four equal shares; describe the shares using the words *halves, fourths,* and *quarters;* and use the *phrases half of, fourth of,* and *quarter* of. Describe the whole as two of, or four of the shares. Understand that decomposing into more equal shares creates smaller shares.			

SECOND GRADE
Mathematics Course of Study

The second grade mathematics course of study consists of four domains of focused study. The four domains are Operations and Algebraic Thinking, Number and Operations in Base Ten, Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All second grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Operations and Algebraic Thinking (OA)

- Represent and solve problems involving addition and subtraction.
- Add and subtraction within 20.
- Work with equal groups of objects to gain foundations for multiplication.

Number and Operations in Base Ten (NBT)

- Understand place value.
- Use place value understanding and properties of operations to add and subtract.

Measurement and Data (MD)

- Measure and estimate lengths in standard units.
- Relate addition and subtraction to length.
- Work with time and money.
- Represent and interpret data.

Geometry (G)

- Reason with shapes and their attributes.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will **develop** and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

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Second Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
Sub-category: Represent and solve problems involving addition and subtraction				
2-OA1	Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	(See Appendix A, Table 1.)		
Sub-category: Add and subtract within 20.				
2-OA2	Fluently add and subtract within 20 using mental strategies.			
2-OA3	Determine whether a group of objects (up to 20) has an odd or even number of members; write an equation to express an even number as a sum of two equal addends.	Possible Extension: with larger groups		
2-OA4	Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.			
Number and Operation in Base Ten				
Sub-category: Understand place value.				
2-NBT1	Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases: see a & b			
2-NBT1a	100 can be thought of as a bundle of ten tens, called a "hundred."			
2-NBT1b	The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).			
2-NBT2	Count within 1000; skip-count by 2s, 5s, 10s, and 100s.			
2-NBT3	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.			

Second Grade				
Area-Grade	**Content Standards In Action (I can…/Students will…)**	**Example(s)/Possible Extensions**	**Suggested Time of Focus**	**Date Taught**
2-NBT4	Compare two 4-digit numbers based on meanings of the hundreds, tens, and ones digits using **>, =,** and **<** symbols to record the results of comparisons and order from least to greatest, greatest to least.			
Sub-category: Use place value understanding and properties of operations to add and subtract.				
2-NBT5	Fluently add and subtract within 1,000 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.			
2-NBT6	Add up to four two-digit numbers using strategies based on place value and properties of operations.			
2-NBT7	Add and subtract within 1000 using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.			
2-NBT8	Mentally add 10 or 100 to a given number 100 – 900, and mentally subtract 10 or 100 from a given number 100 – 900.			
2-NBT9	Explain why addition and subtraction strategies work, using place value and the properties of operations. (Explanations may be supported by drawings or objects.)			
Domain: Measurement and Data				
Sub-category: Measure and estimate lengths in standard units.				
2-MD1	Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.			

Second Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
2-MD2	Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.			
2-MD3	Estimate lengths using units of inches, feet, centimeters, and meters.			
2-MD4	Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.			
Sub-Category: Relate addition and subtraction to length.				
2-MD5	Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.			
2-MD6	Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2…, and represent whole-number sums and differences within 100 on a number line diagram.			
Sub-Category: Word with time and money.				
2-MD7	Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.	Possible extensions: Know half past / quarter past / quarter till		
2-MD8	Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.	Example: If you have 2 dimes and 3 pennies, how many cents do you have? Possible extensions: dollar coins and half dollars.		
Sub-category: Represent and interpret data.				
2-MD9	Generate measurement data by measuring lengths of several objects to the nearest whole unit or by making repeated measurements of the same object. Show the measurements by making a line plot where the horizontal scale is marked off in whole-number units.			

Second Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
2-MD10	Draw a picture graph, a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	(See Appendix A, Table 1)		
Geometry				
Sub-category: Reason with shapes and their attributes.				
2-G1	Recognize and draw shapes having specified attributes such as a given number of angles or a given number of equal faces. (Sizes are compared directly or visually, not compared by measuring.) Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. Solid figures.			
2-G2	Partition a rectangle into rows and columns of same-size squares, and count to find the total number of them.			
2-G3	Partition circles and rectangles into two, three, or four equal shares; describe the shares using the words *halves, thirds, half of, a third of,* etc.; and describe the whole as two halves, three thirds, or four fourths. Recognize that equal shares of identical wholes need not have the same shape.			

THIRD GRADE
Mathematics Course of Study

The third grade mathematics course of study consists of five domains of focused study. The five domains are Counting and Cardinality, Operations and Algebraic Thinking, Number and Operations in Base Ten, Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All third grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Operations and Algebraic Thinking (OA)

- Represent and solve problems involving multiplication and division.
- Understand properties of multiplication and the relationship between multiplication and division.
- Multiply and divide within 100.
- Solve problems involving the four operations, and identify and explain patterns in arithmetic.

Number and Operations in Base Ten (NBT)

- Use place value understanding and properties of operations to perform multi-digit arithmetic.

Number and Operations – Fractions (NF)

- Develop understanding of fractions as numbers.

Measurement and Data (MD)

- Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
- Represent and interpret data.
- Geometric measurement: understand concepts of area and relate area to multiplication and to addition.
- Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

Geometry (G)

- Reason with shapes and their attributes.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
Sub-category: Represent and solve problems involving multiplication and division.				
3-OA1	Interpret products of whole numbers	Example: a) interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each b) Describe a contact in which a total number of objects can be expressed as 5 x 7		
3-OA2	Interpret whole-number quotients of whole numbers interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.	Example: Describe a context in which a number of shares or a number if groups can be expressed as 56 ÷ 8		
3-OA3	Use multiplication and division within 144 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	See Appendix A, Table 2		
3-OA4	Determine the unknown whole number in a multiplication or division equation relating three whole numbers.	Determine the unknown number that makes the equation true in each of the equations, 8 x ? = 48, 5 = □ ÷ 3, and 6 x6 = ?.		
Sub-category: Understand properties of multiplication and the relationship between multiplication and division.				
3-OA5	Apply properties of operations as strategies to multiply and divide.	Example: If 6 x 4 = 24 is known, then 4 x 6 = 24 is also known (commutative property of multiplication). 3 x 5 x 2 can be found by 3 x 5 = 15, then 15 x 2 = 30, or by 5 x 2 = 10, then 3 x 10 = 30 (Associative property of multiplication). Knowing that 8 x 5 =40 and 8 x 2 = 16, one can find 8 x 7 as 8 (5 + 2) = (8 x 5) + (8 x 2) = 40 + 16 = 56 (Distributive property).		
3-OA6	Understand division as an unknown-factor problem.	Find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.		

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Sub-category: Multiply and divide within 100.				
3-OA7	Fluently multiply and divide within 144, using strategies such as the relationship between multiplication and division (e.g., knowing that 8×5=40, one knows 40÷5=8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.			
Sub-category: Solve problems involving the four operations, and identify and explain patterns in arithmetic.				
3-OA8	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Note: Only problems with whole-numbers and whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).			
3-OA9	Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.	Example: Observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.		
Domain: Number and Operations in Base Ten				
Sub-category: Use place value understanding and properties of operations to perform multi-digit arithmetic (A range of algorithms may be used).				
3-NBT1	Use place value understanding to round whole numbers to the nearest 10 and 100.	Possible Extension: whole numbers to nearest 1,000		
3-NBT2	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.			
3-NBT3	Multiply one-digit whole numbers by multiples of 10 in the range 10-90 using strategies based on place value and properties of operations.	Example: 9x80, 5x60, 4x40		

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Number and Operations-Fractions (limited to fractions with denominators 2,3,4, 6, and 8)				
Sub-category: Develop understanding of fractions as numbers.				
3-NF1	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts and size 1/b.			
3-NF2	Understand a fraction as a number on the number line; represent fractions on a number line diagram.			
3-NF2a	Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line.			
3-NF2b	Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.			
3-NF3	Explain equivalence of fractions in special cases/using pictorial representation , and compare fractions by reasoning about their size.			
3-NF3a	Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line.			
3-NF3b	Recognize and generate simple equivalent fractions. Explain why the fractions are equivalent, e.g., by using a visual fraction model.			
3-NF3c	Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.	Example: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.		

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
3-NF3d	Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.			
Domain: Measurement and Data				
Sub-category: Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.				
3-MD1	Tell and write time to the nearest minute, and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.			
3-MD2	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Excludes compound units such as cm3 and finding the geometric volume of a container. Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units to represent the problem. (Excludes multiplicative comparison problems (problems involving notions of "times as much").	See Appendix A, Table 2		
Sub-category: Represent and interpret data.				
3-MD3	Draw and compare a scaled picture graph, scaled bar graph, and Venn (s) to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.	Example: Draw a bar graph in which each square in the bar graph might represent 5 pets.		

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
3-MD4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters.			
Sub-category: Geometric measurement: understand concepts of area and relate area to multiplication and to addition.				
3-MD5	Recognize area as an attribute of plane figures, and understand concepts of area measurement.			
3-MD5a	A square with side length 1 unit called "a unit square," is said to have "one square unit" of area and can be used to measure area.			
3-MD5b	A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.			
3-MD6	Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).			
3-MD6	Relate area to the operations of multiplication and addition.			
3-MD6a	Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.			
3-MD6b	Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.			
3-MD6c	Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.			

Third Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
3-MD6d	Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems.			
Sub-category: Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.				
3-MD8	Solve real-world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.			
Domain: Geometry				
Sub-category: Reason with shapes and their attributes.				
3-G1	Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.			
3-G2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.	Example: Partition a shape into 4 parts With equal area, and describe the area of each part as ¼ of the area of the shape.		

FOURTH GRADE
Mathematics Course of Study

The fourth grade mathematics course of study consists of five domains of focused study. The five domains are Operations and Algebraic Thinking, Number and Operations in Base Ten, Number and Operations – Fractions, Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All fourth grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Operations and Algebraic Thinking (OA)

- Use the four operations with whole numbers to solve problems.
- Gain familiarity with factors and multiples.
- Generate and analyze patterns.

Number and Operations in Base Ten (NBT)

- Generalize place value understanding for multi-digit whole numbers.
- Use place value understanding and properties of operations to perform multi-digit arithmetic.

Number and Operations – Fractions (NF)

- Extend understanding of fractions equivalence and ordering.
- Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers.
- Understand decimal notation for fractions, and compare decimal fractions.

Measurement and Data (MD)

- Solve problems involving measurement and conversion of measurement from a larger unit to a smaller one.
- Represent and interpret data.
- Geometric measurement: understand concepts of angle and measure angles.

Geometry (G)

- Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
Sub-category: Use the four operations with whole numbers to solve problems.				
4-OA1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.			
4-OA2	Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.	Appendix A, Table 2		
4-OA3	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.			
Sub-category: Gain familiarity with factors and multiples.				
4-OA4	Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.			

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Sub-category: Generate and analyze patterns.				
4-OA5	Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.	Example: Given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence, and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.		
Domain: Number and Operations in Base Ten (limited to whole numbers less than or equal to 1,000,000)				
Sub-category: Generalize place value understanding for multi-digit whole numbers.				
4-NBT1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.	Example: Recognize that $700 \div 70 = 10$ by applying concepts of place value and division.		
4-NBT2	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.			
4-NBT3	Use place value understanding to round multi-digit whole numbers to any place.			
Sub-category: Use place value understanding and properties of operations to perform multi-digit arithmetic.				
4-NBT4	Fluently add and subtract multi-digit whole numbers using the standard algorithm.			
4-NBT5	Multiply a whole number of up to four digits by a one-digit and whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.			

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
4-NBT6	Find whole-number quotients and remainders with up to four-digit dividends and one-digit and divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.			
Domain: Number and Operations-Fractions (limited to fractions with denominators 2,3,4,5,6,8,10,12, and 100)				
Sub-category: Extend understanding of fractions equivalence and ordering.				
4-NF1	Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.			
4-NF2	Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators or by comparing to a benchmark fraction such as ½.			
4-NF2a	Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.			
Sub-category: Build fractions from unit fractions by applying and extending previous understandings of operations on the whole number.				
4-NF3	Understand a fraction a/b with a > 1 as a sum of fractions 1/b.			
4-NF3a	Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.			

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
4-NF3b	Decompose a fraction into a sum of fractions with the same denominators in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model.	Example: ⅜ = ⅛ + ⅛ + ⅛; ⅜ = ⅛ + 3/8; 2⅛ = 1 + 1 + ⅛ = 8/8 + 8/8+ ⅛		
4-NF3c	Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.			
4-NF3d	Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.			
4-NF4	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.			
4-NF4a	Understand a fraction a/b as a multiple of 1/b.	Example: Use a visual fraction model to represent ⁵⁄₄ as the product 5 x (¼), recording the conclusion by equation ⁄ = 5 x (¼).		
4-NF4b	Understand a multiple of a/b as a multiple of 1/b, and use this understanding to multiply a fraction by a whole number.	Use a visual fraction model to express 3 x (⅖) as 6 x (⅕), recognizing this product as ⁶⁄₅. (In general, n x (a/b) = (nxa)/b.)		
4-NF4c	Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem.	Example: If each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between which two whole numbers does your answer lie?		

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Sub-category: Understand decimal notation for fractions, and compare decimal fractions.				
4-NF5	Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. (Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.)	Example: Express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.		
4-NF6	Use decimal notation for fractions with denominators 10 or 100.	Example: Rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.		
4-NF7	Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.			
Domain: Measurement and Data				
Sub-category: Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.				
4-MD1	Know relative sizes of measurement units within one system of units, including km, m, cm; kg, g; lb, oz; l, ml; and hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.	Example: Know that 1 ft is 12 times as long as 1 in. Express then length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),…		

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
4-MD2	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.			
4-MD3	Apply the area, perimeter, and volume formulas for rectangles in real-world and mathematical problems.	Example: Find the width of a rectangular room given the area of the flooring and the length by viewing the area formula a s multiplication equation with an unknown factor.		
Sub-category: Represent and interpret data.				
4-MD4	Make a line plot to display a data set of measurements in fractions of a unit (1/2 , 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.	Example: From a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.		
Sub-category: Geometric measurement: understand concepts of angle and measure angles.				
4-MD5	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.			
4-MD5a	An angle is measured with reference to a circle with its center at the common endpoint of the rays by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a one-degree angle" and can be used to measure angles.			
4-MD5b	An angle that turns through n one-degree angles is said to have an angle measure of *n* degrees			

Fourth Grade

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
4-MD6	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.			
4-MD7	Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real-world or mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.			
Geometry				
Sub-category: Draw and identify lines and angles, and classify shapes by properties of their lines and angles.				
4-G1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.			
4-G2	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.			
4-G3	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.			

FIFTH GRADE
Mathematics Course of Study

The fifth grade mathematics course of study consists of five domains of focused study. The five domains are Operations and Algebraic Thinking, Number and Operations in Base Ten, Number and Operations-Fractions (NF), Measurement and Data, and Geometry. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All fifth grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Operations and Algebraic Thinking (OA)

- Write and interpret numerical expressions.
- Analyze patterns and relationships.

Number and Operations in Base Ten (NBT)

- Understand the place system.
- Perform operations with multi-digit whole numbers and with decimals to hundredths.

Number and Operations – Fractions (NF)

- Use equivalent fractions as a strategy to add and subtract fractions.
- Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

Measurement and Data (MD)

- Convert like measurement units within a given measurement system.
- Represent and interpret data.
- Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

Geometry (G)

- Graph points on the coordinate plane to solve real-world and mathematical problems.
- Classify two-dimensional figures into categories based on their properties.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

CATHOLIC SCHOOLS

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Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Operations and Algebraic Thinking				
Write and interpret numerical expressions.				
5-**OA1**	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	Example: (27 + 18) x 12 = _____		
5-OA2	Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.	Example: Express the calculation "add 8 and 7, then multiply by 2" as 2 x (8x7). Recognize that 3 x (18,932 + 921) is three times as large as 18,932 + 921, without having to calculate the indicated sum or product.		
Analyze patterns and relationships.				
5-OA3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.	Example: Given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.		
Domain: Number and Operations in Base Ten				
Understand the place value system.				
5-NBT1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.			
5-NBT2	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	Example: Write 10^5 as a whole number. 10^5 = 10 x 10 x 10 x 10 x 10 = 100,000		
5-NBT3	Read, write, and compare decimals to thousandths.			
5-NBT3a	Read and write decimals to thousandths using base-ten numerals, number names, and expanded form.	Example: 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3x (1/10) + 9x (1/100) + 2x(1/1000)		
5-NBT3b	Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	Example: Use >, <, or = to compare the numbers: 0.087_____0.010		

Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
5-NBT4	Use place value understanding to round decimals to any place.			
5-NBT5	Fluently multiply multi-digit whole numbers using the standard algorithm or models.	Example: 2,564 x 379 = ———————— 		
5-NBT6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.			
5-NBT7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method, and explain the reasoning used.			
Domain: Number and Operations - Fractions				
Use equivalent fractions as a strategy to add and subtract fractions.				
5-NF1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.	Example: 2/3 + 5/4 = 8/12 + 15/12 = 23/12 (In general, a/b + c/d = (ad +bc)/bd		
5-NF2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally, and assess the reasonableness of answers.	Example: Recognize an incorrect result 2/5 + 1/2 = 3/7 by observing that 3/7 < 1/2		

Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
5-NF4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.			
5-NF4a	Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, b as the result of a sequence of operations $a \times q \div b$.	Example: Use a visual fraction model to show (2/3) x 4 = 8/3, and create a story context for this equation. Do the same with (2/3) x (4/5) = 8/15. [In general, (a/b) x (c/d) = ac/bd.]		
5-NF4b	Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.			
5-NF5	Interpret multiplication as scaling (resizing).			
5-NF5a	Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.			
5-NF5b	Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case), explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number, and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.	Example: 3/4 x 9 is the same as 3 x 9/ 4 x 1 		
5-NF6	Solve real-world problems involving multiplication of fractions and mixed numbers.	Example: Use visual-fraction models or equations to represent the problem.		

Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
5-NF7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division. However, division of a fraction by a fraction is not a requirement at this grade.)			
5-NF7a	Interpret division of a unit fraction by a nonzero whole number, and compute such quotients.	Example: Create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) x 4 = 1/3		
5-NF7b	Interpret division of a whole number by a unit fraction, and compute such quotients.	4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 x (1/5) = 4		
5-NF7c	Solve real-world problems involving division of unit fractions by nonzero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem.	Example: How much chocolate will each person get if 3 people share 1/2 lb. of chocolate equally? How many 1/3 cup servings are in 2 cups of raisins?		
Domain: Measurement and Data				
Convert like measurement units within a given measurement system.				
5-MD1	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multistep, real-world problems.			
Represent and interpret data.				
5-MD2	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations as fractions for this grade to solve problems involving information presented in line plots.	Example: Given different measurements of liquid in identical breakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.		

Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.				
5-MD3	Recognize volume as an attribute of solid figures, and understand concepts of volume measurement.			
5-MD3a	A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.			
5-MD3b	A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.			
5-MD4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units.			
5-MD5	Relate volume to the operations of multiplication and addition, and solve real-world and mathematical problems involving volume.			
5-MD5a	Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, (e.g. Represent the associative property of multiplication).			
5-MD5b	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.			
5-MD5c	Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.			

Fifth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Geometry				
Graph points on the coordinate plane to solve real-world and mathematical problems.				
5-G1	Use a pair of perpendicular number lines, called axes, to define a coordinate system with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond.	Example: x-axis and the x-coordinate, y-axis and y-coordinate		
5-G2	Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.			
Classify two-dimensional figures into categories based on their properties.				
5-G3	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.	Example: All rectangles have four right angles, and squares and rectangles, so all squares have four right angles.		
5-G4	Classify two-dimensional figures in a hierarchy based on properties.			

SIXTH GRADE
Mathematics Course of Study

The sixth grade mathematics course of study consists of five domains of focused study. The five domains are Ratios and Proportional Relationships, The Number System, Expressions and Equations, Geometry, and Statistics and Probability. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All sixth grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Ratios and Proportional Relationships (RP)

- Understand ratio concepts and use ratio reasoning to solve problems.

The Number System (NS)

- Apply and extend previous understanding of multiplication and division to divide fractions by fractions.
- Compute fluently with multi-digit numbers and find common factors and multiples.
- Apply and extend previous understanding of numbers to the system of rational numbers.

Expressions and Equations (EE)

- Apply and extend previous understanding of arithmetic to algebraic expressions.
- Reason about and solve one-variable equations and inequalities.
- Represent and analyze quantitative relationships between dependent and impendent variables.

Geometry (G)

- Solve real-world problems and mathematical problems involving area, surface area, and volume.

Statistics and Probability (SP)

- Develop understanding of statistical variability.
- Summarize and describe distributions.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

CATHOLIC SCHOOLS

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Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Ratios and Proportional Relationships				
Subcategory: Understand ratio concepts and use ratio reasoning to solve problems.				
6-RP1	Understand the concept of a ratio, and use ratio language to describe a ratio relationship between two quantities.	Example: "The ratio of wings to beaks in the bird house at the zoo was 2:1 because for every 2 wings there was 1 beak. "For every vote candidate A received, candidate C received nearly three votes."		
6-RP2	Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.	Example: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is a 3/4 cup of flour for each cup of sugar. "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger." (Expectations for unit rates in this grade are limited to non-complex fractions.)		
6-RP3	Use ratio and rate reasoning to solve real-world and mathematical problems.	Example: By reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations		
6-RP3a	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.	Example: Plot Values		
6-RP3b	Solve unit rate problems including those involving unit pricing and constant speed.	Example: If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?		
6-RP3c	Find a percent of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percent.	Example: 30% of a quantity means 30/100 times the quantity		
6-RP3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	Possible extension: know conversion of metric system		

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: The Number System				
Subcategory: Apply and extend previous understandings of multiplication and division to multiply and divide fractions.				
6-NS1	Interpret and compute quotients of fractions, and solve word problems involving division of fractions, e.g., by using visual fraction models and equations to represent the problem.	Example: Create a story context for (⅔) ÷ (¾), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (⅔) ÷ (¾) = 8/9 because ¾ of 8/9 is ⅔. [In general, *(a/b)/(c/d)=ad/bc.]* How much chocolate will each person get if 3 people share ½ lb. of chocolate equally? How many ¾ cup servings are in ¾ of a cup of yogurt? How wide is a rectangular strip of land with length ¾ mi and area ½ square mi?		
Subcategory: Compute fluently with multi-digit numbers and find common factors and multiples.				
6-NS2	Fluently divide multi-digit numbers using the standard algorithm.			
6-NS3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.			
6-NS4	~Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. ~Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. ~Add by using prime factorizations 	Example: Express 36 + 8 as 4(9 + 2).		
Subcategory: Apply and extend previous understandings of numbers to the system of rational numbers.				
6-NS5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts explaining the meaning of 0 in each situation.	Example: Temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge		

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
6-NS6	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.			
6-NS6a	Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, and that 0 is its own opposite.	Example: -(-3) = 3, and that 0 is its own opposite		
6-NS6b	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.			
6-NS6c	Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.			
6-NS7	Understand ordering and absolute value of rational numbers.			
6-NS7a	Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.	Example: Interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.		
6-NS7b	Write, interpret, and explain statements of order for rational numbers in real-world contexts.	Example: Write -3 C > -7 C to express the fact that -3 C is warmer than -7 C.		
6-NS7c	Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real- world situation.	Example: For an account balance of -30 dollars, write |-30| = 30 to describe the size of the debt in dollars.		
6-NS7d	Distinguish comparisons of absolute value from statements about order.	Example: Recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.		
6-NS8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.			

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Expressions and Equations				
Subcategory: Apply and extend previous understandings of arithmetic to algebraic expressions.				
6-EE1	Write and evaluate numerical expressions involving whole-number exponents.			
5-NF6	Write, read, and evaluate expressions in which letters stand for numbers.			
6-EE2a	Write expressions that record operations with numbers and with letters standing for numbers.	Example: Express the calculation, "Subtract y from 5," as $5 - y$.		
6-**EE2b**	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.	Example: Describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.		
6-EE2c	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).	Example: Use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = ½$.		
6-EE3	Apply the properties of operations to generate equivalent expressions.	Example: Apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.		
6-EE4	Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them).	Example: The expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y represents.		

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Subcategory: Reason about and solve one-variable equations and inequalities.				
6-EE5	Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	Example: Arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give argument in terms of transversals why this is so.		
6-EE6	Use variables to represent numbers, and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set.			
6-EE7	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, and x are all nonnegative rational numbers.			
6-EE8	Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x>c or x<c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.			
Subcategory: Represent and analyze quantitative relationships between dependent and independent variables.				
6-EE9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.	Example: In a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.		

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Geometry				
Subcategory: Solve real-world and mathematical problems involving area, surface area, and volume.				
6-G1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.			
6-G2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.			
6-G3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.			
6-G4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.			
Domain: Statistics and Probability				
Subcategory: Develop understanding of statistical variability.				
6-SP1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.	Example: "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.		

Sixth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
6-SP2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.			
6-SP3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.			
Subcategory: Summarize and describe distributions.				
6-SP4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.			
6-SP5	Summarize numerical data sets in relation to their context.			
6-SP5a	Reporting the number of observations.			
6-SP5b	Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.			
6-SP5c	Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation) as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.			
6-SP5d	Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.			

SEVENTH GRADE
Mathematics Course of Study

The seventh grade mathematics course of study consists of five domains of focused study. The five domains are Ratios and Proportional Relationships, The Number System, Expressions and Equations, Geometry and Statistics and Probability. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All seventh grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

Ratios and Proportional Relationships (RP)

- Analyze proportional relationships and use them to solve real-world and mathematical problems.

The Number System (NS)

- Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers.

Expressions and Equations (EE)

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Geometry (G)

- Draw, construct, and describe geometrical figures and describe the relationships between them.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

Statistics and Probability (SP)

- Use random sampling to draw inferences about a population.
- Draw informal comparative inferences about two-populations.
- Investigate chance processes and develop, use, and evaluate probability models.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

CATHOLIC SCHOOLS

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Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Ratios and Proportional Relationships				
Subcategory: Analyze proportional relationships and use them to solve real-world and mathematical problems.				
7-RP1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units.	Example: If a person walks ½ mile in each ¼ hour, compute the unit rate as the complex fraction ½ / ¼ miles per hour, equivalently 2 miles per hour.		
7-RP2	Recognize and represent proportional relationships between quantities.			
7-RP2a	Decide whether two quantities are in a proportional relationship.	Example: By testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.		
7-RP2b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.			
7-RP2c	Represent proportional relationships by equations.	Example: If total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t=pn$		
7-RP2d	Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.			
7-RP3	Use proportional relationships to solve multistep ratio and percent problems.	Example: Sample problems may involve simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, and percent error.		
Domain: The Number System				
Subcategory: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.				
7-NS1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers and fractions; represent addition and subtraction on a horizontal or vertical number line diagram.			

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
7-NS1a	Describe situations in which opposite quantities combine to make 0.	Example: Two negatives make a positive, and two positives make a negative.		
7-NS1b	Understand $p+q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.			
7-NS1c	Understand subtraction of rational numbers as adding the additive inverse, $p-q=p+(-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.			
7-NS1d	Apply properties of operations as strategies to add and subtract rational numbers.			
7-NS2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.			
7-NS2a	Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1)=1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.			
7-NS2b	Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with nonzero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p/q) = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.			
7-NS2c	Apply properties of operations as strategies to multiply and divide rational numbers.			

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
7-NS2d	Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.			
7-NS3	Solve real-world and mathematical problems involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)			
Domain: Expressions and Equations				
Subcategory: Use properties of operations to generate equivalent expressions.				
7-EE1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.			
7-EE2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem, and how the quantities in it are related.	Example: a + 0.05a= 1.05a means that "increase by 5%" is the same as "multiply by 1.05."		
Subcategory: Solve real-world and mathematical problems using numerical and algebraic expressions and equations.				
5-NF6	Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form, convert between forms as appropriate, and assess the reasonableness of answers using mental computation and estimation strategies.	Example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9¾ inches long in the center of a door that is 27½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.		
7-EE4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.			
7-EE4a	Solve word problems leading to equations of the form $px+q=r$ and $p(x+q)=r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.	Example: The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?		

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
7-EE4b	Solve word problems leading to inequalities of the form $px+q>r$ or $px+q<r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem.	Example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write and inequality for the number of sales you need to make, and describe the solutions.		
Domain: Geometry				
Subcategory: Draw, construct, and describe geometrical figures and describe the relationships between them.				
7-G1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.			
7-G2	Draw (freehand, with ruler, protractor, and **compass**) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	Possible extension: demonstrate or model with technology		
7-G3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.			
Subcategory: Solve real-world and mathematical problems involving angle measure, area, surface area, and volume.				
7-G4	Know the formulas for the area and circumference of a circle, and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.			
7-G5	Use facts about supplementary, complementary, vertical, and adjacent angles in a multistep problem to write and solve simple equations for an unknown angle in a figure.			
7-G6	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.			

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: Statistics and Probability				
Subcategory: Use random sampling to draw inferences about a population.				
7-SP1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.			
7-SP2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.	Example: Estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.		
Subcategory: Draw informal comparative inferences about two populations.				
7-**SP3**	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.	Example: The mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.		
7-SP4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	Example: Decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.		
7-SP5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.			

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
7-SP6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.	Example: When rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.		
7-SP7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.			
7-SP7a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.	Example: If a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.		
7-SP7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. (Maye use dice, cards, spinners to demonstrate) 	Example: Find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?		
7-SP8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.			
7-SP8a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.			
7-SP8b	Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.			
7-SP8c	Design and use a simulation to generate frequencies for compound events.	Example: Use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?		

Seventh Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
7-SP8d	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	Example: Collect data from students in your class on whether or not they have a curfew on school nights, and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?		

EIGHTH GRADE
Mathematics Course of Study

The eighth grade mathematics course of study consists of five domains of focused study. The five domains are Ratios and Proportional Relationships, The Number System, Expressions and Equations, Geometry, and Statistics and Probability. Please note the abbreviations for each domain. Under each domain are the sub-categories that serve to group related content standards. All eighth grade mathematical content standards are located on the pages that follow.

The Diocesan Standards for Practice are listed below in the column to the right. These Diocesan standards should be incorporated into classroom instruction of the content standards.

Content Standard Domains and Sub-categories

The Number System (NS)

- Know that there are numbers that are not rational, and approximate them by rational numbers.

Expressions and Equations (EE)

- Work with radicals and integer exponents.
- Understand the connections among proportional relationships, lines, and linear equations.
- Analyze and solve linear equations and pairs of simultaneous linear equations.

Functions (F)

- Define, evaluate, and compare functions.
- Use functions to model relationships between quantities.

Geometry (G)

- Understand congruence and similarity using physical models, transparencies, or geometry software.
- Understand and apply the Pythagorean Theorem.
- Solve real-life and mathematical problems involving volume of cylinders, cones, and spheres.

Statistics and Probability (SP)

- Investigate patterns of association in bi-variate data.

Diocesan Standards for Practice

For student:

Students will make connections to Gospel values across content areas.

Student will develop and demonstrate critical thinking, perseverance, and strong work habits.

Students will be reflective, considerate problem solvers.

Students will develop and demonstrate the ability to be moral evaluators and socially responsible global citizens.

For the classroom:

Gospel values will be modeled through effective instruction, cultural sensitivity and an environment of continuous improvement.

Students will be assessed frequently, fairly and with consideration for the whole child.

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Domain: The Number System				
Subcategory: Know that there are numbers that are not rational, and approximate them by rational numbers.				
8-NS1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.			
8-NS2	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. (e.g., π^2)	By truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.		
Domain: Expressions and Equations				
Subcategory: Work with radicals and integer exponents.				
8-EE1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.	Example: $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$		
8-EE2	~Use square root and cube root symbols to represent solutions to equations of the form $x2 = p$ and $x3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.			
8-EE3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.	Estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.		

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will…)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
8-EE4	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. Interpret scientific notation that has been generated by technology.	Example: Use millimeters per year for seafloor spreading.		
Subcategory: Understand the connections among proportional relationships, lines, and linear equations.				
8-EE5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.	Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.		
8-EE6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.			
Subcategory: Analyze and solve linear equations and pairs of simultaneous linear equations.				
8-EE7	Solve linear equations in one variable.			
8-EE7a	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 simpler forms until an equivalent equation of the form $x = a, a = a$, or $a = b$ results (where a and b are different numbers).			

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
8-EE7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions, using the distributive property and collecting like terms.			
8-EE8	~Analyze and solve pairs of simultaneous linear equations. ~Use Systems of substitution and elimination. 			
8-EE8a	Understand that solutions to a system of two linear equations in two variables correspond to points of intersections of their graphs because points of intersection satisfy both equations simultaneously.			
8-EE8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.	Example: $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.		
8-EE8c	Solve real-world and mathematical problems leading to two linear equations in two variables.	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.		
Domain: Functions				
Subcategory: Define, evaluate, and compare functions.				
8-F1	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. (Function notation is not required in Grade 8.)			
8-F2	Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Example: Given a linear function represented by a table of values and linear function represented by an algebraic expression, determine which function has the greater rate of change.		

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
8-F3	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.	Example: The function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4), and (3,9), which are not on a straight line.		
Use functions to model relationships between quantities.				
8-F4	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 linear function in terms of the situation it models and in terms of its graph or a table of values.			
8-F5	Describe qualitatively the functional relationship between two quantities by analyzing a graph, using substitution and elimination. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.			
Domain: Geometry				
Subcategory: Understand congruence and similarity using physical models, transparencies, or geometry software.				
5-NF6	Verify experimentally the properties of rotations, reflections, and translations			
8-G1a	Lines are taken to lines, and line segments are taken to line segments of the same length.			
8-G1b	Angles are taken to angles of the same measure.			
8-G1c	Parallel lines are taken to parallel lines.			

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
8-G2	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.			
8-G3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.			
8-G4	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.			
8-G5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	Example: Arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give argument in terms of transversals why this is so.		

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
Subcategory: Understand and apply the Pythagorean Theorem				
8-G6	Understand and apply the Pythagorean Theorem and its converse.			
8-G7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.			
8-G8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. (Distance/midpoint formulas).			
Subcategory: Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.				
8-G9	Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real- world and mathematical problems.			
Domain: Statistics and Probability				
Subcategory: Investigate patterns of association in bivariate data.				
8-SP1	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 association, linear association, and nonlinear association.			
8-SP2	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.			

Eighth Grade

Area-Grade	Content Standards In Action (I Can…/Student will...)	Example(s)/Possible Extension(s)	Suggested Time of Focus	Date Taught
8-SP3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	Example: In a linear model for a biology experiment, interpret a slope of 1.5cm/hr. as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.		
8-SP4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	Example: Collect data from students in your class on whether or not they have a curfew on school nights, and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?		

Framework for High School Mathematics

High school mathematics standards fall into six conceptual categories which are covered to varying degrees throughout all of the mathematics courses a student takes during his or her high school career. Each conceptual category can be further broken down into domains and then into subcategories. Every course addresses each of the six conceptual categories but will not necessarily include every domain or subcategory.

The six conceptual categories and their abbreviations are:

1. Number and Quantity (N)
2. Algebra (A)
3. Functions (F)
4. Modeling (M)
5. Geometry (G)
6. Statistics and Probability (S)

In addition to the standards needed by all students, additional mathematical standards may be needed by students planning to take advanced courses in calculus, statistics, or discrete mathematics. These additional standards are noted in the curriculum with a plus symbol (+).

Some standards or headings for groups of standards may include an asterisk (*). If the asterisk is in a group heading it applies to all standards under that heading. The asterisk indicates that the standard requires modeling. Modeling links the classroom standards to real life including everyday skills, work, and decision making.

Conceptual Category: Number and Quantity

Numbers

As students progress through the eighth grade their knowledge of numbers grows from merely using counting numbers (1, 2, 3, ...), to including zero, to working with fractions. In middle school they begin working with negative numbers and irrational numbers. In high school, the concept of imaginary numbers will be added to the real numbers to form complex numbers. As the number system grows, the meanings of addition, subtraction, multiplication, and division are extended and they remain true under the commutative, associative, and distributive properties.

Calculators, spreadsheets, and computer algebra systems allow students to explore the growing number systems and their notation. They can be used to generate data for numerical experiments; to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

Quantities

Real world measurement through eighth grade typically involves length, area, and volume. High school adds a variety of units through modeling including acceleration, currency conversions, and derived quantities like person-hours, heading degree days, per-capita income, and rates in everyday life. Quantification, which will become important in science, is also introduced as students are required to analyze real-life situations and then find solutions for the problems encountered. An example of quantification would be proposing measures to collect data regarding annual highway fatalities. This type of reasoning is important in both government and private agencies which must conceptualize needs and then create solutions for them.

The Conceptual Category Numbers and Quantity (N) includes the following four Domains and their related subcategories.

The Real Number System (N-RN)

- Extend the properties of exponents to rational exponents
- Use the properties of rational and irrational numbers

Quantities (N-Q)

- Reason quantitatively and use units to solve problems

The Complex Number System (N-CN)

- Perform arithmetic operations with complex numbers
- Represent complex numbers and their operations on the complex plane
- Use complex numbers in polynomial identities and equations

Vector and Matrix Quantities

- Represent and model with vector quantities
- Perform operations on vectors
- Perform operations on matrices and use matrices in applications

Expressions

An expression is a record of computation. Recognized conventions regarding the use of grouping symbols and application of the order of operation ensures that expressions are explicit and understood.

Equations and Inequalities

Equations are statements of equality between two expressions. The solution for an equation is the value(s) of the variables which make the equation true. The solutions of an equation in one variable form a set of numbers. The solutions of an equation in two variables form a set of ordered pairs which can be plotted on the coordinate plane. Two or more equations and/or inequalities for a system. Strategic competence in solving equations and inequalities requires students to be able to look ahead for productive manipulations and the ability to anticipate the type and number of solutions.

Connections to Functions and Modeling

Converting a verbal description to an equation, inequality, or system is essential to modeling real-world problems.

The Conceptual Category Algebra (A) includes the following four domains and their related subcategories:

Seeing Structure in Expressions (A-SSE)

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Arithmetic With Polynomials and Rational Expressions (A-APR)

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

Creating Equations (A-CED)

- Create equations that describe numbers or relationships

Reasoning With Equations and Inequalities (A-REI)

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Represent and solve equations and inequalities graphically

Conceptual Category: Functions

Functions are essential in the construction of mathematical models. They describe situations where one quantity determines another. Two important types of functions are linear and exponential functions. The relationships described by functions make them valuable in modeling everyday events.

The Conceptual Category Functions (F) includes the following four domains and their related subcategories:

Interpreting Functions (F-IF)

- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations

Building Functions (F-BF)

- Build a function that models a relationship between two quantities
- Build new functions from existing functions

Linear, Quadratic, and Exponential Models (F-LE)

- Construct and compare linear, quadratic, and exponential models and solve problems
- Interpret expressions for functions in terms of the situation they model

Trigonometric Functions (F-TF)

- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities

Conceptual Category: Modeling

Modeling links mathematics from the classroom with everyday life, work, and decision making. It is the process of choosing the appropriate mathematics and statistics to analyze and understand situations and then make informed decisions. Examples of situations which solutions require modeling include:

- Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people and how it might be distributed
- Planning a table tennis tournament for 7 players using 4 tables, where each player plays against every other player
- Designing the layout of the stalls in a school fair so as to raise as much money as possible
- Analyzing stopping distance for a car
- Modeling savings account balance, bacterial colony growth, or investment growth
- Engaging in critical path analysis such as the turnaround space required for an aircraft at an airport
- Analyzing risk in situations such as extreme sports, pandemics, and terrorism
- Relating population statistics to individual problems

The basic modeling cycle is as follows

1. Identify the variables and select those that represent essential features
2. Formulate a model by creating and selecting geometric, graphical, tabular, or statistical representations to describe relationships between the variables
3. Analyze and perform operations, draw conclusions
4. Interpret results in terms of the original situation
5. Validate conclusions and either improve the model (return to step 2) or move forward
6. Report on conclusions and the reasoning behind them

Descriptive modeling describes and summarizes phenomena. Graphs can be helpful.

Conceptual Category: Geometry

School mathematics focuses primarily on plane Euclidean geometry. High school students solidify their understanding of geometry through precise definitions and by developing proofs. Analytic geometry connects algebra and geometry to create powerful problem solving tools.

The Conceptual Category Geometry (G) includes the following six domains and their related subcategories:

Congruence (C-CO)

- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions

Similarity, Right Triangles, and Trigonometry (G-SRT)

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Apply trigonometry to general triangles

Circles (G-C)

- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles

Expressing Geometric Properties with Equations (G-GPE)

- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically

Geometric Measurement and Dimension (G-GMD)

- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects

Modeling with Geometry (G-MG)

- Apply geometric concepts in modeling situations

Conceptual Category: Statistics and Probability*

Statistics provides tools to describe the variability in data so it can be taken into account when making decisions or predictions. This involves finding patterns and deviations from patterns.

The Conceptual Category Statistics and Probability (S) includes the following four domains and their related subcategories:

Interpreting Categorical and Quantitative Data (S-ID)

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent and interpret data on two categorical and quantitative variables
- Interpret linear models

Making Inferences and Justifying Conclusions (S-IC)

- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments, and observational studies

Conditional Probability and the Rules of Probability (S-CP)

- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model

Using Probability to Make Decisions (S-MD)

- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: The Real Number System				
Subcategory: Extend the Properties of Exponents to Rational Exponents				
N-RN1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.			
N-RN2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.			
Subcategory: Use properties of rational and irrational numbers				
N-RN3	Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.			
Domain: Quantities*				
Subcategory: Reason quantitatively and use units to solve problems. (Foundation for work with expressions, equations, and functions.)				
N-Q1	Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.			
N-Q2	Define appropriate quantities for the purpose of descriptive modeling.			
N-Q3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.			
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (For standard 7 linear, exponential, quadratic, for standard 8 linear, exponential, quadratic, rational)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)^n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to rewrite it.	See x^4-y^4 as $(x^2)^2-(y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2-y^2)(x^2+y^2)$.		
Subcategory: Write expressions in equivalent forms to solve problems. (Quadratic and exponential)				
A-SSE3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.			
A-SSE3a	Factor a quadratic expression to reveal the zeros of the function it defines.			
A-SSE3B	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.			
9c	Determine a quadratic equation when given its graph or roots.			
A-SSE3c	Use the properties of exponents to transform expressions for exponential functions.	The expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.		
Domain: Arithmetic with Polynomials and Rational Exressions				
Subcategory: Perform arithmetic operations on polynomials. (Linear and quadratic.)				
A-APR1	Understand that polynomials form a system analogous to the integers; namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)				
A-APR7	(+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.			
Domain Creating Equations*				
Subcategory: Create equations that describe numbers or relationships.(Linear, quadratic, and exponential (integer inputs only); for standard 14, linear only)				
A-CED1	Create equations and inequalities in one variable, and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.			
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities and interpret solutions as viable or non-viable options in a modeling context.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities				
Subcategory: Understand solving equations as a process of reasoning and explain the reasoning. (Master linear; learn as general principal)				
A-REI1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Solve equations and inequalities in one variable. (Linear inequalities; literal that are linear in the variables being solved for; quadratics with				
A-REI3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.			
A-REI4	Solve quadratic equations in one variable.			
A-REI4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.			
A-REI4b	Solve quadratic equations by inspection, taking square roots, completing the square and the quadratic formula, and factoring as appropriate to the initial form of the equation.	$x^2 = 49$		
Subcategory: Solve systems of equations. (Linear-linear and linear-quadratic.)				
A-REI5	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.			
A-REI6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.			
A-REI7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	Find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.		
Subcategory: Represent and solve equations and inequalities graphically. (Linear and exponential; learn as general principle.)				
A-REI10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-REI11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	Use technology to graph the functions, make tables of values, or find successive approximations.		
A-REI12	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.			
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Understanding the concept of a function and use function notation. (Learn as general principle; focus on linear and exponential and on arithmetic and geometric sequences.)				
F-IF1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.			
F-IF2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.			
F-IF3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.	The Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \geq 1$		

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Interpret functions that arise in applications in terms of the context. (Linear, exponential, and quadratic.)				
F-IF4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**			
F-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	If the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.		
F-IF6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.			
Analyze functions using different representations. (Linear, exponential, quadratic, absolute value, step, and an awareness of piecewise-defined)				
F-IF7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			
F-IF7a	Graph linear and quadratic functions, and show intercepts, maxima, and minima.			
F-FIF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.			
F-IF8b	Use the properties of exponents to interpret expressions for exponential functions.	Identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, and $y = (1.2)^{t/10}$, and classify them as representing exponential growth and decay.		
F-IF9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (For standards 34 and 35, linear, exponential, and quadratic.)				
F-BF1	Write a function that describes a relationship between two quantities.			
F-BF1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.			
F-BF1b	Combine standard function types using arithmetic operations.	Build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.		
F-BF2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. *			
Subcategory: Build new functions from existing functions. (Linear, exponential, quadratic, and absolute value.)				

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-BF3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems.				
F-LE1	Distinguish between situations that can be modeled with linear functions and with exponential functions.			
F-LE1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.			
F-LE1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.			
F-LE1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.			
F-LE2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).			
F-LE3	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.			
Subcategory: Interpret expressions for functions in terms of the situation they model. (Linear and exponential of form $f(x) = b^x + k$.)				
F-LE5	Interpret the parameters in a linear or exponential function in terms of a context.			
Concept: Statistics and Probability				
Domain: Interpreting Categorical and Quantitative Data				
Subcategory: Summarize, represent, and interpret data on a single count or measurement variable.				
S-ID1	Represent data with plots on the real number line (dot plots, histograms, and box plots).			

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-ID2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.			
S-ID3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).			
Subcategory: Summarize, represent, and interpret data on two categorical and quantitative variables. (Linear focus, discuss general principle.)				
S-ID5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.			
S-ID6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.			
S-ID6a	Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.			
S-ID6b	Informally assess the fit of a function by plotting and analyzing residuals.			
S-ID6c	Fit a linear function for a scatter plot that suggests a linear association.			
Subcategory: Interpret linear models.				
S-ID7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.			
Domain: Conditional Probability and the Rules of Probability				
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)				

Algebra I

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: The Complex Number System				
Subcategory: Perform arithmetic operations with complex numbers.				
N-CN1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real.			
N-CN2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			
N-CN3	(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.			
Subcategory: Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients.)				
N-CN7	Solve quadratic equations with real coefficients that have complex solutions.			
N-CN8	(+) Extend polynomial identities to the complex numbers.	Rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$		
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.			
Domain: Vector and Matrix Quantities				
Subcategory: Perform operations on matrices and use matrices in applications.				
N-VM6	(+) Use matrices to represent and manipulate data.	Represent payoffs or incidence relationships in a network. (Use technology to approximate roots.)		
N-VM7	(+) Multiply matrices by scalars to produce new matrices.	As when all of the payoffs in a game are doubled.		
N-VM8	(+) Add, subtract, and multiply matrices of appropriate dimensions.			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM9	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.			
N-VM10	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.			
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (Polynomial and rational.)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.*			
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)^n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to rewrite it.	See $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.		
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.*	Calculate mortgage payments		

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Arithmetic with Polynomials and Rational Exressions				
Subcategory: Perform arithmetic operations on polynomials. (Beyond Quadratic.)				
A-APR1	Understand that polynomials form a system analogous to the integers; namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.			
Subcategory: Understand the relationship between zeros and factors of polynomials.				
A-APR2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x-a$ is $p(a)$, so $p(a)=0$ if and only if $(x-a)$ is a factor of $p(x)$.			
A-APR3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.			
Subcategory: Use polynomial identities to solve problems.				
A-APR4	Prove polynomial identities and use them to describe numerical relationships.	The polynomial identity $(x^2+y^2)^2=(x^2-y^2)^2+(2xy)^2$		
Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)				
A-APR6	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)+r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or for the more complicated examples, a computer algebra system.			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Creating Equations*				
Subcategory: Create equations that describe numbers or relationships. (Equations using all available types of expressions, including simple root functions.)				
A-CED1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.			
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities				
Subcategory: Understand solving equations as a process of reasoning and explain the reasoning. (Simple rational and radical.)				
A-REI2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.			
Subcategory: Solve equations and inequalities in one variable.				
A-REI4b	Recognize when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers a and b.			
Subcategory: Solve systems of equations.				
A-REI9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Represent and solve equations and inequalities graphically. (Combine polynomial, rational, radical, absolute value, and exponential functions.)				
A-REI11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*			
Domain: Conic Sections				
Subcategory: Understand the graphs and equations of conic sections. (Emphasize understanding graphs and equations of circles and parabolas.)				
28	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
28a	Formulate equations of conic sections from their determining characteristics.	Write the equation of an ellipse with center (5,-3), and a horizontal major axis of length 10, and a minor axis of length 4. Answer: $[(x-5)^2/25] + [(y+3)^2/4] = 1$		
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models.)				
F-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	If the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.		
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model functions.)				
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			
F-IF9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (Include all types of functions studied.)				
F-BF1	Write a function that describes a relationship between two quantities.*			
F-BF1a	Combine standard function types using arithmetic operations.	Build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.		

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Build new functions from existing functions. (Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types.)				
F-BF3	Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $k\,f(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.			
F-BF4	Find inverse functions.			
F-BF4a	Solve an equation of the form $f(x)=c$ for a simple function f that has an inverse, and write an expression for the inverse.	$f(x)=2x3$ or $f(x)=(x+1)/(x-1)$ for $x\neq 1$		
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems. (Logarithms as solutions for exponentials.)				
F-LE4	For exponential models, express as a logarithm the solution to $ab^{ct}=d$ where a, c, and d are numbers, and the base b is 2, 10, or e; evaluate the logarithm using technology.			
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Include more complex situations.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		
S-MD7	(+) Analyze decisions and strategies using probability concepts.	Product testing, medical testing, pulling a hockey goalie at the end of a game		

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Conditional Probability and the Rules of Probability				
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)				
S-CP1	Describe events as subsets of a sample space (the set of outcomes), using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").			
S-CP3	40. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.			
S-CP4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	Collect data from a random sample of students in your school on their favorite subject among mathematics, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.		
S-CP5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	Compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.		
Subcategory: Use the rules of probability to compute probabilities of compound events in a uniform probability model.				
S-CP6	Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.			
S-CP7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.			

Algebra II

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP8	(+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B\|A) = P(B)P(A\|B)$, and interpret the answer in terms of the model.			
S-CP9	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: The Complex Number System				
Subcategory: Perform arithmetic operations with complex numbers.				
N-CN1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real.			
N-CN2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			
N-CN3	(+) Find the conjugate of a complex number; use conjugates			
Subcategory: Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients.)				
N-CN7	Solve quadratic equations with real coefficients that have complex solutions.			
N-CN8	(+) Extend polynomial identities to the complex numbers.	Rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$		
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that			
Domain: Vector and Matrix Quantities				
Subcategory: Perform operations on matrices and use matrices in applications.				
N-VM6	(+) Use matrices to represent and manipulate data. Use technology to approximate roots.	Represent payoffs or incidence relationships in a network.		
N-VM7	(+) Multiply matrices by scalars to produce new matrices.	When all of the payoffs in a game are doubled		
N-VM8	(+) Add, subtract, and multiply matrices of appropriate dimensions.			
N-VM9	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.			
N-VM10	(+) Understand that the zero and identity matrices play a			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Interpret the structure of expressions. (Polynomial and rational.)				
A-SSE1	Interpret expressions that represent a quantity in terms of its context.*			
A-SSE1a	Interpret parts of an expression such as terms, factors, and coefficients.			
A-SSE1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)n$ as the product of P and a factor not depending on P		
A-SSE2	Use the structure of an expression to identify ways to	See $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a		
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	Derive the formula for the sum of a finite geometric series	Calculate mortgage payments		
Domain: Arithmetic with Polynomials and Rational Exressions				
Subcategory: Perform arithmetic operations on polynomials. (Beyond Quadratic.)				
A-APR1	Understand that polynomials form a system analogous to			
Subcategory: Understand the relationship between zeros and factors of polynomials.				
A-APR2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x-a$ is $p(a)$, so $p(a) = 0$ if and only if $(x-a)$ is a factor of $p(x)$.			
A-APR3	Identify zeros of polynomials when suitable factorizations			
Subcategory: Use Polynomial identities to solve problems.				
A-APR4	Prove polynomial identities and use them to describe	The polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can		
Subcategory: Rewrite rational expressions. (Linear and quadratic denominators.)				
A-APR6	Rewrite simple rational expressions in different forms;			
Domain: Creating Equations*				
Subcategory: Create equations that describe numbers or relationships. (Equations using all available types of expressions, including simple root				
A-CED1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
A-CED2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.			
A-CED3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	Represent inequalities describing nutritional and cost constraints on combinations of different foods.		
A-CED4	Rearrange formulas to highlight a quantity of interest,	Rearrange Ohm's law $V = IR$ to highlight resistance R.		
Domain: Reasoning with Equations and Inequalities				
Subcategory: Understand solving equations as a process of reasoning, and explain the reasoning. (Simple rational and radical.)				
A-REI2	Solve simple rational and radical equations in one variable,			
Subcategory: Solve equations and inequalities in one variable.				
A-REI4b	Recognize when the quadratic formula gives complex			
Subcategory: Solve systems of equations.				
A-REI9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for			
Subcategory: Represent and solve equations and inequalities graphically. (Combine polynomial, rational, radical, absolute value, and exponential				
A-REI11	Explain why the x-coordinates of the points where the			
Domain: Conic Sections				
Subcategory: Understand the graphs and equations of conic sections. (Emphasize understanding graphs and equations of circles and parabolas.)				
28	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
28a	Formulate equations of conic sections from their	Write the equation of an ellipse with center (5,-3), and a		
Concept: Functions				
Domain: Interpreting Functions				
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models.)				
F-IF5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*	If the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model functions.)				
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.			
F-IF8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.			
F-IF9	Compare properties of two functions each represented in a	Given a graph of one quadratic function and an algebraic		
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities. (Include all types of functions studied.)				
F-BF1	Write a function that describes a relationship between two quantities.*			
F-BF1b	Combine standard function types using arithmetic operations.	Build a function that models the temperature of a cooling body by adding a constant function to a decaying		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Subcategory: Build new functions from existing functions. (Include simple radical, rational, and exponential functions; emphasize common effect of each				
F-BF3	Identify the effect on the graph of replacing f(x) by $f(x)+k$, $k\,f(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.			
F-BF4	Find inverse functions.			
F-BF4a	Solve an equation of the form $f(x)=c$ for a simple function f	$f(x)=2x^3$ or $f(x)=(x+1)/(x-1)$ for $x\neq 1$		
Domain: Linear, Quadratic, and Exponential Models*				
Subcategory: Construct and compare linear, quadratic, and exponential models and solve problems. (Logarithms as solutions for exponentials.)				
F-LE4	For exponential models, express as a logarithm the solution			
Domain: Trigonometric Functions				
Subcategory: Extend the domain of trigonometric functions using the unit circle.				
F-TF1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.			
F-TF2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.			
39	Define the six trigonometric functions using ratios of the			
Subcategory: Model periodic phenomena with trigonometric functions.				
F-TF5	Choose trigonometric functions to model periodic			
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Include more complex situations.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		
S-MD7	(+) Analyze decisions and strategies using probability	Product testing, medical testing, pulling a hockey goalie at		

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Conditional Probability and the Rules of Probability				
Subcategory: Understand independence and conditional probability and use them to interpret data. (Link to data from simulations or experiments.)				
S-CP1	Describe events as subsets of a sample space (the set of outcomes), using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").			
S-CP3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.			
S-CP4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.	Collect data from a random sample of students in your school on their favorite subject among mathematics, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.		
S-CP5	Recognize and explain the concepts of conditional	Compare the chance of having lung cancer if you are a		
Subcategory: Use the rules of probability to compute probabilities of compound events in a uniform probability model.				
S-CP6	Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.			
S-CP7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.			
S-CP8	(+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B\|A) = P(B)P(A\|B)$, and interpret the answer in terms of the model.			

Algebra II With Trigonometry

Area-Grade	Content Standards In Action (I can…/Students will...)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-CP9	(+) Use permutations and combinations to compute probabilities of compound events and solve problems.			

Algebraic Connections

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra				
Subcategory: Modeling				
1	Create algebraic models for application-based problems by developing and solving equations and inequalities, including those involving direct, inverse, and joint variation.	The amount of sales tax on a new car is directly proportional to the purchase price of the car. If the sales tax on a $20,500 car is $1,600, what is the purchase price of a new car that has a sales tax of $3,200? Answer: the purchase price of the new car is $41,000.		
2	Solve application-based problems by developing and solving systems of linear equations and inequalities.			
3	Use formulas or equations of functions to calculate outcomes of exponential growth or decay.	Solve problems involving compound interest, bacterial growth, carbon-14 dating, and depreciation.		
Subcategory: Graphing				
4	Determine maximum and minimum values of a function using linear programming procedures.	Observe the boundaries $x \geq 0$, $y \geq 0$, $2x - 3y + 15 \geq 0$, and $x \leq 9$ to find the maximum and minimum values of $f(x,y) = 3x + 5y$		
5	Determine approximate rates of change of nonlinear relationships from graphical and numerical data.			
5a	Create graphical representations from tables, equations, or classroom-generated data to model consumer costs and to predict future outcomes.			
6	Use the extreme value of a given quadratic function to solve applied problems.	Determine the selling price needed to maximize profit.		
Subcategory: Finance				
7	Use analytical, numerical, and graphical methods to make financial and economic decisions, including those involving banking and investments, insurance, personal budgets, credit purchases, recreation, and deceptive and fraudulent pricing and advertising.	Determine the best choice of certificates of deposit, savings accounts, checking accounts, or loans. Compare the costs of fixed- or variable-rate mortgage loans. Compare costs associated with various credit cards. Determine the best cellular telephone plan for a budget.		

Algebraic Connections

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
7a	a. Create, manually or with technological tools, graphs and tables related to personal finance and economics.	Use spreadsheets to create an amortization table for a mortgage loan or a circle graph for a personal budget.		
Concept: Geometry				
Subcategory: Modeling				
8	Determine missing information in an application-based situation using properties of right triangles, including trigonometric ratios and the Pythagorean Theorem.	Use a construction or landscape problem to apply trigonometric ratios and the Pythagorean Theorem.		
Subcategory: Symmetry				
9	Analyze aesthetics of physical models for line symmetry, rotational symmetry, or the golden ratio.	Identify the symmetry found in nature, art, or architecture.		
Subcategory: Measurement				
10	Critique measurements in terms of precision, accuracy, and approximate error.	Determine whether one candidate has a significant lead over another candidate when given their current standings in a poll and the margin of error.		
11	Use ratios of perimeters, areas, and volumes of similar figures to solve applied problems.	Use a blueprint or scale drawing of a house to determine the amount of carpet to be purchased.		
Concept: Statistics and Probability				
Subcategory: Graphing				
12	Create a model of a set of data by estimating the equation of a curve of best fit from tables of values or scatter plots.	Create models of election results as a function of population change, inflation, or employment rate as a function of time, cholesterol density as a function of age or weight of a person.		
12a	Predict probabilities given a frequency distribution.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: Vector and Matrix Quantities				
Subcategory: Represent and model with vector quantities.				
N-VM1	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes, including the use of Eigen-values and Eigen-vectors.	**v**, |v|, ||v||		
N-VM3	(+) Solve problems involving velocity and other quantities that can be represented by vectors, including navigation (e.g., airplane, aerospace, oceanic).			
N-VM4a	(+) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. Find the dot product and the cross product of vectors.			
N-VM4b	(+) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum, including vectors in complex vector spaces.			
N-VM4c	(+) Understand vector subtraction **v**–**w** as **v** + (–**w**), where (–**w**) is the additive inverse of **w**, with the same magnitude as **w** and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise, including vectors in complex vector spaces.			
Subcategory: Perform operations on matrices and use matrices in applications.				
N-VM6	(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network, including linear programming.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM7	(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled, including rotation matrices.			
N-VM10	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. Solve matrix equations using augmented matrices.			
N-VM11	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors, including matrices larger than 2 × 2.			
N-VM12	(+) Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. Solve matrix application problems using reduced row echelon form.			
Domain: Complex Numbers				
Subcategory: Use complex numbers in polynomial identities and equations.				
N-CN9	(+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. Understand the importance of using complex numbers in graphing functions on the Cartesian or complex plane. [			
Subcategory: Limits				
12	Calculate the limit of a sequence, of a function, and of an infinite series.			

Analytical Mathematics

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Algebra				
Domain: Seeing Structure in Expressions				
13	Use the laws of Boolean Algebra to describe true/false circuits. Simplify Boolean expressions using the relationships between conjunction, disjunction, and negation operations.			
14	Use logic symbols to write truth tables.			
Domain: Arithmetic with Polynomials and Rational Functions				
15	Reduce the degree of either the numerator or denominator of a rational function by using partial fraction decomposition or partial fraction expansion.			
Concept: Functions				
Domain: Trigonometric Functions				
Subcategory: Extend the domain of trigonometric functions using the unit circle.				
F=TF4	(+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.			
Subcategory: Apply trigonometry to general triangles.				
G-SRT10	(+) Prove the Law of Sines and the Law of Cosines and use them to solve problems. Understand Law of Sines = $2r$, where r is the radius of the circumscribed circle of the triangle. Apply the Law of Tangents.			
18	Apply Euler's and deMoivre's formulas as links between complex numbers and trigonometry.			

Discrete Mathematics

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
1	Analyze topics from elementary number theory, including perfect numbers and prime numbers, to determine properties of integers.			
2	Determine characteristics of sequences, including the Fibonacci sequence, the triangular numbers, and pentagonal numbers.	Write a sequence of the first 10 triangular numbers and hypothesize a formula to find the n^{th} triangular number.		
3	Use the recursive process and difference equations to create fractals, population growth models, sequences, series, and compound interest models.			
4	Convert between base ten and other bases.			
Concept: Algebra				
5	Determine results of operations upon 3 × 3 and larger matrices, including matrix addition and multiplication of a matrix by a matrix, vector, or scalar.			
6	Analyze determinants and inverses of 2 × 2, 3 × 3, and larger matrices to determine the nature of the solution set of the corresponding system of equations, including solving systems of equations in three variables by echelon row reduction and matrix inverse.			
7	Solve problems through investigation and application of existence and nonexistence of Euler paths, Euler circuits, Hamilton paths, and Hamilton circuits.	Show why a 5 × 5 grid has no Hamiltonian circuit.		
7a	Develop optimal solutions of application-based problems using existing and student- created algorithms.			
8	Apply algorithms, including Kruskal's and Prim's, relating to minimum weight spanning trees, networks, flows, and Steiner trees.			

Discrete Mathematics

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
8a	Use shortest path techniques to find optimal shipping routes.			
9	Determine a minimum project time using algorithms to schedule tasks in order, including critical path analysis, the list-processing algorithm, and student-created algorithms.			
Concept: Geometry				
10	Use vertex-coloring techniques and matching techniques to solve application-based problems.	Use graph-coloring techniques to color a map of the western states of the United States so no adjacent states are the same color, including determining the minimum number of colors needed and why no fewer colors may be used.		
11	Solve application-based logic problems using Venn diagrams, truth tables, and matrices.			
Concept: Statistics and Probability				
12	Use combinatorial reasoning and counting techniques to solve application-based problems.	Determine the probability of a safe opening on the first attempt given the combination uses the digits 2, 4, 6, and 8 with the order unknown. Answer: The probability of the safe opening on the first attempt is 1/24.		
13	Analyze election data to compare election methods and voting apportionment, including determining strength within specific groups.			

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Geometry				
Domain: Congruence				
Subcategory: Experiment with transformations in the plane.				
G-CO1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment based on the undefined notions of point, line, distance along a line, and distance around a circular arc.			
G-CO2	Represent transformations in the plane; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g. translation versus horizontal stretch).			
G-CO3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.			
G-CO4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.			
G-CO5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure (e.g. using graph			
Subcategory: Understand congruence in terms of rigid motions. (Build on rigid motions as a familiar starting point for development of concept of geometric proof.)				
G-CO6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.			
G-CO7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.			

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-CO8	Explain how the criteria for triangle congruence, angle-side-			
Subcategory: Prove geometric theorems. (Focus on validity of underlying reasoning while using variety of ways of writing proofs.)				
G-CO9	Prove theorems about lines and angles. Theorems include vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.			
G-CO10	Prove theorems about triangles. Theorems include measures of interior angles of a triangle sum to 180°, base angles of isosceles triangles are congruent, the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length, and the medians of a triangle meet at a point.			
G-CO11	Prove theorems about parallelograms. Theorems include			
Subcategory: Make geometric constructions. (Formalize and explain processes.)				
G-CO12	Make formal geometric constructions with a variety of tools and methods such as compass and straightedge, string, reflective devices, paper folding, and dynamic geometric software. Constructions include copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.			
G-CO13	Construct an equilateral triangle, a square, and a regular			
Domain: Similarity, Right Triangles, and Trigonometry				
Subcategory: Understand similarity in terms of similarity transformations.				
G-SRT10	Verify experimentally the properties of dilations given by a center and a scale factor.			

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-SRT1a	A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.			
G-SRT1b	The dilation of a line segment is longer or shorter in the ratio given by the scale factor.			
G-SRT2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	Examples given in state COS...		
G-SRT3	Use the properties of similarity transformations to establish			
Subcategory: Prove theorems involving similarity.				
G-SRT4	Prove theorems about triangles. Theorems include a line parallel to one side of a triangle divides the other two proportionally, and conversely; and the Pythagorean Theorem proved using triangle similarity.			
G-SRT5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.			
Subcategory: Define trigonometric ratios and solve problems involving right triangles.				
G-SRT6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle leading to definitions of trigonometric ratios for acute angles.			
G-SRT7	Explain and use the relationship between the sine and cosine of complementary angles.			
G-SRT8	Use trigonometric ratios and the Pythagorean Theorem to			
Subcategory: Apply trigonometry to general triangles.				
G-SRT10	(+) Prove the Law of Sines and the Law of Cosines and use them to solve problems.			

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-SRT11	(+) Understand and apply the Law of Sines and the Law of			
Domain: Circles				
Subcategory: Understand and apply theorems about circles.				
G-C1	Prove that all circles are similar.			
G-C2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.			
G-C3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.			
G-C4	(+) Construct a tangent line from a point outside a given			
Subcategory: Find arc lengths and areas of sectors of circles. (Radian introduced only as unit of measure.)				
G-C5	Derive, using similarity, the fact that the length of the arc			
Domain: Expressing Geometric Properties with Equations				
Subcategory: Translate between the geometric description and the equation for a conic section.				
G-GPE1	Derive the equation of a circle of given center and radius			
Subcategory: Use coordinates to prove simple geometric theorems algebraically. (Include distance formula; relate to Pythagorean Theorem.)				
G-GPE4	Use coordinates to prove simple geometric theorems algebraically.	Prove or disprove that a figure is defined by four points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point (0,2)		
G-GPE5	Prove the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems.	Find the equation of a line parallel or perpendicular to a given line that passes through a given point.		

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-GPE6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.			
G-GPE7	Use coordinates to compute perimeters of polygons and			
Subcategory: Use coordinates to prove simple geometric theorems algebraically.				
34	Determine areas and perimeters of regular polygons,			
Domain: Geometric Measurement and Dimension				
Subcategory: Explain volume formulas and use them to solve problems.				
G-GMD1	Give an informal argument for the formulas for the circumference of a circle; area of a circle; and volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.			
G-GMD3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*			
37	Determine the relationship between surface areas of similar			
Subcategory: Visualize relationships between two-dimensional and three-dimensional objects.				
G-GMD4	Identify the shapes of two-dimensional cross-sections of			
Domain: Modeling with Geometry				
Subcategory: Apply geometric concepts in modeling situations.				
G-MG1	Use geometric shapes, their measures, and their properties to describe objects.*			
G-MG2	Apply concepts of density based on area and volume in modeling situations.*			
G-MG3	Apply geometric methods to solve design problems.*	Design an object or structure to satisfy physical constraints		
Concept: Statistics and Probability				
Domain: Using Probability to Make Decisions				
Subcategory: Use probability to evaluate outcomes of decisions. (Introductory, apply counting rules.)				
S-MD6	(+) Use probabilities to make fair decisions.	Drawing by lots, using a random number generator		

Geometry

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-MD7	(+) Analyze decisions and strategies using probability concepts. Product testing, medical testing, pulling a hockey goalie at the end of a game.	A shaded circle is inscribed inside a square whose sides measure 6 units. What is the probability of tossing a penny and having it land in a non-shaded region (i.e.: inside the square but outside the circle)?		

Mathematical Investigations

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
1	Critique ancient numeration systems and applications, including astronomy and the development and use of money and calendars.			
1a	Determine relationships among mathematical achievements of ancient peoples, including the Sumerians, Babylonians, Egyptians, Mesopotamians, Chinese, Aztecs, and Incas.			
1b	Explain origins of the Hindu-Arabic numeration system.	Perform addition and subtraction in both the Hindu-Arabic and the Roman numeration systems to compare place value and place holders.		
2	Analyze mathematical relationships in music to interpret frequencies of musical notes and to compare mathematical structures of various musical instruments.	Compare frequencies of notes exactly one octave apart on the musical scale; using frequencies and wave patterns of middle C, E above middle C, and G above middle C to explain why the C major chord is harmonious.		
2a	Determine lengths of strings necessary to produce harmonic tones as in Pythagorean tuning.			
3	Use special numbers, including e, i, π, and the golden ratio, to solve application-based problems.			
3a	Identify transcendental numbers.	Calculate e to ten decimal places using a summation with $1/n!$.		
4	Explain the development and uses of sets of numbers, including complex, real, rational, irrational, integer, whole, and natural numbers.			
4a	Analyze contributions to the number system by well-	Plot solutions to the polynomial equation, $x^2 - 6x + 11 = 0$,		
Concept: Algebra				
5	Identify beginnings of algebraic symbolism and structure through the works of European mathematicians.			

Mathematical Investigations

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
5a	Create a Fibonacci sequence when given two initial integers.			
5b	Investigate Tartaglia's formula for solving cubic equations.			
6	Explain the development and applications of logarithms, including contributions of John Napier, Henry Briggs, and the Bernoulli family.			
7	Justify the historical significance of the development of multiple perspectives in mathematics.	Relate the historical development of multiple perspectives to the works of Sir Isaac Newton and Gottfried Wilhelm von Leibniz in the foundations of calculus.		
7a	Summarize the significance of René Descartes' Cartesian coordinate system.			
7b	Interpret the foundation of analytic geometry with regard			
Concept: Geometry				
8	Solve problems from non-Euclidean geometry, including graph theory, networks, topology, and fractals.	Determine if a given figure is traversable and if it is, describe the path that will traverse it. Verify that two objects are topologically equivalent. Sketch four iterations of Sierpinski's triangle.		
9	Analyze works of visual art and architecture for mathematical relationships.	Use Leonardo da Vinci's *Vitruvian Man* to explore the golden ratio. Identify mathematical patterns in Maurits Cornelis Escher's drawings, including the tessellations in art, quilting, paintings, pottery, and architecture.		
9a	Summarize the historical development of perspective in art and architecture.			
10	Determine the mathematical impact of the ancient Greeks, including Archimedes, Eratosthenes, Euclid, Hypatia, Pythagoras, and the Pythagorean Society.	Use Euclid's proposition to inscribe a regular hexagon within a circle.		
10a	Construct multiple proofs of the Pythagorean Theorem.			

Mathematical Investigations

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
10b	Solve problems involving figurate numbers, including triangular and pentagonal numbers.	Write a sequence of the first 10 triangular numbers and hypothesize a formula to find the n^{th} triangular number.		
11	Describe the development of mathematical tools and their	Use knotted ropes for counting; Napier's bones for		
Concept: Statistics and Probability				
12	Summarize the history of probability, including the works of Blaise Pascal; Pierre de Fermat; Abraham de Moivre; and Pierre-Simon, marquis de Laplace.	Discuss the impact of probability on gaming, economics, and insurance.		

Precalculus

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Concept: Number and Quantity				
Domain: The Complex Number System				
Subcategory: Represent complex numbers and their operations on the complex plane.				
N-CN4	(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.			
N-CN5	(+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.	$(-1+\sqrt{3}i)^3 = 8$ because $(-1+\sqrt{3}i)$ has modus 2 and argument 120°		
N-CN6	(+) Calculate the distance between numbers in the			
Domain: Limits				
Subcategory: Understand limits of functions				
4	Determine numerically, algebraically, and graphically the limits of functions at specific values and at infinity.			
4a	Apply limits in problems involving convergence and			
Domain: Vector and Matrix Quantities				
Subcategory: Represent and model with vector quantities.				
N-VM1	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes.	$\boldsymbol{v}, \lvert\boldsymbol{v}\rvert, \lVert\boldsymbol{v}\rVert, v$		
N-VM2	(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.			
N-VM3	(+) Solve problems involving velocity and other quantities			
Subcategory: Perform operations on vectors.				
N-VM4	(+) Add and subtract vectors.			

Precalculus

Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
N-VM4a	(+) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.			
N-VM4b	(+) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.			
N-VM4c	(+) Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.			
N-VM5	(+) Multiply a vector by a scalar.			
N-VM5a	(+) Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise.	As $c(\boldsymbol{v}_x, \boldsymbol{v}_y) = (c\boldsymbol{v}_x, c\boldsymbol{v}_y)$		
N-VM5b	(+) Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using			
Subcategory: Perform operations on matrices and use matrices in applications.				
N-VM11	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.			
N-VM12	11. (+) Work with 2×2 matrices as transformations of the			
Concept: Algebra				
Domain: Seeing Structure in Expressions				
Subcategory: Write expressions in equivalent forms to solve problems.				
A-SSE4	Derive the formula for the sum of a finite geometric series	Calculate mortgage payments		
Domain: Arithmetic with Polynomials and Rational Expressions				
Subcategory: Use Polynomial identities to solve problems.				
A-APR5	(+) Know and apply the Binomial Theorem for the			

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
Domain: Reasoning with Equations and Inequalities				
Subcategory: Solve systems of equations				
A-REI8	(+) Represent a system of linear equations as a single			
Concept: Functions				
Domain: Conic Sections				
Subcategory: Understand the graphs and equations of conic sections.				
15	Create graphs of conic sections, including parabolas, hyperbolas, ellipses, circles, and degenerate conics, from second-degree equations.	Graph $x^2 - 6x + y^2 - 12y + 41 = 0$ or $y^2 - 4x + 2y + 5 = 0$		
15a	Formulate equations of conic sections from their	Write the equation of an ellipse with center (5,-3), and a		
Domain: Interpret Functions				
Subcategory: Interpret functions that arise in applications in terms of the context. (Emphasize selection of appropriate models. Understand limits of				
F-IF4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. (Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Determine odd, even, neither.)*			
F-IF6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a			
Subcategory: Analyze functions using different representations. (Focus on using key features to guide selection of appropriate type of model function				
F-IF7	Graph functions expressed symbolically, and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*			

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
F-IF7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.			
F-IF7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.			
F-IF7d	(+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.			
F-IF7e	Graph exponential and logarithmic functions, showing			
Domain: Building Functions				
Subcategory: Build a function that models a relationship between two quantities.				
F-BF1c	(+) Compose functions.	If $T(y)$ is the temperature in the atmosphere as a function of		
Subcategory: Build new functions from existing functions.				
20	Determine the inverse of a function and a relation.			
F-BF4b	(+) Verify by composition that one function is the inverse of another.			
F-BF4c	Read values of an inverse function from a graph or a table, given that the function has an inverse.			
F-BF4d	(+) Produce an invertible function from a non-invertible function by restricting the domain.			
F-BF5	(+) Understand the inverse relationship between exponents and logarithms, and use this relationship to solve problems involving logarithms and exponents.			
25	Compare effects of parameter changes on graphs of	Explain the relationship of the graph $y = e^{x-2}$ to the graph y		
Domain: Trigonometric Functions				
Subcategory: Recognize attributes of trigonometric functions and solve problems involving trigonometry.				
26	Determine the amplitude, period, phase shift, domain, and range of trigonometric functions and their inverses.			

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
27	Use the sum, difference, and half-angle identities to find the exact value of a trigonometric function.			
28	Utilize parametric equations by graphing and by converting to rectangular form.			
28a	Solve application-based problems involving parametric equations.			
28b	Solve applied problems that include sequences with			
Subcategory: Extend the domain of trigonometric functions using the unit circle.				
F-TF3	(+) Use special triangles to determine geometrically the values of sine, cosine, and tangent for π/3, π/4, and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π–x, π+x, and 2π–x in terms of their values for x, where x is any real number.			
F-TF4	(+) Use the unit circle to explain symmetry (odd and even)			
Subcategory: Model periodic phenomena with trigonometric functions.				
F-TF6	(+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.			
F-TF7	(+) Use inverse functions to solve trigonometric equations			
Subcategory: Prove and apply trigonometric identities.				
F-TF8	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$, and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.			
F-TF9	(+) Prove the addition and subtraction formulas for sine,			
Concept: Geometry				
Domain: Similarity, Right Triangles, and Trigonometry				
Subcategory: Apply trigonometry to general triangles.				
G-SRT9	(+) Derive the formula $A = (½)ab\sin(C)$ for the area of a			
Domain: Expressing Geometric Properties with Equations				
Subcategory: Translate between the geometric description and the equation for a conic section.				

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
G-GPE2	(+) Derive the equations of a parabola given a focus and directrix.			
G-GPE3	(+) Derive the equations of ellipses and hyperbolas given			
Subcategory: Explain volume formulas and use them to solve problems.				
G-GMD2	(+) Give an informal argument using Cavalieri's principle			
Concept: Statistics and Probability				
Domain: Interpreting Categorical and Quantitative Data				
Subcategory: Summarize, represent, and interpret data on a single count or measurement variable.				
S-ID2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (Focus on increasing rigor using standard deviation.)			
S-ID3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (Identify uniform, skewed, and normal distributions in a set of data. Determine the quartiles and interquartile range for a set of data.)			
S-ID4	Use the mean and standard deviation of a data set to fit it			
Subcategory: Interpret linear models.				
S-ID8	Compute (using technology) and interpret the correlation coefficient of a linear fit.			
S-ID9	Distinguish between correlation and causation.			
Domain: Making Inferences and Justifying Conclusions				
Subcategory: Understand and evaluate random processes underlying statistical experiments.				
S-IC1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.			
S-IC2	Decide if a specified model is consistent with results from a	A model says a spinning coin falls heads up with		
Subcategory: Make inferences and justify conclusions from sample surveys, experiments, and observational studies.				

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-IC3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.			
S-IC4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.			
S-IC5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.			
S-IC6	Evaluate reports based on data.			
Domain: Using Probability to Make Decisions				
Subcategory: Calculate expected values and use them to solve problems.				
S-MD1	(+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.			
S-MD2	(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.			
S-MD3	(+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.	Find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.		
S-MD4	(+) Develop a probability distribution for a random variable	Find a current data distribution on the number of television		
Subcategory: Use probability to evaluate outcomes of decisions.				
S-MD5	(+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.			
S-MD5a	Find the expected payoff for a game of chance.	Find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.		

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Area-Grade	Content Standards In Action (I can…/Students will…)	Example(s)/Possible Extensions	Suggested Time of Focus	Date Taught
S-MD5b	Evaluate and compare strategies on the basis of expected values.	Compare a high-deductible versus low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.		