

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 1: Apply and Extend Understanding of Operations

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, The Number System

7.NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

- 7.NS.1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
- 7.NS.1a. Describe situations in which opposite quantities combine to make 0.
- 7.NS.1b. 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.NS.1c. 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.NS.1d. Apply properties of operations as strategies to add and subtract rational numbers.
- 7.NS.2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.2a. 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.NS.2b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero

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.NS.2c. Apply properties of operations as strategies to multiply and divide rational numbers.
- 7.NS.2d. 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.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers.

Essential Questions

- How can I model operations with integers using a vertical or horizontal number line?
- How is subtraction of integers related to addition of integers?
- Why does multiplying or dividing two negatives equal a positive?
- How can adding and subtracting integers be represented on a number line?
- Why is subtracting rational numbers the same as adding the additive inverse?
- How can the properties of operations be applied to adding, subtracting, multiplying, and dividing?
- What strategies are used to convert rational numbers into equivalent forms?
- How can I solve real-world problems by doing addition, subtraction, multiplication, or division with a positive and negative number?

Content

The students will know

1. Operations with rational numbers
2. Order of Operations involving rational numbers
3. Properties of rational numbers
 - Identity of addition
 - Identity of multiplication
 - Associative
 - Commutative
 - Distributive
 - Additive inverse.
 - Multiplicative inverse
4. Division by zero
5. Absolute Value
6. Decimal expansion of rational numbers

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Construct number lines and coordinate planes using operations involving the rational number system.
2. Solve problems where two quantities add to make a sum of 0 (additive inverse).
3. Create situations in which opposite quantities combine to equal zero.
4. Describe real world situations where two quantities add to make a sum of zero.
5. Define the sum of two rational numbers as the distance one addend is away from the total by the absolute value of the other addend.
6. Define the direction of the distance on a number line based on the sign of the addend. (Negative is left/down and positive is right/up.)
7. Define additive inverse as a rational number added to its negative which results in a sum of zero.
8. Solve real world problems involving adding rational numbers.
9. Compare subtracting rational numbers to adding the additive inverse.
10. Prove that the distance between two rational numbers is equal to the absolute value of their difference.
11. Apply commutative, associative, additive inverse, and distributive properties to solve addition and subtraction of rational numbers.
12. Apply and extend the commutative, associative, and distributive property of multiplication from fractions to rational numbers. Focus on the distributive property.
13. Prove the rules for multiplying signed numbers by applying the distributive property.
14. Solve real-world problems involving signed numbers.
15. Define the quotient of two integers (divisor not = 0) as a rational number.
16. Solve real word problems involving division of rational numbers.
17. Explain that a negative symbol can be written in the numerator, denominator, or next to the fraction without changing the value of the fraction.

	<p>18. Multiply and divide rational numbers by applying commutative, associative, and distributive properties.</p> <p>19. Divide the numerator of a fraction by its denominator using long division.</p> <p>20. Define a rational number as a decimal that terminates or eventually repeats.</p> <p>21. Solve real world problems involving all four operations with rational numbers.</p> <p>Reading/Writing Skills</p> <p>1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems.</p> <p>2. Justify solutions, either verbally or in written form.</p> <ul style="list-style-type: none"> ▪ Explain step-by-step process. ▪ Summarize results using specific and appropriate vocabulary. <p>3. Use technology to produce written explanations and justifications for real life and mathematical problems.</p>
<p>Common Core Vocabulary</p> <ol style="list-style-type: none"> 1. Order of Operations 2. Rational numbers 3. Identity 4. Associative properties 5. Commutative properties 6. Distributive property 7. Additive Inverse 8. Multiplicative Inverse 9. Decimal expansion 10. Signed numbers 11. Integers 12. Undefined 13. Absolute Value 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Properties of inequality 2. Properties of equality 3. Long division 4. Repeating decimals 5. Terminating decimals
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class activity. Begin the study of the this unit with a review of the following concepts previously learned: <ol style="list-style-type: none"> a. quantities can be shown using + or – as having opposite directions or values. b. points on a number line show distance and direction. c. opposite signs of numbers indicate locations on opposite sides of 0 on the number line. d. the opposite of an opposite is the number itself. e. the absolute value of a rational number is its distance from 0 on the number line. f. the absolute value is the magnitude for a positive or negative quantity g. locating and comparing locations on a coordinate grid by using negative and positive numbers. 2. Following the review of the concepts listed above, have students work with a partner to solve real-world problems exemplifying each concept to ensure understanding by all students. 3. Class activity/Online learning. Engage students in gaining fluency in applying and extending previous understandings of addition and subtraction to add and subtract rational numbers; 	<p>Assessment (Suggested)</p> <p>Let's Review Diagnostic: Class Work</p> <p>Students will show their understanding of each of the following points by providing an example of each followed by an explanation.</p> <ol style="list-style-type: none"> a. quantities can be shown using + or – as having opposite directions or values. b. points on a number line show distance and direction. c. opposite signs of numbers indicate locations on opposite sides of 0 on the number line. d. the opposite of an opposite is the number itself. e. the absolute value of a rational number is its distance from 0 on the number line. f. the absolute value is the magnitude for a positive or negative quantity. g. locating and comparing locations on a coordinate grid by using negative and positive numbers. <p>Adding and Subtracting Rational Numbers Formative: Cooperative Group Work</p>

represent addition and subtraction on a horizontal or vertical number line diagram. Use the videos for 7.NS.1a-d found at the Learn Zillion site or another appropriate site. (See Links)

4. Provide students with a number of problems in which they add and subtract positive and negative numbers showing their work on a number line.
After solving the problems, have students work in cooperative groups to check their answers. Challenge them to determine the rules for adding and subtracting positive and negative numbers. Have them write a paragraph explaining the procedures (rules) for adding and subtracting rational numbers, including examples of when they would use these skills in the real world, or what real-world situations would reflect these skills.
5. Class activity/Online learning. Engage students in gaining fluency in applying and extending previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. Use the videos for 7.NS.2a-d found at the Learn Zillion site or another appropriate site. (See Links)
6. Follow up the class activity by having students work with a partner to solve a number of problems that focus on applying and extending previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. After solving the problems have students determine which rule applies in solving each problem. Have them write a paragraph explaining the procedures (rules) for multiplying fractions and rational numbers, including examples of when they would use these skills in the real world, or what real-world situations would reflect these skills.
7. Have students respond to the following questions. With each response provide an example and explain the reasoning used to determine the response.
 - a. Is it always true that multiplying a negative factor by a positive factor results in a negative product?
 - b. Does a positive factor times a positive factor always result in a positive product?
 - c. What is the sign of the product of two negative factors?
 - d. When three factors are multiplied, how is the sign of the product determined?
 - e. How is the numerical value of the product of any two numbers found?
8. Have students create a poster (digital, if possible) briefly explaining each of the mathematical properties and rules they learned in this unit as a way of summarizing their understanding of each concept examined. Have students share their poster with the class.
9. Have students work with a partner to solve real-world and mathematical problems that will be useful in solidifying their understanding of order of operations and properties of operations. For each problem have them write a paragraph explaining the reasoning used in solving the problem. Where appropriate, have them identify the rule that was employed in solving the problem.



[Learn Zillion ~ Common Core Videos](#)



[The National Library of Virtual Manipulatives](#)



[The Math Worksheets Site](#)

Students will be provided with a number of problems in which they add and subtract positive and negative numbers. They will show their work on a number line.

After solving the problems, students will work in cooperative groups to check their answers. They will be challenged to determine the rules for adding and subtracting positive and negative numbers. In doing so they will write a paragraph explaining the procedures (rules) for adding and subtracting rational numbers, including examples of when they would use these skills in the real world, or what real-world situations would reflect these skills.

Multiplying and Dividing Rational Numbers **Formative: Cooperative Group Work**

Students will work with a partner to solve a number of problems that focus on applying and extending previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

After solving the problems, students will determine which rule applies in solving each problem and write a paragraph explaining the procedures (rules) for multiplying fractions and rational numbers, including examples of when they would use these skills in the real world, or what real-world situations would reflect these skills.

Can You Answer This? **Formative: Homework**

Students will respond to the following questions. With each response they will provide an example and explain the reasoning used to determine the response.

- a. Is it always true that multiplying a negative factor by a positive factor results in a negative product?
- b. Does a positive factor times a positive factor always result in a positive product?
- c. What is the sign of the product of two negative factors?
- d. When three factors are multiplied, how is the sign of the product determined?
- e. How is the numerical value of the product of any two numbers found?

What Have You Learned? **Summative: Posters**

Students will create a poster (digital, if possible) briefly explaining each of the mathematical properties and rules they learned in this unit as a way of summarizing their understanding of each concept examined.

Math In the Real-World **Summative: Cooperative Group Work**

Students will work with a partner to solve real-world and mathematical problems that will be useful in solidifying their understanding of order of operations and properties of operations. For each problem they will write a paragraph explaining the reasoning used in solving the problem. Where appropriate, they will identify the rule that was employed in solving the problem.



[Ohio Resource Center ~ Math Educators](#)



[Ohio's Digital Library of Resources](#)



[Grade 7 Math Practice](#)



[Free Algebra Worksheets](#)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
 - The 512 Ants on Sullivan Street* by Carol A. Losi
 - Ben Franklin and the Magic Squares* by Frank Murphy and Richard Walz
 - The Man Who Counted: A Collection of Mathematical Adventures* by Malba Tahan and Patricia Reid Baquero
 - How Much Is a Million?* by David M. Schwartz
 - If You Hopped Like A Frog* by David M. Schwartz
 - On Beyond a Million: An Amazing Math Journey* by David M. Schwartz

3. Internet Resources



[Order of Operations](#)



[Order of Operations](#)



[Order of Operations](#)



[Properties of Operations](#)



[Properties of Operations](#)



[Algebra Basics](#)



[Learn Zillion ~ Common Core Videos](#)



[Math Puzzles, Activities, Games, Etc.](#)



[The Khan Academy](#)



[iLearn Ohio](#)

Catholic Identity

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

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Unit 2: Create Equivalent Expressions

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

- WHST.6-8.1. Write arguments focused on discipline-specific content.

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 4. Model with mathematics.
- 6. Attend to precision.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Expressions & Equations

7.EE Use properties of operations to generate equivalent expressions.

- 7.EE.1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
- 7.EE.2. 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.

DOC: Mathematics, DOC: Grade 7, Patterns, Functions, and Algebra

B. Algebraic Representation

- 3. Continue to explore the effects of the order of operations on computations and use parentheses appropriately to group numbers.

Essential Questions

- How are properties of operations used to create equivalent forms of linear expressions?
- Why would I want to look at different forms of equivalent expression in terms of a real-world problem?
- How can I write an expression in multiple ways, including a visual representation of the problem, and determine which representation is most useful in solving a problem?
- What strategies can be used to simplify expressions with rational coefficients?
- How can writing equations and inequalities help solve mathematical and real life problems?

Content

The students will know

- Order of Operations including various grouping symbols
- Rational coefficients
- Linear equations
- Equivalent expressions

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

- Add linear expressions with rational coefficients.
- Subtract linear expressions with rational coefficients.
- Factor linear expressions with rational coefficients.
- Expand linear expressions with rational coefficients.
- Apply properties of operations to all operations with rational coefficients.
- Translate word situations to algebraic expressions.
- Identify the GCF of rational coefficients in linear expressions.
- Translate words to expressions.
- Translate situation problems to algebraic expressions.
- Simplify expressions.
- Rewrite expressions to help analyze problems.
- Explain how an equivalent expression relates to the original situation problem.
- Describe and illustrate how numerical and algebraic expressions using numbers of any form can be used to solve real world problems.
- Describe and illustrate how equations and inequalities can be written to solve mathematical problems.

Reading/Writing Skills






- Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems.
- Justify solutions, either verbally or in written form.
 - Explain step-by-step process.
 - Summarize results using specific and appropriate vocabulary.
- Use technology to produce written explanations and justifications for real life and mathematical problems.

Common Core Vocabulary

- Order of Operations
- Linear expressions
- Equivalent expressions
- Rational coefficients
- Distributive Property
- Factor

Additional Vocabulary

- Expression
- Numerical expression
- Algebraic expression
- Quantities
- Grouping symbols

<p>7. Like terms</p>	
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> Class activity/Online learning. Have students build on their understanding of properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. Use the videos at the Learn Zillion site for Standard 7.EE.1 or another appropriate site. (See Links) Have students work in cooperative groups to become experts on adding and subtracting like terms and in factoring and expanding linear expressions. <ol style="list-style-type: none"> Expert Group(s) A will learn about adding and subtracting like terms using one of the sites shown in the Links. Expert Group(s) B will learn about factoring and expanding linear expressions using one of the sites shown in the Links. After a given time, have students form new cooperative groups in which they will explain in detail the topic they studied to all members of their group. The group will practice solving problems that exemplify the concept being discussed. Following the cooperative group activity, have students write a summary of what they have learned about each topic including an explanation of the procedure to follow in order to write equivalent expressions as well as a sample problem and solution. Class activity/Online learning. Assist students in recognizing 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. Use the video for Standard 7.EE.2 at the Learn Zillion site or another appropriate site. (See Links) Have students write ten mathematical expressions on index cards, one per card. Ask students to team up with one other student and exchange cards and write the expression in as many different forms as possible. (For example: $15\% = 15/100 = 3/20 = 0.15$) When students have completed the activity, have them share some of their expressions. Ask them to explain why they may have found some forms of numbers easier than others. Have students complete a problem solving activity involving equivalent expressions and order of operations. <p> Adding and Subtracting Like Terms!</p> <p> Adding and Subtracting Like Terms!</p> <p> Factoring and Expanding Linear Expressions ~ Solving Linear Equations</p> <p> Factoring and Expanding Linear Expressions!</p> <p> Learn Zillion ~ Common Core Videos!</p>	<p>Assessment (Suggested)</p> <p>Working with Equations Formative: Cooperative Group Work</p> <p>Students will work in cooperative groups to become experts on adding and subtracting like terms and in factoring and expanding linear expressions. After a given time, students will form new cooperative groups in which they will explain in detail the topic they studied to all members of their group. The group will practice solving problems that exemplify the concept being discussed.</p> <p>More on Working with Equations Summative: Writing Assignment</p> <p>Following the cooperative group work:</p> <p>Students will write a summary of what they have learned about each topic including an explanation of the procedure to follow in order to write equivalent expressions as well as a sample problem and solution.</p> <p>Rewriting Mathematical Expressions Formative: Class Work</p> <p>Students will write ten mathematical expressions on index cards, one per card. They will team up with one other student and exchange cards. They will write the expression in as many different forms as possible. When students have completed the activity, they will share some of their expressions and explain why they may have found some forms of numbers easier than others.</p> <p>Problem Solving Activity - Equivalent Expressions Formative: Cooperative Group Work</p> <p>Students will work in groups to apply properties learned in class to real-world and mathematical problems. Using this as a problem solving and critical thinking activity or game will keep the students interest.</p>
<p>Resources (Suggested)</p>	<p>Catholic Identity</p>

1. iPad Resources
2. Literature Connection
A Gebra Named Al: A Novel by Wendy Isdell
Sideways Arithmetic From Wayside School by Louis Sachar
Do the Math #2: The Writing on the Wall by Wendy Lichtman
The Unknowns: A Math Mystery by Benedict Care
3. Internet Resources



[Evaluate Expressions for Numerators and Denominators](#)



[Online Videos, Games, Activities, and Worksheets](#)



[Learn Zillion ~ Common Core Videos](#)



[The Math Worksheets Site](#)



[Ohio Resource Center ~ Math Educators](#)



[The National Library of Virtual Manipulatives](#)



[InfOhio for Educators](#)



[iLearn Ohio](#)



[The Khan Academy](#)

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

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Unit 3: Solve Equations and Inequalities

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 4. Model with mathematics.
- 6. Attend to precision.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Expressions & Equations

7.EE Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

- 7.EE.3. Solve multi-step 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.
- 7.EE.4. 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.EE.4a. 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.
- 7.EE.4b. 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.

Essential Questions

- How can the natural world and real life situations be represented symbolically?
- How can I use patterns to understand mathematics and model situations?
- How do algebraic representations relate and compare to one another?
- How can I communicate and generalize algebraic relationships?
- How can I compare algebraic solutions to arithmetic solutions?

Content

The students will know

1. Positive and negative rational numbers


Skills

Bloom's Taxonomy

DOK Links

The students will be able to

<ol style="list-style-type: none"> 2. Properties of operations 3. Multi-step equations 4. Multi-step inequalities 5. Algebraic expressions 6. Solution set of an inequality 	<ol style="list-style-type: none"> 1. Apply properties of operations to solve multi-step real-world problems with all rational numbers. 2. Solve multi-step real-world problems involving all types of rational numbers. 3. Justify the reasonableness of solutions using mental computations and estimation. 4. Convert fluently between forms for fractions, decimals, and percents. 5. Explain the connection between different forms of equivalent rational numbers. 6. Construct and solve two-step linear equations and inequalities from real-world problems. 7. Explain the steps used in solving an equation or an inequality. 8. Fluently solve two-step linear equations and inequalities. 9. Identify the sequence of operations used to solve an equation and an inequality. 10. Graph inequalities and make sense of the inequality in context. 11. Identify when the inequality symbol changes to its opposite. 12. Explain when and/or why an open or closed dot is used on a number line. 13. Write a linear inequality from a graph. 14. Compare and contrast algebraic and numerical solutions. 15. Translate word phrases into expressions, equations, and inequalities. <p>Reading/Writing Skills</p> <ol style="list-style-type: none"> 1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems. 2. Justify solutions, either verbally or in written form. <ul style="list-style-type: none"> ▪ Explain step-by-step process. ▪ Summarize results using specific and appropriate vocabulary. 3. Use technology to produce written explanations and justifications for real-life and mathematical problems.
<p>Common Core Vocabulary</p> <ol style="list-style-type: none"> 1. Positive rational numbers 2. Negative rational numbers 3. Solution set 4. Mental computation 5. Estimation 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Expression 2. Equation 3. Inequality 4. Rational numbers
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class activity/Online learning. Review the order of operations (PEMDAS) with the students using the video addressing order of operations in the series of videos for Standard 7.EE.3 found at the Learn Zillion site. (See Links) 2. Following the review of order of operations, have the students solve several mathematical problems to reinforce their understanding of the order of operations. Have them write a sentence explaining each step used to solve the problem. 3. Class activity/Online learning. Engage students in the explanation of solving multi-step problems using the videos in the series of videos for 7.EE.3 found in the Learn Zillion site or another appropriate site. (See Links) 	<p>Assessment (Suggested)</p> <p>PEMDAS Formative: Homework</p> <p>Students will solve several mathematical problems to reinforce their understanding of the order of operations. They will write a sentence explaining each step used to solve the problems.</p> <p>Justifying Solutions Formative: Class Work</p> <p>Students will work with a partner to solve a number of multi-step real-</p>

<p>While using the videos, have students work similar problems to reinforce the concepts presented.</p> <p>4. Have students work with a partner to solve a number of multi-step real-world problems involving all types of rational numbers. Have them justify the reasonableness of solutions using mental computations and estimation. Ask them to share their justifications with the class.</p> <p>5. Class activity/Online learning. Engage students in the explanation of using variables to represent quantities in a real-world or mathematical problem, and constructing simple equations and inequalities to solve problems by reasoning about the quantities by using the videos in the series of videos for 7.EE.4 found in the Learn Zillion site or another appropriate site. (See Links)</p> <p>While using the videos, have students work similar problems to reinforce the concepts presented.</p> <p>6. Have students work with a partner to fluently solve a number of real-world word problems requiring the following:</p> <p>a. Leading to equations in the form of $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Have them compare an algebraic solution to an arithmetic solution and identify the sequence of the operations used in each approach.</p> <p>b. Leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Have them graph the solution set of the inequality and interpret it in the context of the problem.</p> <p>7. Summary project. Have students work in cooperative groups to create a PowerPoint presentation that explains how to solve algebraic equations and inequalities. This is a comprehensive project that assumes a knowledge of working with equation and inequalities and computation with integers, fractions and decimals. Have them share their presentation with the class. The PowerPoint should include the following slides:</p> <p>a. A slide that explains the steps used to solve an algebraic equation.</p> <p>b. Slide(s) that explains the steps used to solve an inequality.</p> <p>c. A real-world word problem (equation) and solve it in the next slide(s).</p> <p>d. A real-world word problem (inequality) and solve it in the next slide(s).</p> <p>e. Create word problems--1 equation and 1 inequality--to be solved by your classmates.</p>  <p>Learn Zillion - Common Core Videos</p>	<p>world problems involving all types of rational numbers. They will justify the reasonableness of their solutions using mental computations and estimation and share their justifications with the class.</p> <p>Real-World Equations Formative: Class Work</p> <p>Students will work with a partner to fluently solve a number of real-world word problems leading to equations in the form of $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. They will compare an algebraic solution to an arithmetic solution and they will identify the sequence of the operations used in each approach.</p> <p>Real-World Equations and Inequalities Formative: Lab Assignment</p> <p>Using some form of technology, students will work with a partner to construct and solve real-world situations involving equations and inequalities.</p> <p>Real-World Inequalities Formative: Class Work</p> <p>Students will work with a partner to fluently solve a number of real-world word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. They will graph the solution set of the inequality and interpret it in the context of the problem.</p> <p>Showing What We Know! Summative: Technology Project</p> <p>Students will create PowerPoint presentation that explains how to solve algebraic equations and inequalities. The PowerPoint should include the following slides:</p> <p>a. A slide that explains the steps used to solve an algebraic equation.</p> <p>b. Slide(s) that explains the steps used to solve an inequality.</p> <p>c. A real-world word problem (equation) and solve it in the next slide(s).</p> <p>d. A real-world word problem (inequality) and solve it in the next slide(s).</p> <p>e. Create word problems--1 equation and 1 inequality--to be solved by your classmates.</p> <p>Students will share their presentations with class.</p>
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Resources (Suggested)

- iPad Resources
- Literature Connection
 - The King's Chessboard* by David Birch
 - One Grain Of Rice: A Mathematical Folktale* by Demi
 - A Gebra Named Al: A Novel* by Wendy Isdell
 - Equal Shmequal* by Virginia L. Kroll and Philomena O'Neill
 - Tuck Everlasting* by Natalie Babbitt
 - Moja Means One* by Muriel Feelings and Tom Feelings
 - Sideways Arithmetic From Wayside School* by Louis Sachar
 - Do the Math #2: The Writing on the Wall* by Wendy Lichtman
 - Do the Math: Secrets, Lies, and Algebra* by Wendy Lichtman

- Catholic Identity**
- Social Justice Teachings**
- Life And Dignity Of The Human Person
 - Call To Family, Community, And Participation
 - Rights And Responsibilities
 - Solidarity
 - Care For God's Creation
- Rights of Children**
- THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.

3. Internet Resources



[Writing Algebraic Expressions](#)



[Writing Algebraic Equations](#)



[Two-step and Multi-step Equations](#)



[Linear Equation Solver](#)



[Solving Multi-Step Equations](#)



[Pan Balance \(Expressions\)](#)



[Learn Zillion ~ Common Core Videos](#)



[The Math Worksheet Site](#)



[The National Library of Virtual Manipulatives](#)



[Ohio Resource Center ~ Math Educators](#)



[Math Is Fun ~ PreAlgebra Activities](#)



[Ohio's Pre-K Digital Library](#)



[The Khan Academy](#)



[Learn Ohio](#)



THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.



THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.



THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.



THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.



THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.



THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 4: Analyze Proportional Relationships

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Ratios & Proportional Relationships

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

- 7.RP.1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
- 7.RP.2. Recognize and represent proportional relationships between quantities.
- 7.RP.2a. Decide whether two quantities are in a proportional relationship, e.g., 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.RP.2b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- 7.RP.2c. Represent proportional relationships by equations.
- 7.RP.2d. 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.RP.3. Use proportional relationships to solve multistep ratio and percent problems.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 6. Attend to precision.

DOC: Mathematics, DOC: Grade 7, Measurement

B. Measurement Techniques and Tools

- 2. Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same

measurement system.

DOC: Mathematics, DOC: Grade 7, Patterns, Functions, and Algebra

B. Algebraic Representation

- b. Describe problem situations involving ratios, proportions, and percents with algebraic expressions.

Essential Questions

- When and why do I use proportional comparisons?
- How does comparing quantities describe the relationship between them?
- How does finding patterns help me do computations?
- To what extent are proportional patterns present in our everyday world?
- How can the natural world and real life situations be represented symbolically?
- How do I translate verbal ideas to the language of mathematics?
- Where are patterns in nature, architecture, music, words, and numbers?

Content

The students will know

1. Ratios of fractions
2. Proportions
3. Proportional relationships
4. Percents
5. Unit rates
6. Scale factors

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Solve unit problems that have fractional quantities, including those that require solving complex fractions.
2. Solve ratio problems whose quantities are lengths of the same unit and of different units.
3. Solve ratio problems whose quantities are areas of the same unit and of different units.
4. Solve ratio problems of other quantities with the same unit and with different units.
5. Divide two fractions by taking the reciprocal of the divisor.
6. Compare unit rate.
7. Calculate the cross product to determine if the two ratios are in proportion.
8. Analyze ratios in a table to determine if the ratios are equivalent by finding the slope.
9. Graph ratios on a coordinate plane to determine if the ratios are proportional by observing if the graph is a straight line through the origin.
10. Solve proportions by cross multiplication.
11. Write and solve proportions.
12. Calculate the constant of proportionality/unit rate from a table or diagram.
13. Compute the rate of change/slope from a graph or equation.
14. Calculate the constant proportionality/unit rate given a verbal description of a proportional relationship.
15. Write an equation from proportional relationships.
16. Solve equations created from proportional relationships.
17. Define the rate of proportionality from a graph.
18. Explain the meaning of a point on a graph $y=mx$ of a real-life situation.
19. Solve multi-step ratio problems using proportions. (*Examples from simple interest, tax, mark-us/downs, fees, commissions, percent increase/decrease, percent error.*)
20. Solve multi-step percent problems using proportions. (*Examples from simple interest, tax, mark-ups/downs, fees, commissions, percent increase/decrease, percent error.*)
21. Describe problem situations involving ratios, proportions, and

	<p>percents with algebraic expressions.</p> <p>Reading/Writing Skills</p> <ol style="list-style-type: none"> 1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems. 2. Justify solutions, either verbally or in written form. <ul style="list-style-type: none"> ▪ Explain step-by-step process. ▪ Summarize results using specific and appropriate vocabulary. 3. Use technology to produce written explanations and justifications for real-life and mathematical problems.
<p>Common Core Vocabulary</p> <ol style="list-style-type: none"> 1. Proportion 2. Proportional relationship 3. Unit rate 4. Scale factor 5. Constant of proportionality 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Point 2. Percent 3. Ratio 4. Coordinate plane 5. Origin 6. Ordered pair
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class activity. Using the <i>Think-Pair-Share</i> strategy, have students respond to the following questions then pair with another student and share their answers. After all have shared their answers have a class discussion focusing on the questions to insure that all students have a correct understanding of the information. Prompts/Questions: <ol style="list-style-type: none"> a. How do you perform unit conversion? b. When would you use unit conversion in the real world? c. What are two ways to find the percent of a number? d. What is a ratio? e. How do you know if two ratios are equivalent? f. What is a proportion? g. When would you use ratios and proportions in the real world? 2. Class activity/Online learning. Engage students in discussions aimed at developing their understanding of how to compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. Use the videos for Standard 7.PR.1 found at the <i>Learn Zillion</i> site or another appropriate site. (See Links) 3. Working in cooperative groups, have students move through five stations solving problems found in each station. Ask them to justify the reasoning used in solving each problem. Prepare five stations with problems addressing: <ol style="list-style-type: none"> a. Translating verbal phrases into unit rates. b. Finding unit rates in problems involving fractions. c. Using unit rates to interpret maps and scale models. d. Finding the best deal by comparing unit rates. e. Scaling recipes by applying unit rates. 4. Follow up the group work by asking the students to respond in writing to the question, "What is the process for finding a unit rate when you have a ratio with fractions in the numerator and denominator?" Have students share their responses with the class and discuss. 	<p>Assessment (Suggested)</p> <p>What do We Know? Diagnostic: Class Discussion</p> <p>Students will respond to the following questions then pair with another student and share their answers. After all have shared their answers have a class discussion focusing on the questions to insure that all students have a correct understanding of the information. Prompts/Questions: <ol style="list-style-type: none"> a. How do you perform unit conversion? b. When would you use unit conversion in the real world? c. What are two ways to find the percent of a number? d. What is a ratio? e. How do you know if two ratios are equivalent? f. What is a proportion? g. When would you use ratios and proportions in the real world? </p> <p>Station Work Formative: Cooperative Group Work</p> <p>Students will move through five stations solving problems found in each station. They will write a justification for the reasoning used in solving each problem.</p> <p>What Did You Learn? Formative: Writing Assignment</p> <p>Students will respond in writing to the question "What is the process for finding a unit rate when you have a ratio with fractions in the numerator and denominator?" They will share their responses with the class and discuss.</p> <p>Real World Application Formative: Cooperative Group Work</p>

5. Have students look through various sources to find examples of ratios and ask them to convert each ratio into its unit rate. When all students have located several examples and converted them, have them work with a partner to use the unit rates to create a table or graph for the unit rate and then write an equation to show the relationship between the two quantities in the ratio. Finally, ask them to reflect on how ratios, proportions, tables, graphs, equations, and unit rates are related.
6. Class activity/Online learning. In order to reinforce student ability to recognize and represent proportional relationships between quantities use the videos for Standard 7.PR.2a-d found at the *Learn Zillion* site or another appropriate site. (See Links)
7. As a follow up to the discussion of each video for Standards 7.PR.2a-d, provide students with a number of numerical and real-life problems to ensure understanding of the concept. Have students work with a partner to solve the problems and ask them to explain the reasoning they used to solve each problem.
8. Online learning. Working with a partner and using technological device, have students learn to use proportional relationships to solve multi-step ratio and percent problems by viewing and studying the videos for Standard 7.PR.3 found at the Learn Zillion site or another appropriate site. (See Links) After studying each video, have the teams write a description, including an example, of what they learned.
9. Following the study of the videos for standard 7.PR.3, have students work with a partner to create real-world problems involving ratios, proportions, percents involving algebraic expressions and a graphical representation of the proportional relationship.
10. Divide the class into four groups. Ask each group to complete the following task.
Task. Provide students with sales circulars, catalogs, etc., and a gift ordering form. Tell the students that they have \$1,500 to spend on gifts for the holidays. They are to search through the sales papers and catalogs to find the items they would like to purchase. Remind them that they cannot go over their allotted amount.
 The gift ordering form should include the following columns: store, item, quantity, original price, discount %, sale price, total, cumulative total, subtotal, tax, shipping, grand total.
 Ask each group to share the reasoning they used in purchasing their items and determine which team got the most for their money.
11. Class activity/Online learning. Using the videos on calculating simple interest (see Links) engage students in developing an understanding of how to calculate simple interest using the formula $I = Prt$.
12. Have students solve a number of real-life problems in which they must calculate simple interest. Have them justify the reasoning used in solving the problem.



[Proportional Reasoning: Activities and Real world problems](#)



[Proportions Trail](#)



[Learn Zillion ~ Common Core Videos](#)

Working in cooperative groups, students will create and solve a real-world problem involving ratios, proportions, percents involving algebraic expressions and a graphical representation of the proportional relationship.

Working with Simple Interest

Summative: Homework

Students will solve a number of real-life problems in which they must calculate simple interest. They will write a justification for the reasoning used in solving the problem.

Application of Proportions

Formative: Technology Project

Students will use technology to design a blueprint of a bedroom, playground, or restaurant. Students will explain their step-by-step procedure in creating the correct scale dimensions.

Getting the Most For Your Money!

Summative: Project

Divide the class into four groups. Each group will complete the following task.

Task. Provide students with sales circulars, catalogs, etc., and a gift ordering form. Tell the students that they have \$1,500 to spend on gifts for the holidays. They are to search through the sales papers and catalogs to find the items they would like to purchase. Remind them that they cannot go over their allotted amount.

The gift ordering form should include the following columns: store, item, quantity, original price, discount %, sale price, total, cumulative total, subtotal, tax, shipping, grand total.

Each group will be asked to share the reasoning they used in purchasing their items and determine which team got the most for their money.



[Math Expressions ~ Simple Interest Formula](#)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
If You Hopped Like A Frog by David M. Schwartz
Jim and the Beanstalk by Raymond Briggs
Roll of Thunder, Hear My Cry by Mildred D. Taylor
Warlord's Puppeteers by Virginia Pilegard (Author), Nicolas Debon
Holes by Louis Sachar, Vladimir Radunsky and Bagram Ibatoulline
Math Curse by Jon Scieszka and Lane Smith
The Principal's New Clothes by Stephanie Calmenson and Denise Brunkus
Saturday Night at the Dinosaur Stomp by Carol Diggory Shields and Scott Nash
Tuck Everlasting by Natalie Babbitt
3. Internet Resources



[Proportional Relationship Flash Cards](#)



[Ratios, Proportions, Percents, Rates, Unit Rates, Scale Factor, and Scale Drawing](#)



[iLearn Ohio](#)



[The Khan Academy](#)



[Learn Zillion ~ Common Core Videos](#)



[The National Library of Virtual Manipulatives](#)



[The Math Worksheets Site](#)



[Algebra Worksheet Generator](#)

Catholic Identity

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 5: Draw Construct and Describe Geometrical Figure

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Geometry

7.G Draw construct, and describe geometrical figures and describe the relationships between them.

- 7.G.1. 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.G.2. Draw (freehand, with ruler and protractor, and with technology) 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.
- 7.G.3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

DOC: Mathematics, DOC: Grade 7, Geometry and Spatial Sense

A. Characteristics and Properties

- 1. Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.
- 5. Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.

Essential Questions

- How can proportions be used to solve scale drawings?
- How can geometric shapes be drawn to meet given conditions?
- How can geometric facts and formulas be used to solve real world situations?
- How are angles used in real world situations?
- To what extent does spatial awareness impact my ability to function in the world around me?
- In what ways is geometry present in my everyday life?

Content

The students will know

1. Proportional reasoning
2. Properties of congruent triangles
3. Properties of similar triangles
4. Representations of two-dimensional objects
5. Representations of three-dimensional objects

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Compute the actual length of a figure from a scale drawing.
2. Use proportions to solve problems involving scale drawings.
3. Show how geometric shapes can be drawn using a variety of tools to meet given conditions.
4. Compute the actual length of a figure from a scale drawing.
5. Compute the actual area of a figure from a scale drawing.
6. Given a scale drawing and scale, recreate the drawing using a different scale.
7. Solve problems involving scale drawings of geometric figures.
8. Construct a triangle (freehand, with ruler and protractor, and technology) given three angle measures.
9. Construct a triangle (freehand, with ruler and protractor, and technology) given three side measures.
10. Construct a geometric shape given side lengths /angle measures.
11. Describe when angle measures determine a triangle (given angles equal 180°) or no triangle (given angles are greater or less than 180°).
12. Describe when side measures determine a unique triangle ($a+b>c$) or no triangle ($a+b \leq c$).
13. Define two-dimensional figures that result from slicing the following geometric figures.
 - a. right rectangular prism
 - b. right rectangular pyramid
 - c. triangular pyramid
 - d. cube
 - e. cylinder
 - f. cone
14. Apply the use of geometric formulas to solve mathematical problems for two and three-dimensional figures.
15. Draw conclusions from proportional reasoning based on the attributes of similar and congruent figures.
16. Apply the concepts of congruent and/or similar triangles to solve real life and mathematical problems.
17. Explain three-dimensional figures in terms of plane figures.

Reading/Writing Skills

1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems.
2. Justify solutions, either verbally or in written form.
 - Explain step-by-step process.
 - Summarize results using specific and appropriate vocabulary.
3. Use technology to produce written explanations and

	justifications for real-life and mathematical problems.
<p>Common Core Vocabulary</p> <ol style="list-style-type: none"> Scale Scale factors Scale drawings Angle Side Attribute Proportion Intersect Parallel lines Transversal Plane Supplementary-complementary-vertical-adjacent angles Scalene Isosceles Equilateral Equiangular Acute Obtuse Right triangles Rectangular prism/pyramid Quadrilateral Polygon Cube Area Surface area Volume 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> Triangle Two-dimensional figures Three-dimensional figures Similar Congruent
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> Class activity/Online learning. Engage students in developing the ability to 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. Use the videos for Standard 7.G.1 found in the Learn Zillion site or another appropriate site. (See Links) Working with a partner, have students measure rectangular prism nets to create and design a cereal box with a given scalar factor. Have them determine the surface area and volume of both boxes to compare changes made after the scalar factor is performed. Ask them to write an explanation of the reasoning they used to complete the task and solve the problem. Have students complete the <i>Great Cartoon Blowup</i> activity to ensure understanding of the need for accuracy in making scale drawings. (See <i>Geometry Websites</i> in the Links) Working with a partner, have students create a blueprint on graph paper for a bedroom, a playground, or a restaurant. Have them set up a scale using the blocks. For example 2 blocks = 1 foot. Add furniture, etc. to the creation drawing them to scale using the indicated scale. Share their blueprints with class and explain the reasoning used to make the blueprint. Class activity/Online learning. Engage students in drawing geometric shapes with given conditions, with a particular 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. Use the videos for 	<p>Assessment (Suggested)</p> <p>Geometric Shapes Formative: Lab Assignment</p> <p>Students will use freehand, with protractor and ruler, and technology to construct geometric figures with given conditions.</p> <p>Working With A Scale Formative: Cooperative Group Work</p> <p>Students will measure rectangular prism nets to create and design a cereal box with a given scalar factor. They will determine the surface area and volume of both boxes to compare changes made after the scalar factor is performed. They will then write an explanation of the reasoning they used to complete the task and solve the problem.</p> <p>Blueprint Design Summative: Project</p> <p>Students will create a blueprint on graph paper for a bedroom, a playground, or a restaurant. They will set up a scale using the blocks. For example 2 blocks = 1 foot. They will add furniture, etc. to the creation, drawing them to scale using the indicated scale. They will share their blueprints with class and explain the reasoning used to make the blueprint.</p> <p>Great Cartoon Blowup</p>

Standard 7.G.2 found in the Learn Zillion site or another appropriate site. (See Links)

6. Have students complete tasks similar to the following to demonstrate understanding of Standards 7.G.2.
 - a. Give students the measurements of three line segments. Ask them to form/create a triangle. Explain reasoning used.
 - b. Present students with a triangle whose angles measure $A = 57$ degrees, $B = 62$ degrees, and $C = 61$ degrees. Ask them to sketch this triangle. Without measuring, have them name the longest side and explain how they know it is the longest side.
 - c. Have students draw two triangles with congruent angles but different side lengths. Ask them to explain how this is possible.
 - d. Have students give three side measures that would not form a triangle and explain why the sides would not form the triangle.
7. Class activity/Online learning. Engage students in an explanation of how to describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. Use the videos for Standard 7.G.3 found in the Learn Zillion site or another appropriate site. (See Links)
8. Have students work with a partner to *slice* a geometric solid and identify the two-dimensional shape that is formed by the slicing. Using modeling clay and a large straightened paper clip, have students create various geometric solids and then use the paper clip to slice the figure at an angle. Reshape the object and slice it again from a different angle. Repeat this process three or four times. After each *slicing* have the students draw and name the resulting two-dimensional shape. Conclude the activity with the students sharing their findings with the class.



[7th Grade Math ~ Geometry Web sites](#)



[Learn Zillion ~ Common Core Videos](#)

Formative: Technology Project

Students will complete the *Great Cartoon Blowup* activity to ensure understanding of the need for accuracy in making scale drawings.

Drawing and Working with Geometric Shapes Formative: Homework

Students will complete tasks similar to the following to demonstrate understanding of Standards 7.G.2.

- a. Given the measurements of three line segments, students form/create a triangle. They will explain reasoning used.
- b. Students will be presented with a triangle whose angles measure $A = 57$ degrees, $B = 62$ degrees, and $C = 61$ degrees. They will sketch this triangle. Without measuring, they will name the longest side and explain how they know it is the longest side.
- c. Students will draw two triangles with congruent angles but different side lengths and explain how this is possible.
- d. Students will be given three side measures that would not form a triangle. They will explain why the sides would not form the triangle.

Slicing a Geometric Figure Summative: Class Work

Students will work with a partner to *slice* a geometric solid and identify the two-dimensional shape that is formed by the slicing. Using modeling clay and a large straightened paper clip, students will create various geometric solids and then use the paper clip to slice the figure at an angle. Reshape the object and slice it again from a different angle. Repeat this process three or four times. After each *slicing*, students will draw and name the resulting two-dimensional shape. Students will share their findings with the class.

Resources (Suggested)

1. iPad Resources
2. Literature Connection
 - A Drop of Water: A Book of Science and Wonder* by Walter Wick
 - The Greedy Triangle* by Marilyn Burns
 - Holes* by Louis Sachar
 - A Light in the Attic ("Shapes")* by Shel Silverstein
 - The Missing Piece* by Shel Silverstein
 - Spaghetti and Meatballs for All! A Mathematical Story* by Marilyn Burns
 - The Village of Round and Square Houses* by Ann Grifalconi
 - Angles Are Easy As Pie* by Robert Froman and Byron Barton
 - A Cloak For The Dreamer* by Aileen Friedman and Kim Howard
 - Catherine, Called Birdy* by Karen Cushman
 - Grandfather Tang's Story* by Ann Tompert and Robert Andrew Parker
3. Internet Resources



[Congruent Triangles](#)

Catholic Identity

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND



[Congruent Figures](#)



[Investigating Prisms](#)



[The Khan Academy](#)



[iLearn Ohio](#)



[The National Library of Virtual Manipulatives](#)



[Math Worksheet Generator ~ Grade 7](#)



[Learn Zillion ~ Common Core Videos](#)

CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS
and to recognize the rights of others to be safe and free from
harassment and abuse.

✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and
their actions.

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 6: Solve Geometrical and Real-life Problems

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Geometry

7.G Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- 7.G.4. 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.G.5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
- 7.G.6. 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.

DOC: Mathematics, DOC: Grade 7, Geometry and Spatial Sense

D. Visual and Geometric Models

- 5. Recognize and apply geometric ideas and relationships to areas such as art, science, music, and everyday life.

Essential Questions

- How do I find area, surface area, and volume of two- and three-dimensional figures?

- How are geometric properties used to solve real-life problems?
- How and where is geometry used in the real world?

Content

The students will know

1. Circumference of a circle
2. Area of a circle
3. Adjacent angles
4. Vertical angles
5. Complementary angles
6. Supplementary angles
7. Area of two-dimensional objects
8. Surface area of three-dimensional objects
9. Volume of three-dimensional objects

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Know the formulas for the area and circumference of a circle and use them to solve problems.
2. Explain the relationship between the circumference and area of a circle.
3. Solve problems utilizing the circumference of a circle formula.
4. Solve problems utilizing the area of a circle formula.
5. Explore and investigate angles to find relationships in a geometric figure.
6. Define supplementary, complementary, vertical, and adjacent angles.
7. Solve for an unknown angle in a figure utilizing definitions of supplementary, complementary, vertical, and adjacent angles.
8. Determine the surface area of geometric solids using rectangular prisms with whole number dimensions.
9. Investigate relationships between two and three-dimensional objects.
10. Solve area, volume, and surface area problems of two- and three-dimensional objects from real-world situations. (triangles, quadrilaterals, polygons, cubes, and right prisms)
11. Recognize and apply geometric ideas and relationships to areas such as art, science, music, and everyday life.

Reading/Writing Skills

1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems.
2. Justify solutions, either verbally or in written form.
 - Explain step-by-step process.
 - Summarize results using specific and appropriate vocabulary.
3. Use technology to produce written explanations and justifications for real-life and mathematical problems.

Common Core Vocabulary

1. Circle
2. Circumference
3. Area
4. Diameter
5. Radius
6. Vertical angles
7. Supplementary
8. Complementary
9. Adjacent angles
10. Surface area
11. Volume

Additional Vocabulary

1. Circumference
2. Area
3. Circle
4. Triangle
5. Quadrilateral
6. Polygon
7. Cube
8. Right prisms

Learning Experiences (Suggested)

Assessment (Suggested)

1. Begin the study of the unit using the introductory You Tube video *Circles Radius Diameter & Pi*. (See Links) Follow this with having students work with a partner to explain the following in writing and provide a sample problem for each.
 - a. how pi (π) is calculated
 - b. the formula for the circumference of a circle
 - c. how to find the circumference of a circle given the diameter of the circle
 - d. how to find the circumference of a circle given the radius of the circle
2. Online learning. Extend student learning addressing the relationship between circumference, diameter and radius using the videos for Standard 7.G.4 found at the *Learn Zillion* site or another appropriate site. (See Links) After studying each video, ask students to write out the sample problem discussed and create a similar problem by writing a story about the problem and then explaining the steps taken to solve each problem.
3. Working in cooperative groups, have students work through the instructional strategies found in the ODE Model Curriculum, page 14. (See Links)
4. Class activity/Online learning. Engage students in developing familiarity with facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem in order to write and solve simple equations for an unknown angle in a figure. Use the videos for Standard 7.G.5 at the *Learn Zillion* site or another appropriate site. (See Links)
5. As a follow-up to working with the videos for Standard 7.G.5, have students work with a partner to create problems that address each of the following concepts.
 - a. Use consecutive interior angles to find unknown angles.
 - b. Use supplementary angles to find unknown angles.
 - c. Use interior angles of triangles to find unknown angles.
 - d. Use complimentary angles to find an unknown angle.
 - e. Use vertical and adjacent angles to find unknown angle.
 - f. Use interior and exterior angles to find unknown angles.
 Have teams exchange problems and then solve the new problems they have. Explain the reasoning used in finding the unknown angles.
6. Class activity/Online learning. Using the *Online Math Learning* site (See Links), engage students in investigating and calculating the surface area and volume of three-dimensional geometrical shapes. Ask them to explain the reasoning used to solve related problems.
7. Class activity/Group work. Using the lesson on *Area, Surface, and Volume* (see Links) or another appropriate lesson/activity, have the students engage in real-world problem solving activities involving area, surface, and volume. In each activity, have students explain their work and justify their solutions.



[Geometry of Circles](#)



[Circles Radius Diameter & Pi](#)



[ODE Model Curriculum for Math ~ page 14-15](#)

Let's Review

Diagnostic: Class Work

Students will work with a partner to explain the following in writing and provide a sample problem for each.

- a. how pi (π) is calculated
- b. the formula for the circumference of a circle
- c. how to find the circumference of a circle given the diameter of the circle
- d. how to find the circumference of a circle given the radius of the circle

Going Around in Circles

Formative: Homework

Students will write sample problems addressing the relationship between circumference, diameter and radius. They will write a story about the problem and then they will explain the steps one will take to solve the problem.

What's Your Angle

Formative: Class Work

Students will work with a partner to create problems that address each of the following concepts.

- a. Use consecutive interior angles to find unknown angles.
- b. Use supplementary angles to find unknown angles.
- c. Use interior angles of triangles to find unknown angles.
- d. Use complimentary angles to find an unknown angle.
- e. Use vertical and adjacent angles to find unknown angle.
- f. Use interior and exterior angles to find unknown angles.

Teams will exchange problems and then solve the new problems they have. They will explain the reasoning used in finding the unknown angles.

Which Object Holds More?

Formative: Lab Assignment

Students will engage in real-world problem solving activities involving area, surface, and volume. In each activity, they will explain their work and justify their solutions. (See Links in Learning Experiences.)

Angle Relationships

Summative: Posters

Using facts and concepts learned in this unit, students will create a poster emphasizing how to use this knowledge to solve real-world problems.



[Square Circles!](#)

[Apple pi!](#)

[Circle Tool!](#)

[Circles and Their Area!](#)

[Exploring \$c/d = \pi\$](#)

[Online Math Learning ~ Surface Area Formulas!](#)

[Area, Surface, and Volume!](#)

Resources (Suggested)

- iPad Resources
- Literature Connection
A Drop of Water: A Book of Science and Wonder by Walter Wick
The Greedy Triangle by Marilyn Burns
A Light in the Attic ("Shapes") by Shel Silverstein
The Missing Piece by Shel Silverstein
Spaghetti and Meatballs for All! A Mathematical Story by Marilyn Burns
The Village of Round and Square Houses by Ann Grifalconi
Angles Are Easy As Pie by Robert Froman and Byron Barton
A Cloak For The Dreamer by Aileen Friedman and Kim Howard
Chasing Vermeer by Blue Balliett
- Internet Resources



[Investigating geometric solids!](#)



[Geometry Activities!](#)



[Geometry Activities and Review!](#)



[iLearn Ohio!](#)



[The Khan Academy!](#)



[The National Library of Virtual Manipulatives!](#)



[Learn Zillion ~ Common Core Videos!](#)

Catholic Identity

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.



Math Worksheet Generator ~ Grade 7

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 7: Use Random Sampling to Draw Inferences

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Statistics & Probability

7.SP Use random sampling to draw inferences about a population.

- 7.SP.1. 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.SP.2. 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.

7.SP Draw informal comparative inferences about two populations.

- 7.SP.3. 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.
- 7.SP.4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

DOC: Mathematics, DOC: Grade 7, Data Analysis and Probability

A. Data Collection

- 1. Design experiments and surveys and consider potential sources of bias in design and data collection.
- 2. Read, create, and interpret box-and-whisker plots, stem-and-leaf plots, histograms, and other types of graphs.

B. Statistical Methods

- 7. Identify misuses of statistical data in articles, advertisements, and other media.

Essential Questions

- How can data be described and interpreted?
- How can estimations of likelihood be made for random events?
- How can I gather, organize and display data to communicate and justify results in the real world?
- How can I use probability to calculate outcomes of real world problems?
- How are data collection and statistics used in relevant real-world activities?
- How can I analyze data to make inferences and/or predictions, based on surveys, experiments, probability and observational studies?

Content

The students will know

1. Data collection
2. Different graphical representations
3. Random sampling
4. Numerical data distributions
5. Measures of center, variability, central tendency
 - Mean
 - Median
 - Mode
 - Range
 - Standard deviation
 - Mean absolute deviation

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Design experiments and surveys and consider potential sources of bias in design and data collection.
2. Analyze statistics and samples to draw conclusions about a population.
3. Analyze how decisions about graphing affect the graphical representation, e.g., scale, size of class, number of categories, etc.
4. Analyze decisions about populations and samples to gain information.
5. Develop a logical argument using the random sampling to support valid inferences about the population.
6. Construct comparative inferences about two populations using measures of central tendency.
7. 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.
8. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
9. Read, create, and interpret box-and-whisker plots, stem-and-leaf plots, histograms, and other types of graphs.
10. Analyze different graphical representations to compare groups of data.
11. Identify misuses of statistical data in articles, advertisements, and other media.

Reading/Writing Skills

1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems.
2. Justify solutions, either verbally or in written form.
 - Explain step-by-step process.
 - Summarize results using specific and appropriate vocabulary.

3. Use technology to produce written explanations and justifications for real-life and mathematical problems.

Common Core Vocabulary

1. Sample space
2. Population
3. Biased versus unbiased sampling
4. Random sample
5. Random sampling
6. Valid inference
7. Types of sampling
 - Simple random
 - Systematic
 - Stratified
 - Cluster
8. Measures of variability
9. Measures of center (measures of central tendency)
10. Mean absolute deviation

Additional Vocabulary

1. Statistics
2. Histogram (bar graph)
3. Box-and-whisker plot
4. Line graph
5. Stem-and-leaf plot
6. Circle graph
7. Mean
8. Median
9. Mode
10. Range
11. Overlap

Learning Experiences (Suggested)

1. Class activity/Online learning. Engage students in developing an understanding of random sampling as tending to produce representative samples and support valid inferences. Use the videos for Standard 7.SP.1 at the Learn Zillion site or another appropriate site. (See Links)
2. Have students work in cooperative groups to conduct the following survey or a similar survey.
Survey Situation. The school food service wants to increase the number of students who eat hot lunch in the cafeteria. The student council has been asked to conduct a survey of the student body to determine the students' preferences for hot lunch.
Survey Type. What type of survey should be used? Which survey option would produce a random sample? Which survey option should the student council use and why?
Survey Options.
 1. Write all of the students' names on cards and pull them out in a draw to determine who will complete the survey.
 2. Survey the first 20 students that enter the lunchroom.
 3. Survey every 3rd student who gets off a bus.
3. Class activity/Online learning. Engage students in developing an understanding of how to collect and use multiple samples of data to make generalizations about a population and the issues of variation possible in the samples. Use the videos for Standard 7.SP.2 at the Learn Zillion site or another appropriate site. (See Links)
4. As a follow-up to the class activity/online learning experience, have students work in cooperative groups to analyze surveys [question(s), sample data and graph] to:
 - a. discuss and determine biases that may be present.
 - b. develop a logical argument using the sampling method to support valid inferences about the population.
 - c. discuss how decisions about graphing affect the graphical representation, e.g. scale, size of class, number of categories, etc. and the information communicated from the graphical representation.

Assessment (Suggested)

Conducting a Survey Summative: Technology Project

Students, working in groups, will conduct a survey of their peers and will construct different graphical representations of their data.

- Dot plots
- Line plots
- Histograms
- Frequency tables
- Box-and-whisker plots

Groups will then present their findings and explain the measures of spread and variability in their data as well as the different types of samples used in the survey. Students will use technology to create a presentation of their findings.

School Food Service Formative: Cooperative Group Work

Students will work in cooperative groups to conduct the following survey or a similar survey.

Survey Situation. The school food service wants to increase the number of students who eat hot lunch in the cafeteria. The student council has been asked to conduct a survey of the student body to determine the students' preferences for hot lunch.

Survey Type. What type of survey should be used? Which survey option would produce a random sample? Which survey option should the student council use and why?

Survey Options.

1. Write all of the students' names on cards and pull them out in a draw to determine who will complete the survey.
2. Survey the first 20 students that enter the lunchroom.
3. Survey every 3rd student who gets off a bus.

Comparing Scores on a Test

- d. compare groups using different graphical representations.
5. Have students work with a partner to create a survey they will use to collect data on a topic of their choosing. Once they have amassed enough data, they will use the data to construct different representations and present and explain their findings to the class.
 6. Class activity. Engage students in a discussion focusing on building their understanding of graphs, mean, median, Mean Absolute Deviation (MAD) and interquartile range from 6th grade. Students should understand that
 1. a full understanding of the data requires consideration of the measures of variability as well as mean or median.
 2. variability is responsible for the overlap of two data sets and that an increase in variability can increase the overlap.
 3. median is paired with the interquartile range and mean is paired with the mean absolute deviation.
 7. Working with a partner, have students create data that can be used to determine which class did better on a data analysis test. Once they have listed the scores for the two classes, have them use a measure of center and the mean absolute variation to describe the data and draw two dot plots to represent the data. Ask them to share and explain their work with the class correctly using terminology pertinent to the task. Namely, variation/variability, distribution, measures of center, and measures of variability.
 8. Class activity/Online learning. Engage students in developing an understanding of the use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. Use the videos for Standard 7.SP.4 at the Learn Zillion site or another appropriate site. (See Links)
 9. As a follow up to the class activity/online learning lesson, have the students work in cooperative groups to analyze the nutritional value of at least five different protein snack bars from two different name brands. After collecting their data, have them draw comparative inferences using the measures of center and measures of variability to support their claims. Have the groups share and explain their findings with the class.



[Learn Zillion ~ Common Core Videos!](#)

Formative: Cooperative Group Work

Students will create data that can be used to determine which class did better on a data analysis test. Once they have listed the scores for the two classes, they will use a measure of center and the mean absolute variation to describe the data and draw two dot plots to represent the data.

They will share and explain their work with the class correctly using terminology pertinent to the task.

Comparative Inferences About Two Populations

Formative: Cooperative Group Work

Students will work in cooperative groups to analyze the nutritional value of at least five different protein snack bars from two different name brands.

After collecting their data, they will draw comparative inferences using the measures of center and measures of variability to support their claims.

Groups will share and explain their findings with the class.

Resources (Suggested)

1. iPad Resources
2. Literature Connection
 - Picturing Math* by Carol Otis Hurst and Rebecca Otis
 - Anno's Hat Tricks* by Akihiro Nozaki
 - Factastic Book of 1,001 Lists* by Russell Ash
 - Harry Potter and the Sorcerer's Stone* by J. K. Rowling
 - The Phantom Tollbooth* by Norton Juster
 - Tikki Tikki Tembo* by Arlene Mosel
 - Guess Who My Favorite Person Is* by Byrd Baylor
 - A Million Fish...More or Less* by Patricia McKissack
 - Wrinkle in Time* by Madeleine L'Engle
 - Jumanji* by Chris Van Allsburg
3. Internet Resources

Catholic Identity

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.



[Displaying Data and Graphs](#)



[Constructing Inferences Using Measures of Central Tendency](#)



[Learn Zillion ~ Common Core Videos](#)



[The Khan Academy](#)



[iLearn Ohio](#)



[The Math Worksheets Site](#)



[The National Library of Virtual Manipulatives](#)

- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Mathematics Curriculum ~ Grade Seven

Diocese of Cleveland



Unit 8: Investigate Probability Models

Standards Assessed

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

Craft and Structure 4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12, OH: CCSS: Grades 6-8, Writing

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

- WHST.6-8.2d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 6. Attend to precision.

CCSS: Mathematics (2011), OH: CCSS: Grade 7, Statistics & Probability

7.SP Investigate chance processes and develop, use, and evaluate probability models.

- 7.SP.5. 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.
- 7.SP.6. 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.
- 7.SP.7. 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.SP.7a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
- 7.SP.7b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
- 7.SP.8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
- 7.SP.8a. 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.SP.8b. 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.SP.8c. Design and use a simulation to generate frequencies for compound events.

DOC: Mathematics, DOC: Grade 7, Data Analysis and Probability

C. Probability

- 4. Explore relationships such as independent and dependent events, permutations and combinations when determining probabilities.

Essential Questions

- How can the knowledge of probability help you in the decision making process?
- What kinds of questions can be answered using different data displays?
- How does the type of data influence the choice of graph?
- How is the probability of an event determined and described?
- How do people use data to influence others?
- How are data collection and statistics used in relevant real-world activities?

Content

The students will know

- Probability
 - Experimental
 - Theoretical
- Data collection
- Probability models
- Frequency of data
- Probability of simple events
- Probability of compound events
- Independent events
- Dependent events
- Permutations
- Combinations

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

- Explain probability in terms of concepts including
 - chance event
 - measurement between 0 and 1
 - 0 is an improbable event
 - 1 is a probable event
 - $1/2$ is neither an improbable or probable event
- Investigate the probability of chance using experimental probability.
- Investigate the probability of chance using theoretical probability.
- Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency.
- Predict the approximate relative frequency given the probability.
- Develop a probability model and use it to find probabilities of events.
- Compare probabilities from a model to observed frequencies.
- Construct a probability model to describe the equal probability to all outcomes.
- Explain possible sources of the discrepancy if the agreement is not good in the observed frequency.
- Investigate uniform and non-uniform probability models.
- Draw conclusions in relation to sample events using the probability models.
- Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
- Recognize that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- Apply properties of simple probability to calculate compound probabilities.
- Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams.
- Design and use a simulation to generate frequencies for compound events.
- Describe and illustrate relationships such as independent and dependent events, permutations and combinations when

	<p>determining probabilities.</p> <p>Reading/Writing Skills</p> <ol style="list-style-type: none"> 1. Define, using context clues, specific vocabulary from the Common Core and apply the terms and definitions to solve problems. 2. Justify solutions, either verbally or in written form. <ul style="list-style-type: none"> ▪ Explain step-by-step process. ▪ Summarize results using specific and appropriate vocabulary. 3. Use technology to produce written explanations and justifications for real-life and mathematical problems.
<p>Common Core Vocabulary</p> <ol style="list-style-type: none"> 1. Experimental probability 2. Theoretical probability 3. Compound events 4. Independent events 5. Dependent events 6. Permutation 7. Combination 8. Assimilation 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Probability 2. Outcomes 3. Event 4. Fair 5. Tree diagram 6. Table
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class discussion. Engage students in a class discussion focusing on theoretical and experimental probability of events happening. Such as: <ol style="list-style-type: none"> a. Will we have a snow day? b. How often will I roll a three on a dice? c. How often will I flip a head on a coin? Follow up the discussion using the lesson that introduces the concept of probability and in particular explores theoretical and experimental probability with tree diagrams and the fundamental counting principle. (See Links.) 2. Following the class discussion, have students work with a partner and use <i>Boxing Up</i> (see Links) to further explore the relationship between theoretical and experimental probabilities. 3. Class activity. Engage students in developing an understanding of the probability of chance using the benchmarks of probability: 0, 1, and $\frac{1}{2}$. Provide students with situations that have clearly defined probability of never happening as zero, always happening as 1 or equally likely to happen as to not happen as $\frac{1}{2}$. Then advance to situations in which the probability is somewhere between any two of the benchmark values. 4. Online learning. Have students work with a partner to estimate the size of a total population by taking samples and using proportions to estimate the entire population. Ask them to write a story about their population and explain the steps taken to estimate the size of the total population. See <i>Capture-Recapture</i> in the Links. 5. Working with a partner, have students solve the following problem or one similar to it. Problem. A container contains 2 gray, 1 white, and 4 black marbles. Without looking, if Sam chooses a marble from the container, will the probability be closer to 0 or to 1 that Sam will select a white marble? A gray marble? A black marble? Justify 	<p>Assessment (Suggested)</p> <p>Investigating Probability Formative: Lab Assignment</p> <p>Using M&Ms or Skittles, students will investigate properties of experimental probability.</p> <p>Boxing Up Formative: Class Work</p> <p>Students will work with a partner and use <i>Boxing Up</i> to further explore the relationship between theoretical and experimental probabilities.</p> <p>Population Sampling Formative: Cooperative Group Work</p> <p>Students will work with a partner to estimate the size of a total population by taking samples and using proportions to estimate the entire population. They will write a story about their population and explain the steps taken to estimate the size of the total population. See <i>Capture-Recapture</i> in the Links.</p> <p>More on Probability Formative: Homework</p> <p>Students will solve the following problem or one similar to it. Problem. A container contains 2 gray, 1 white, and 4 black marbles. Without looking, if Sam chooses a marble from the container, will the probability be closer to 0 or to 1 that Sam will select a white marble? A gray marble? A black marble? Justify each of your predictions. (See the <i>Random Drawing Tool</i> to use simulations to generate data and examine</p>

each of your predictions. (See the Random Drawing Tool to use simulations to generate data and examine patterns in the Links.)

6. Class activity/Online learning. Engage students in developing the ability to 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. Use the videos for Standard 7.SP.6 in *Learn Zillion* site or another appropriate site. (See Links)
7. Class activity/Online learning. Engage students in developing skill in creating a probability model and use it to find probabilities of events and compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. Use the videos for Standards 7.SP.7a and b in the *Learn Zillion* site or another appropriate site. (See Links)
8. Have students work in cooperative groups to perform probability experiments and compare the results to theoretical probabilities. Critical components to include:
 - a. making predictions about the outcomes.
 - b. applying principles of theoretical probability.
 - c. compare the predictions to outcomes.
 - d. replicate the experiment to compare results.
9. Class activity/Online learning. Engage students in developing skill in making predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results to predicted results, and explain differences. Use the *Dart Throwing* activity found in the Links.
10. **Project.** Have students work in a cooperative group to analyze data such as the 1930 U.S. census compared to the 1960 census to see what inferences they can draw from the data analysis. Many possible areas of analysis can be found at the *Gapminder* site. (See Links)



[Deal or No Deal Probability](#)



[Learn Zillion](#)



[Introduction to the Concept of Probability](#)



[Boxing Up](#)



[Capture-Recapture](#)



[Random Drawing Tool](#)



[Dart Throwing](#)



[Gapminder ~ Statistical Data Resource](#)

patterns in the Links.)

Experimenting with Probability

Formative: Cooperative Group Work

Students will work in cooperative groups to perform probability experiments and compare the results to theoretical probabilities. Critical components to include:

- a. making predictions about the outcomes.
- b. applying principles of theoretical probability.
- c. compare the predictions to outcomes.
- d. replicate the experiment to compare results.

Throwing Darts

Formative: Cooperative Group Work

Working with a partner, students will develop skill in making predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results to predicted results, and explain differences. Use the *Dart Throwing* activity found in the Links.

Analyzing Probability Data

Summative: Cooperative Group Work

Project. Students will work in a cooperative group to analyze data such as the 1930 U.S. census compared to the 1960 census to see what inferences they can draw from the data analysis. Many possible areas of analysis can be found at the *Gapminder* site. (See Links)

Resources (Suggested)

Catholic Identity

1. iPad Resources
2. Literature Connection
 - One Two Three Infinity* by George Garrow
 - Guess Who My Favorite Person Is* by Byrd Baylor
 - Socrates and the Three Little Pigs* by Tuyosi Mori and Mitsumasa Anno
 - La Casa en Mango Street* by Sandra Cisneros and Elena Poniatowska
 - All Mixed Up!: A Mixed-Up Matching Book* by J. Gukova and Julia Gukova
 - A Million Fish...More or Less* by Patricia McKissack
 - Do You Wanna Bet?: Your Chance to Find Out About Probability* by Jean Cushman and Martha Weston
 - Math Curse* by Jon Scieszka and Lane Smith
3. Internet Resources



[Interactive Learning Experiences: Ideas that Lead to Probability](#)



[Data Analysis and Probability Games](#)



[Learn Zillion](#)



[The Khan Academy](#)



[iLearn Ohio](#)



[The National Library of Virtual Manipulatives](#)



[Generating Math Worksheets](#)



[Probability Games and Activities ~ Grades 8-12](#)



[Gapminder ~ Statistical Data Resource](#)

Social Justice Teachings

- ✚ Life And Dignity Of The Human Person
- ✚ Call To Family, Community, And Participation
- ✚ Rights And Responsibilities
- ✚ Solidarity
- ✚ Care For God's Creation

Rights of Children

- ✚ THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.
- ✚ THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.
- ✚ THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.
- ✚ THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
- ✚ THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION, and challenges its members to critical and reflective thinking in their search for truth.
- ✚ THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.
- ✚ THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

PARENT GUIDE

GRADE SEVEN MATHEMATICS CURRICULUM

DIOCESE OF CLEVELAND

Below is a list of skills your child will be taught in Grade Seven Mathematics.

As parents, you are encouraged to support the work of your child's teacher in helping your child acquire each of these skills.

RATIOS AND PROPORTIONAL RELATIONSHIPS	
ANALYZE PROPORTIONAL RELATIONSHIPS AND USE THEM TO SOLVE REAL-WORLD AND MATHEMATICAL PROBLEMS.	
	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
	Recognize and represent proportional relationships between quantities.
	Decide whether two quantities are in a proportional relationship, e.g., 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.
	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
	Represent proportional relationships by equations.
	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.
	Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
NUMBER SYSTEM	
APPLY AND EXTEND PREVIOUS UNDERSTANDINGS OF OPERATIONS WITH FRACTIONS.	
	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
	Describe situations in which opposite quantities combine to make 0.
	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.
	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.
	Apply properties of operations as strategies to add and subtract rational numbers.
	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
	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.
	Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero 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.
	Apply properties of operations as strategies to multiply and divide rational numbers.
	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.
	Solve real-world and mathematical problems involving the four operations with rational numbers.

STATISTICS & PROBABILITY	
USE RANDOM SAMPLING TO DRAW INFERENCES ABOUT A POPULATION.	
	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.
	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.
DRAW INFORMAL COMPARATIVE INFERENCES ABOUT TWO POPULATIONS.	
	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.
	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
INVESTIGATE CHANCE PROCESSES AND DEVELOP, USE, AND EVALUATE PROBABILITY MODELS.	
	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.
	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.
	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.
	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
	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.
	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.
	Design and use a simulation to generate frequencies for compound events.
DOC: Patterns, Functions and Algebra	
ALGEBRAIC REPRESENTATION	
	Describe problem situations involving ratios, proportions, and percents with algebraic expressions.
	Continue to explore the effects of the order of operations on computations and use parentheses appropriately to group numbers.
DOC: Measurement	
MEASUREMENT TECHNIQUES AND TOOLS	
	Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system.
DOC: Geometry and Spatial Sense	
CHARACTERISTICS AND PROPERTIES	
	Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.
	Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.

DOC: Geometry and Spatial Sense continued	
VISUAL AND GEOMETRIC MODELS	
	Recognize and apply geometric ideas and relationships to areas such as art, science, music, and everyday life.
DOC: Data Analysis and Probability	
DATA COLLECTION	
	Design experiments and surveys and consider potential sources of bias in design and data collection.
	Read, create, and interpret box-and-whisker plots, stem-and-leaf plots, histograms, and other types of graphs.
STATISTICAL METHODS	
	Identify misuses of statistical data in articles, advertisements, and other media.
PROBABILITY	
	Explore relationships such as independent and dependent events, permutations and combinations when determining probabilities.

DATE TAUGHT	
OH: CCSS: Literacy: Reading: Science & Technical Subjects	
KEY IDEAS AND DETAILS	
	Cite specific textual evidence to support analysis of science and technical texts.
CRAFT AND STRUCTURE	
	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
OH: CCSS: Literacy: Writing	
TEXT TYPES AND PURPOSES	
	Write arguments focused on discipline-specific content.
	Use precise language and domain-specific vocabulary to inform about or explain the topic.
USE TECHNOLOGY, INCLUDING THE INTERNET, TO PRODUCE AND PUBLISH WRITING AND TO INTERACT AND COLLABORATE WITH OTHERS.	
	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.



(Source: [1] National Governors Association Center for Best Practices, Council of Chief State School Officers. 2010. *Common Core State Standards for Mathematics*. Washington, D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.[2] Office of Catholic Education. 2007. *Mathematics Curriculum*. Cleveland, Ohio: Office of Catholic Education.)

NOTES: _____

MATHEMATICS CURRICULUM

GRADE SEVEN

CHECKLIST FOR COMMON CORE STATE STANDARDS & DIOCESAN CURRICULUM

DATE TAUGHT	
RATIOS AND PROPORTIONAL RELATIONSHIPS	
ANALYZE PROPORTIONAL RELATIONSHIPS AND USE THEM TO SOLVE REAL-WORLD AND MATHEMATICAL PROBLEMS.	
	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
	Recognize and represent proportional relationships between quantities.
	Decide whether two quantities are in a proportional relationship, e.g., 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.
	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
	Represent proportional relationships by equations.
	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.
	Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
NUMBER SYSTEM	
APPLY AND EXTEND PREVIOUS UNDERSTANDINGS OF OPERATIONS WITH FRACTIONS.	
	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
	Describe situations in which opposite quantities combine to make 0.
	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.
	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.
	Apply properties of operations as strategies to add and subtract rational numbers.
	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
	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.
	Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero 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.
	Apply properties of operations as strategies to multiply and divide rational numbers.
	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.
	Solve real-world and mathematical problems involving the four operations with rational numbers.

DATE TAUGHT		
STATISTICS & PROBABILITY		
USE RANDOM SAMPLING TO DRAW INFERENCES ABOUT A POPULATION.		
	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.	
	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.	
DRAW INFORMAL COMPARATIVE INFERENCES ABOUT TWO POPULATIONS.		
	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.	
	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	
INVESTIGATE CHANCE PROCESSES AND DEVELOP, USE, AND EVALUATE PROBABILITY MODELS.		
	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.	
	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.	
	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.	
	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.	
	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.	
	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.	
	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.	
	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.	
	Design and use a simulation to generate frequencies for compound events.	
DOC: Patterns, Functions and Algebra		
ALGEBRAIC REPRESENTATION		
	Describe problem situations involving ratios, proportions, and percents with algebraic expressions.	
	Continue to explore the effects of the order of operations on computations and use parentheses appropriately to group numbers.	
DOC: Measurement		
MEASUREMENT TECHNIQUES AND TOOLS		
	Solve problems involving proportional relationships and scale factors; e.g., scale models that require unit conversions within the same measurement system.	
DOC: Geometry and Spatial Sense		
CHARACTERISTICS AND PROPERTIES		
	Use proportional reasoning to describe and express relationships between parts and attributes of similar and congruent figures.	
	Apply properties of congruent or similar triangles to solve problems involving missing lengths and angle measures.	

DATE TAUGHT	
DOC: Geometry and Spatial Sense continued	
VISUAL AND GEOMETRIC MODELS	
	Recognize and apply geometric ideas and relationships to areas such as art, science, music, and everyday life.
DOC: Data Analysis and Probability	
DATA COLLECTION	
	Design experiments and surveys and consider potential sources of bias in design and data collection.
	Read, create, and interpret box-and-whisker plots, stem-and-leaf plots, histograms, and other types of graphs.
STATISTICAL METHODS	
	Identify misuses of statistical data in articles, advertisements, and other media.
PROBABILITY	
	Explore relationships such as independent and dependent events, permutations and combinations when determining probabilities.

DATE TAUGHT	
OH: CCSS: Literacy: Reading: Science & Technical Subjects	
KEY IDEAS AND DETAILS	
	Cite specific textual evidence to support analysis of science and technical texts.
CRAFT AND STRUCTURE	
	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
OH: CCSS: Literacy: Writing	
TEXT TYPES AND PURPOSES	
	Write arguments focused on discipline-specific content.
	Use precise language and domain-specific vocabulary to inform about or explain the topic.
USE TECHNOLOGY, INCLUDING THE INTERNET, TO PRODUCE AND PUBLISH WRITING AND TO INTERACT AND COLLABORATE WITH OTHERS.	
	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.



(Source: [1] National Governors Association Center for Best Practices, Council of Chief State School Officers. 2010. *Common Core State Standards for Mathematics*. Washington, D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.[2] Office of Catholic Education. 2007. *Mathematics Curriculum*. Cleveland, Ohio: Office of Catholic Education.)

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