

Mathematics Curriculum ~ Grade Eight

Diocese of Cleveland



Unit 1: Know the Real Number System

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 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.

- 2. Reason abstractly and quantitatively.
- 6. Attend to precision.
- 8. Look for and express regularity in repeated reasoning.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, The Number System

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

- 8.NS.1. Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
- 8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Expressions & Equations

8.EE Work with radicals and integer exponents.

- 8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.
- 8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
- 8.EE.3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
- 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

DOC: Mathematics, DOC: Grade 8, Numbers, Number Sense and Operations

A. Number and Number Systems

- 2. Recognize that natural numbers, whole numbers, integers, rational numbers, and irrational numbers are subsets of the real number system.
- 4. Demonstrate an understanding of the properties of the rational number system; e.g., order, and reciprocals.

B. Meaning of Operations

- 1. Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals

C. Computation and Estimation

- 5. Add, subtract, multiply, divide, and compare numbers written in scientific notation.

Essential Questions

- Why is the real number system important in the study of mathematics?
- To what extent can scientific notation be used or found in your life?
- How is thinking algebraically different from thinking mathematically?
- How do I use algebraic expressions to analyze and solve problems?
- How do I know where to begin when solving a problem?
- How does explaining my process help me to understand a problem's solution?
- Why is the ability to solve problems the heart of mathematics?

Content

The students will know

1. Subsets of the real number system
2. Rational numbers
3. Irrational numbers
4. Square roots of non-perfect squares
5. Decimal expansion
6. Rational approximations
7. Cube roots
8. Properties of exponents
9. Operations with scientific notation

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Differentiate subsets of the real number system.
2. Describe and illustrate properties of the real number system.
3. Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.
4. Explain that every number has a decimal expansion.
5. Calculate the decimal expansion of rational numbers.
6. Convert decimal expansions into rational numbers.
7. Describe and illustrate rational numbers as those with decimal expansions that terminate in 0s or eventually repeat.
8. Define irrational numbers.
9. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions.
10. Compare the size of irrational numbers through the use of rational approximations of irrational numbers.
11. Generate equivalent numerical expressions.
12. Calculate numerical expressions applying the properties of exponents.
13. Recognize and apply the properties of integer exponents:
 - a. Product of Powers
 - b. Quotient of Powers
 - c. Power of a Power
 - d. Negative Exponents
 - e. Zero Exponents
14. Apply a combination of properties to show equivalency.
15. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$.
16. Recognize and apply the following:
 - a. Perfect Squares

	<ul style="list-style-type: none"> b. Perfect Cubes c. Square Roots (Symbol Notation) d. Cube Roots (Symbol Notation) e. Principal (positive) roots/negative roots <ol style="list-style-type: none"> 17. Recognize that $\sqrt{2}$ is irrational. 18. Utilize numbers written in scientific notation. 19. Add, subtract, multiply, divide, and compare large and small numbers using properties of integer exponents. 20. Interpret scientific notation that has been generated by technology. 21. Formulate written explanations using the concepts in the real number system. <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> <ul style="list-style-type: none"> ▪ Rational number ▪ Irrational number ▪ Decimal expansion ▪ Rational approximations ▪ Scientific notation ▪ Exponents 	<p>Additional Vocabulary</p> <ul style="list-style-type: none"> ▪ Subsets of the real number system
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class activity/Online learning. Engage students in developing the informal understanding that every number has a decimal expansion and that rational numbers are those with decimal expansions that terminate in 0s or eventually repeat and, finally, that other numbers are called irrational. Use the videos for Standards 8.NS.1 found in the <i>Learn Zillion</i> site or another appropriate site. (See Links) 2. As a follow up to the above activity, have students work with a partner to explain and provide an example for each of the following: <ol style="list-style-type: none"> a. definition of rational numbers. b. definition of irrational numbers. c. distinguish between rational and irrational numbers. d. compare irrational and rational numbers. e. convert repeating decimals into fractions. 3. Provide students with 10-20 decimal numbers and have them convert each decimal to a rational number. Ask students to state the steps taken to: <ol style="list-style-type: none"> a. convert a decimal expansion that terminates to a rational number. b. convert a decimal expansion that repeats to a rational number. 4. Class activity/Online learning. Engage students in using rational approximations of irrational numbers to compare the size of 	<p>Assessment (Suggested)</p> <p>Real Number System Formative: Graphic Organizer</p> <p>Students will create a poster illustrating the real number system and all of the subsets of that system of numbers. They will then present their organizer to the class.</p> <p>Rational and Irrational Numbers Formative: Class Work</p> <p>Students will work with a partner to explain and provide an example for each of the following:</p> <ol style="list-style-type: none"> a. definition of rational numbers b. definition of irrational numbers c. distinguish between rational and irrational numbers d. compare irrational and rational numbers e. convert repeating decimals into fractions <p>Converting a Decimal Expansion Formative: Homework</p> <p>Given 10-20 decimal numbers, students will convert each decimal to a rational number. They will state the steps taken to:</p>

irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions. Use the videos for Standards 8.NS.2 found in the *Learn Zillion* site or another appropriate site. (See Links)

5. Provide students with at least ten radicals that are not perfect squares. Working with a partner, have them find the number on a number line that best represents the location of the radical (between two integers). Have them write an explanation of the reasoning used in placing the radical on the number line.
6. Online learning and class discussions. Working with a partner, have students use the videos found in the *Learn Zillion* site for Standard 8.EE.1 to help them work with radicals and integer exponents. As they work, ask them to provide at least five examples for each of the following properties:
 - a. Product of Powers
 - b. Quotient of Powers
 - c. Power of a Power
 - d. Negative Exponents
 - e. Zero Exponents
7. Have students find the square root and the cube root of the numbers. Using calculators, ask them to create a table showing the number, the square (or cube), and the square root (cube root) for the numbers 1 through 12.
8. Cooperative group work. Provide students with populations from the largest country (China) and the smallest country (Vatican City). Ask them to translate the populations as an integer times a power of 10 and use this form to compare the populations, estimating how many times larger China's population is. Following this, ask the groups to select some other countries for comparison and estimate how many times larger one is to the other population. (Round off the populations so that they will be a single number times a power of 10.) Use the *Countries of the World* site found in the Links.



[Countries of the World](#)



[Learn Zillion ~ Common Core Videos](#)

- a. convert a decimal expansion that terminates to a rational number.
- b. convert a decimal expansion that repeats to a rational number.

Squares That Are Not Perfect Squares

Formative: Cooperative Group Work

Given at least ten radicals that are not perfect squares, students will work with a partner to find the number on a number line that best represents the location of the radical (between two integers). They will write an explanation of the reasoning used in placing the radical on the number line.

Properties of Powers

Formative: Class Work

Students will work with a partner to provide at least five examples for each of the following properties:

- a. Product of Powers
- b. Quotient of Powers
- c. Power of a Power
- d. Negative Exponents
- e. Zero Exponents

Squares and Cubes

Formative: Homework

Students will find the square root and the cube root of numbers. Using calculators, they will create a table showing the number, the square (or cube), and the square root (cube root) for the numbers 1 through 12.

Working with Large Numbers

Summative: Cooperative Group Work

Cooperative group work. Students will be provided with populations from the largest country (China) and the smallest country (Vatican City). They will translate the populations as an integer times a power of 10 and use this form to compare the populations, estimating how many times larger China's population is.

The groups will then select some other countries for comparison and estimate how many times larger one is to the other population. (Round off the populations so that they will be a single number times a power of 10.)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
 - Powers of Ten: A Flipbook* by Charles Eames and Ray Eames
 - Uno's Garden* by Graeme Base
 - A Grain of Rice* by Helena Clare Pittman
 - Alice in Wonderland* by Lewis Carroll
 - Tuck Everlasting* by Natalie Babbitt
3. Internet Resources



[Rational or Irrational Game](#)



[Scientific Notation Activities](#)

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



[Algebra games](#)



[The National Library of Virtual Manipulatives](#)



[iLearn Ohio](#)



[Learn Zillion ~ Common Core Videos](#)



[The Khan Academy](#)



[Ohio Resource Center](#)



[NCTM Illuminations Site](#)



[Algebra I Activities](#)

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 LEARN RESPONSIBILITY for themselves and their actions.



THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Mathematics Curriculum–Grade Eight

Diocese of Cleveland

Unit 2: Understand Proportional Relationships

Standards Assessed

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

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

OH: CCSS: Mathematics (2011), OH: 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.

- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.

OH: CCSS: Mathematics (2011), OH: Grade 8, Expressions & Equations

8.EE Understand the connections between proportional relationships, lines, and linear equations.

- 8.EE.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
- 8.EE.6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .

DOC: Mathematics, DOC: Grade 8, Patterns, Functions, and Algebra

A. Patterns, Relations and Functions

- 1. Describe and represent relations and functions with tables, graphs, words, and symbols.

- 3. Identify functions as linear or nonlinear based on information given in a table, graph, or equation.

B. Algebraic Representation

- 3. Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change.

C. Analyze Change

- 1. Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, direct variation vs. inverse variation.
- 2. Describe and compare how changes in an equation affect the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.
- 4. Use calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.

Essential Questions

- When and why do I use proportional comparisons?
- How can I use data in multiple formats to determine similarities and differences among them?
- How can proportional relationships be used to represent authentic situations in life and solve actual problems?
- How can tables and graphs help me in making everyday decisions?

Content The students will know	Skills <u>Bloom's Taxonomy</u> <u>DOK Links</u> The students will be able to
<ol style="list-style-type: none"> Proportional relationships Types of changes in mathematical relationships and skills <ol style="list-style-type: none"> Linear functions Nonlinear functions Direct variation Inverse variation Unit rate Slope Slope intercept form of an equation of a line The effect of changes in an equation on the related graph Similar triangles Slopes of parallel lines 	<ol style="list-style-type: none"> Differentiate and explain types of changes in mathematical relationships. Explain how changes in an equation affect the related graph. Analyze change utilizing graphing calculators or computers. Construct graphs of proportional relationships. Interpret the unit rate as the slope of the graph. Prove the unit rate is the slope of the line using concepts such as similar triangles. Compare and contrast proportional relationships represented in different forms. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. Describe and illustrate the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b. Explain and illustrate why the slope of a line would be the same between any two points on a non-vertical line. Derive the slope-intercept equation for a line through the origin and a point on the vertical axis, the y-intercept. Draw conclusions about parallel lines based upon the slopes of the two lines. Describe and represent relations and functions with

	<p>tables, graphs, words, and symbols.</p> <ol style="list-style-type: none"> 14. Identify functions as linear or nonlinear based on information given in a table, graph, or equation. 15. Describe the relationship between the graph of a line and its equation. 16. Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, direct variation vs. inverse variation. 17. Describe and compare how changes in an equation affect the related graphs. 18. Use technology to analyze change. <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. 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. Proportional relationships 2. Linear functions 3. Nonlinear functions 4. Direct variation 5. Inverse variation 6. Slope 7. Similar triangles 8. Slope-intercept form of an equation of a line 9. Y-intercept 10. Parallel lines (using the definition of slopes) 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Rate of change 2. Constant rate of change 3. Unit rates
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Warm-up activity. Have students work with a partner to solve the following problem in as many distinctly different ways as they can. <i>A student adds 3 new apps (applications) to her cell phone every month. She currently has 12 apps (applications). Her goal is to have 75 apps (applications). How many more months will she need to reach her goal? (Answer: 21 months) Ask students to explain the reasoning they used to solve the problem.</i> 2. Class activity/Online learning. Engage students in learning how to graph proportional relationships, interpreting the unit rate as the slope of the graph and compare two different proportional relationships represented in different ways. Use the videos for Standard 8.EE.5 in the <i>Learn Zillion</i> site or another 	<p>Assessment (Suggested)</p> <p>Functions in Different Representations Formative: Graphic Organizer Students will create or fill in a graphic organizer to show the different representations of a function, i.e., table, graph, etc.</p> <p>How Many APPS Diagnostic: Class Work Students will work with a partner to solve the following problem in as many distinctly different ways as they can. <i>A student adds 3 new apps (applications) to her cell phone every month. She currently has 12 apps (applications). Her goal is to have 75 apps (applications). How many more months will she need to reach her goal?</i></p> <p>Graphing Equations Formative: Homework</p>

appropriate site. (See Links)

3. Follow up the above activity by asking students to do the following:
 - a. graph the equation $y = 2x$ by finding the ordered pairs that are solutions to the equation.
 - b. graph $y = 3x$ and $y = 4x$ by finding the ordered pairs that are solutions to each of the equations.
Have students justify their solutions.
4. Cooperative group work. Challenge the students to create a graph depicting the following:
 - a. Grade 7 homeroom started day 1 of the magazine drive with a teacher donation of 14 magazines. They then added 23 magazines per day for the next 5 days.
 - b. Grade 8 homeroom started day 1 of the magazine drive with a teacher donation of 40 magazines. They then added 12 magazines per day for the next 5 days.
 - c. After the graphs are completed, ask the students what the y-intercept of each graph represents. (*Answer: What the teacher donated; What the class started with before they collected*) Then ask the students what the slope represents. (*Answer: The rate of magazines collected each day*)
5. Working with a partner, have students use the *Graphing Calculator* (see Links) to enter equations, virtually graph the equations, and make and test conjectures about the equations. Share results with the class.
6. In order to strengthen student understanding of graphing and interpreting proportional relationships, have students work with a partner and play against one another using the *slope-intercept basketball game*. (See Links).
7. Class activity/Online learning. Engage students in using similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane and derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b . Use the videos for Standard 8.EE.6 found at the *Learn Zillion* site or another appropriate site. (See Links)
8. Cooperative group work. Have students demonstrate their understanding of the Standard by reiterating the material presented in each video and giving an example and/or explanation of each.
 - a. describe a line with a unique slope
 - b. derive $y=mx$ using similar triangles
 - c. find the slope of a line on the coordinate plane
 - d. make lines from right triangles
 - e. find coordinates of points on a straight line
 - f. derive $y=mx+b$ using similar triangles
 - g. describe positive and negative slopes
9. Class activity/Online learning. Use the various lessons/activities found at the *Internet4Classrooms* site to reinforce the understanding of Standard 8.EE.6. (See Links)

Students will do the following:

- a. graph the equation $y = 2x$ by finding the ordered pairs that are solutions to the equation.
- b. graph the equations $y = 3x$ and $y = 4x$ by finding the ordered pairs that are solutions to each of the equations.

Students will justify their solutions and share their thinking with the class.

How Many Magazines?

Formative: Cooperative Group Work

Students will work with a partner to create a graph depicting the following:

- a. Grade 7 homeroom started day 1 of the magazine drive with a teacher donation of 14 magazines. They then added 23 magazines per day for the next 5 days.
- b. Grade 8 homeroom started day 1 of the magazine drive with a teacher donation of 40 magazines. They then added 12 magazines per day for the next 5 days.
- c. After the graphs are completed, ask the students (1) what does the y-intercept of each graph represent and (2) what does the slope represent.

Using a Graphing Calculator

Formative: Class Work

Students will use the *Graphing Calculator* to enter equations, virtually graph the equations, and make and test conjectures about the equations. They will share their work with the class.

Knowing the Standard

Formative: Class Work

Students demonstrate their understanding of the Standard 8.EE.6 by reiterating the material presented in each video and giving an example and/or explanation of each.

- a. describe a line with a unique slope
- b. derive $y=mx$ using similar triangles
- c. find the slope of a line on the coordinate plane
- d. make lines from right triangles
- e. find coordinates of points on a straight line
- f. derive $y=mx+b$ using similar triangles
- g. describe positive and negative slopes

<ul style="list-style-type: none">  <u>Algebra games</u>  <u>Slope-intercept basketball game</u>  <u>Learn Zillion ~ Common Core Videos</u>  <u>Graphing Calculator</u>  <u>Internet4Classrooms ~ 8.EE.6</u> 	
Resources (Suggested)	<u>Catholic Identity</u>
<ol style="list-style-type: none"> 1. iPad Resources 2. Literature Connection <ul style="list-style-type: none"> <i>5-Minute Math Problem of the Day: 250 Fun, Multi-Step Problems That Sharpen Math Reasoning, Number Sense</i> by Marcia Miller and Martin Lee <i>Math Curse</i> by Jon Scieszka and Lane Smith <i>Tuck Everlasting</i> by Natalie Babbitt <i>Do the Math: Secrets, Lies, and Algebra</i> by Wendy Lichtman <i>The Unknowns: A Math Mystery</i> by Benedict Carey <i>The King's Giraffe</i> by Mary Jo Collier and Peter Collier <i>Roll of Thunder, Hear My Cry</i> by Mildred D. Taylor <ul style="list-style-type: none">  <u>Solving Proportions Activity</u>  <u>Direct Variation Lessons</u>  <u>Slope and Similar Triangles Examples</u>  <u>The National Library of Virtual Manipulatives</u>  <u>Learn Zillion ~ Common Core Videos</u>  <u>iLearn Ohio</u>  <u>The Khan Academy</u>  <u>Gapminder ~ Statistical Data Resource</u>  <u>Probability Games and Activities ~ Grades 8-12</u>  <u>Ohio Resource Center</u> 	Rights of Children <ul style="list-style-type: none">  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 THE SKILL OF SELF PROTECTION by identifying safe and unsafe situations.  THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.  THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Mathematics Curriculum ~ Grade Eight

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Unit 3: Define, Evaluate, and Compare Functions

Standards Assessed

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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.

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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.

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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.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Functions

8.F Define, evaluate, and compare functions.

- 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
- 8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

8.F Use functions to model relationships between quantities.

- 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing

or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Essential Questions

- How is thinking algebraically different from thinking arithmetically?
- How do I use algebraic expressions to analyze or solve problems?
- How do the properties contribute to my algebraic understanding?
- How can the natural world and real-life situations be represented symbolically and graphically?
- How do tables and graphs impact our everyday decision-making process?

Content

The students will know

1. Definition of a function
2. Function rule
3. Properties of functions
4. Functional relationship between two quantities
5. Slope of a line
6. Slope-intercept equation of a line
7. Initial value of a function
8. Rate of change of a linear relationship

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Explain that a function is a rule that assigns to each input exactly one output.
2. Construct a function as a rule assigning one input to exactly one output.
3. Describe and illustrate the graph of a function as the set of ordered pairs consisting of an input and the corresponding output.
4. Compare and contrast the properties of two functions each represented in a different way.
5. Construct a function to model a linear relationship between two quantities.
6. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line.
7. Prove $y = mx + b$ as defining a linear function.
8. Differentiate between the graphs of linear functions and non-linear functions.
9. Construct a function to model a linear relationship between two quantities.
10. Analyze a graph to describe the functional relationship between two quantities.
11. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values.
12. Analyze a table of values to determine the rate of change and initial value of a linear function.
13. Describe qualitatively the functional relationship between two quantities by analyzing a graph.
14. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

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

Additional Vocabulary

1. Function rule
2. Input
3. Output
4. Initial value
5. Rate of change
6. Functional relationship
7. Slope
8. Non-linear function

1. Graph
2. Coordinate plane
3. Ordered pair
4. Corresponding
5. Table of values
6. One-to-one correspondence

Learning Experiences (Suggested)

1. Class activity. Introduce students to Standard 8.F.1, 2, and 3 using the Learn Zillion site or another appropriate site. (See Links) After using the videos with the students have them define, in their own words, what a function is and what the domain and range of a function is. Ask them to provide examples to support their definitions.
2. Working with a partner, have students use the *Function Machine* in the *National Library of Virtual Manipulatives* to find the rule the Function Machine is using to pair each input with one output. (See Links) Have them copy the table and the function rule and use graph paper to graph the function. Repeat at least three times. In conclusion, ask the students to discuss what is common in each graph.
3. Class activity/Online learning. Engage students to Standard 8.F.4 and 5 using the Learn Zillion site or another appropriate site. (See Links) Have students work out the problems presented in the videos to ensure understanding of the concept presented. Discuss in class.
4. Have students work with a partner to find three real-world situations that can be represented by linear functions in which the rate of change is constant. Situations that can be modeled by linear functions may include the following.
 - a. taxi rates
 - b. rental fees
 - c. admission fees to sports events
 - d. ticket prices for movies/concerts, etc.
 In completing the activity, students should write an equation, identify the rate of change, identify the initial value, and draw a graph of the equations and interpret the slope and the initial value. Share the reasoning used in completing the task with the class.
5. Working with a partner, have students use the *Graphing Calculator* (see Links) to explore the effects changing the slope and y-intercept will have on the linear equation's orientation on the coordinate plane. Share conclusions with the class.



[Slope-intercept basketball game](#)



[Algebra games](#)



[Function Machine](#)



[Internet4Classrooms ~ Algebraic Functions](#)

Assessment (Suggested)

Group work

Formative: Cooperative Group Work

Students will work in groups to construct and model functions for real-world and mathematical problems. Students will describe and explain their relationships.

Function Rule

Formative: Class Work

Students will use the *Function Machine* in the *National Library of Virtual Manipulatives* to find the rule the Function Machine is using to pair each input with one output. (See Links) They will copy the table and the function rule and use graph paper to graph the function. Repeat at least three times. In conclusion, the students will discuss what is common in each graph.

Real-World Situations

Formative: Cooperative Group Work

Students will work with a partner to find three real-world situations that can be represented by linear functions in which the rate of change is constant. Situations that can be modeled by linear functions may include the following.

- a. taxi rates
- b. rental fees
- c. admission fees to sports events
- d. ticket prices for movies/concerts, etc.

In completing the activity, students will write an equation, identify the rate of change, identify the initial value, and draw a graph of the equations and interpret the slope and the initial value. They will share the reasoning used in completing the task with the class.



[Graphing Calculator](#)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
5-Minute Math Problem of the Day: 250 Fun, Multi-Step Problems That Sharpen Math Reasoning, Number Sense, and Computation Skills by Marcia Miller and Martin Lee
A Tangled Tale by Lewis Carroll
Moja Means One by Muriel Feelings and Tom Feelings
3. Internet Resources



[Function Machine](#)



[Interactive Function Machine](#)



[Rate of Change activities](#)



[The National Library of Virtual Manipulatives](#)



[The Khan Academy](#)



[iLearn Ohio](#)



[Learn Zillion ~ Common Core Videos](#)



[Ohio Resource Center](#)



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



[Gapminder ~ Statistical Data Resource](#)



[Math Concepts, Tips, Games and Worksheets](#)

Catholic Identity

Social Justice Teachings

- Life And Dignity Of The Human Person
- Call To Family, Community, And Participation
- Rights And Responsibilities
- Option For The Poor And Vulnerable
- The Dignity Of Work And The Rights Of Workers
- 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.
- THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Mathematics Curriculum—Grade Eight

Diocese of Cleveland

Unit 4: Linear Equations and Systems of Equations

Standards Assessed

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

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

OH: CCSS: Mathematics (2011), OH: 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.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.

OH: CCSS: Mathematics (2011), OH: Grade 8, Expressions & Equations

8.EE Analyze and solve linear equations and pairs of simultaneous linear equations.

- 8.EE.7. Solve linear equations in one variable.
- 8.EE.7a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- 8.EE.7b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
- 8.EE.8. Analyze and solve pairs of simultaneous linear equations.
- 8.EE.8a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
- 8.EE.8b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
- 8.EE.8c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

B. Algebraic Representation

- 4. Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems.
- 5. Write, simplify, and evaluate algebraic expressions (including formulas) to generalize situations and solve problems.
- 6. Solve linear equations and inequalities graphically, symbolically, and using technology.
- 8. Solve systems of linear equations graphically and by simple substitution.
- 9. Interpret the meaning of the solution for a system of equations; i.e., point, line, no solution.

Essential Questions

1. What are linear relationships?
2. How can I use linear relationships in real life?
3. In what ways can I display a linear relationship?
4. What conclusions can I make when I have a linear relationship?
5. How are systems of linear equations and inequalities useful in interpreting real-world situations?

<p>Content The students will know</p>	<p>Skills <u>Bloom's Taxonomy</u> <u>DOK Links</u> The students will be able to</p>
<ol style="list-style-type: none"> 1. One variable linear equations 2. Solutions for one variable linear equations: <ol style="list-style-type: none"> a. one solution, no solution, and infinite number of solutions 3. Multi-step linear equations 4. Systems of two linear equations in two variables 5. Solutions of systems of two linear equations in two variables: <ol style="list-style-type: none"> a. one solution, no solution, and infinite number of solutions 6. Algebraic and geometric representations of solutions of systems of two linear equations in two variables 7. Real world applications of linear systems of equations 	<ol style="list-style-type: none"> 1. Solve linear equations in one variable using one or more steps. 2. Differentiate and explain the type of solution for the linear equation in one variable. 3. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. 4. Solve linear equations with rational number coefficients. 5. Solve equations whose solutions require expanding expressions using the distributive property and collecting like terms. 6. Analyze and solve pairs of simultaneous linear equations. 7. Recognize that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs. 8. Solve systems of two linear equations in two variables algebraically. 9. Estimate solutions by graphing the equations. 10. Solve systems of equations by graphing, by substitution, and by elimination. 11. Solve simple cases by inspection. 12. Differentiate and explain the type of solution for a system of two linear equations in two variables. 13. Solve simple cases by inspection. 14. Solve real-world and mathematical problems leading to two linear equations in two variables. 15. Write, simplify, and evaluate algebraic expressions to generalize situations and solve problems.

	<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. <ol style="list-style-type: none"> a. Explain step-by-step process. b. 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. System of equations 2. Coefficient 3. Intersection of two lines 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Linear equations 2. Rational number 3. Distributive property 4. Like terms 5. Solution 6. Two variable equation of a line
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Begin this unit of study by having students respond to an assessment similar to the one presented in the lesson on <i>Solving Linear Equations in One Variable</i> found in the Links. When students have completed the assessment, discuss the results in order to clarify any misconceptions and to reinforce student understanding. 2. Class activity/Online learning. Engage students in continued study of solving linear equations in one variable using the videos for Standard 8.EE.7a & b found in the <i>Learn Zillion</i> site or another appropriate site. (See Links) 3. Following the above activity, have students work with a partner to write equations that have one solution, an infinite number of solutions, or no solution. Then have them solve the equations to determine that they have an equation in each category. If they do not, they should try to write an equation that fulfills the requirement. Ask students to explain which types of equations were most difficult to write and solve. 4. Class activity/Online learning. Engage students in continued work to analyze and solve pairs of simultaneous linear equations using the videos for Standard 8.EE.8a, b, & c found in the <i>Learn Zillion</i> site or another appropriate site. (See Links) 5. Class activity extension. Engage students in the various activities of the <i>Supply and Demand</i> lesson, which focuses on having them create and solve a system of linear equations in a real-world setting. By solving the system, they will find the equilibrium point for supply and demand. 	<p>Assessment (Suggested)</p> <p>Systems of Equations Group Work Formative: Cooperative Group Work Students will work in groups to solve systems of equations. They will discuss among their groups what method to use to solve the system and what their solution means in terms of the problem.</p> <p>Solving Equations Formative: Class Work Students will work with a partner to write equations that have one solution, an infinite number of solutions, or no solution. The students will solve the equations to determine that they have an equation in each category. If they do not, they should try to write an equation that fulfills the requirement. Students will explain which types of equations were most difficult to write and solve.</p> <p>Supply and Demand Formative: Class Work Students will complete the various activities of the <i>Supply and Demand</i> lesson, which focuses on having them create and solve a system of linear equations in a real-world setting.</p>



 <u>Ohio Resource Center ~ The Busing Problem</u>  <u>Supply and Demand Lesson</u>	
Resources (Suggested)	<u>Catholic Identity</u>
<ol style="list-style-type: none"> 1. iPad Resources 2. Literature Connections <i>Equal Shmequal</i> by Virginia L. Kroll and Philomena O'Neill <i>Kiss My Math: Showing Pre-Algebra Who's Boss</i> by Danica McKellar <i>Do the Math: Secrets, Lies, and Algebra</i> by Wendy Lichtman <i>Do the Math #2: The Writing on the Wall</i> by Wendy Lichtman <i>The Unknowns: A Math Mystery</i> by Benedict Carey <i>The 512 Ants on Sullivan Street</i> by Carol A. Losi  <u>Equation Games</u>  <u>Equation Solver</u>  <u>Systems of Equations Solver</u>  <u>Systems of Equations activities</u>  <u>The Khan Academy</u>  <u>The National Library of Virtual Manipulatives</u>  <u>iLearn Ohio</u>  <u>Learn Zillion ~ Common Core Videos</u>  <u>Math Concepts, Tips, Games and Worksheets</u>  <u>Ohio Resource Center</u>	Social Justice Teachings <ul style="list-style-type: none">  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 <ul style="list-style-type: none">  1. THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.  2. THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection and security.  3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.  4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.  5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.  6. 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.  8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.  9. THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Mathematics Curriculum ~ Grade Eight

Diocese of Cleveland



Unit 5: Understand Congruence and Similarity

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 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.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Geometry

8.G Understand congruence and similarity using physical models, transparencies, or geometry software.

- 8.G.1. Verify experimentally the properties of rotations, reflections, and translations:
 - 8.G.1a. Lines are taken to lines, and line segments to line segments of the same length.
 - 8.G.1b. Angles are taken to angles of the same measure.
 - 8.G.1c. Parallel lines are taken to parallel lines.
- 8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- 8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- 8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
- 8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

DOC: Mathematics, DOC: Grade 8, Geometry and Spatial Sense

A. Characteristics and Properties

- 2. Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-dimensional objects.
- 3. Explore inductive and deductive arguments concerning geometric ideas and relationships.
 - b. Use SSS, SAS, ASA, to prove congruency of triangles.
- 4. Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal.
- 5. Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures).

D. Visual and Geometric Models

- 3. Recognize and apply geometric ideas and relationships outside the mathematics classroom in areas such as art, science, and everyday life.

Essential Questions

- How will a shape look when rotated, reflected, and/or translated?
- How can I verify symmetry and congruency?
- To what extent does spatial awareness impact my ability to function in the world around you?
- In what ways is geometry present in my everyday world?
- Why is the ability to solve problems the heart of mathematics?

Content

The students will know

1. Properties of transformations
 - Translations
 - Reflections
 - Rotations
 - Dilations
2. Identity properties of
 - points
 - line segments
 - lines
 - parallel lines
 - angles
3. Congruency of two-dimensional figures
4. Proving two triangles congruent
 - SSS
 - SAS
 - ASA
 - AAS
5. Corresponding parts of congruent triangles are congruent
6. Similarity of two-dimensional figures
 - AA
7. Triangle Sum Theorem
8. Exterior Angle Theorem
9. Parallel lines cut by a transversal
 - Corresponding angles
 - Same-side exterior angles
 - Same-side interior angles
 - Alternate exterior angles
 - Alternate interior angles
 - Vertical angles
10. Characteristics and properties of 2D and 3D figures
 - sides

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Experiment to verify the properties of
 - Translations
 - Reflections
 - Rotations
 - Dilations
2. Experiment to verify the properties and characteristics of 2-dimensional and 3-dimensional objects.
3. Recognize that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations.
4. Apply the concepts that a line is taken to a line, an angle is taken to an angle, and parallel lines are taken to parallel lines.
5. Describe a sequence that exhibits the congruence between two congruent figures.
6. Describe a sequence that exhibits the similarity between two similar figures.
7. Prove two triangles are congruent by Side-Side-Side.
8. Prove two triangles are congruent by Side-Angle-Side.
9. Prove two triangles are congruent by Angle-Side-Angle.
10. Prove two triangles are congruent by Angle-Angle-Side.
11. Prove two triangles are similar by Angle-Angle.
12. Prove the Triangle Sum Theorem.
13. Draw conclusions from applying the Triangle Sum Theorem.
14. Prove the Exterior Angle Theorem.
15. Draw conclusions from applying the Exterior Angle Theorem.
16. Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal.
17. Explore inductive and deductive arguments concerning

<ul style="list-style-type: none"> ▪ angles ▪ symmetry 	<p>geometric ideas and relationships.</p> <ol style="list-style-type: none"> 18. Use proportions in several forms to solve problems involving similar figures. 19. Recognize and apply geometric ideas and relationships in areas such as art, science, and everyday life. <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. Transformations 2. Translation 3. Reflection 4. Rotation 5. Dilation 6. Identity property 7. Congruent 8. Congruent figures 9. Side-Side-Side congruency 10. Side-Angle-Side congruency 11. Angle-Side-Angle congruency 12. Angle-Angle-Side congruency 13. CPCTC 14. Similar 15. Similar figures 16. Angle-Angle similarity 17. Triangle Sum Theorem 18. Exterior Angle Theorem 19. Transversal 20. Corresponding angles 21. Exterior angles 22. Interior angles 23. Vertical angles 	<p>Additional Vocabulary</p> <ol style="list-style-type: none"> 1. Corresponding sides 2. Part-to-part ratios and proportions 3. Part-to-whole ratios and proportions 4. Parallel lines 5. Symmetry
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Use the four-day lesson which moves students through a mathematical dance of flips (reflections), slides (translations), and turns (rotations). In the lesson students will learn to identify congruent figures in order to describe the properties of slides, flips and turns for two-dimensional objects through the use of student-centered investigations including comic strips, finger painting, pattern blocks and designing a dream bedroom. (See Links) 2. Have students work with a partner to show (a) that two figures are said to be congruent when one can describe a sequence that exhibits the congruence between them, and (b) that two two-dimensional figures are similar when one can describe a sequence that exhibits the similarity between them. Use diagrams and write an explanation of the reasoning used to 	<p>Assessment (Suggested)</p> <p>Congruence and Similarity Formative: Cooperative Group Work</p> <p>Students will work with a partner to show (a) that two figures are said to be congruent when one can describe a sequence that exhibits the congruence between them, and (b) that two two-dimensional figures are similar when one can describe a sequence that exhibits the similarity between them. They will use diagrams and write an explanation of the reasoning used to show congruence and similarity.</p> <p>Reflections, Dilations, Rotations, and Transformations Formative: Class Work</p>

show congruence and similarity.

3. Class activity/Online Learning. Engage students in understanding that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Use the videos for Standard 8.G.4 found at the *Learn Zillion* site or another appropriate site. (See Links)
4. Working with a partner, have students use graph paper and make drawings that show each of the following and write an explanation for each.
 - a. prove two figures are similar after a dilation
 - b. prove two figures are congruent after a series of reflections, rotations or dilations
 - c. describe a sequence of transformations
5. Class activity/Online learning. Engage students in using informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles using the videos for Standard 8.G.5 found at the *Learn Zillion* site or another appropriate site. (See Links)
6. Working with a partner, have students use graph paper and make drawings of angles that are created when parallel lines are cut by a transversal. Write an explanation for each.
 - a. find the measure of exterior angle
 - b. find the measurements of corresponding angles
 - c. find the side length of a triangle using angle-angle criterion
 - d. find the measurements of vertical and adjacent angles
 - e. find the measurements of alternate interior and alternate exterior angles
 - f. find the measurement of an angle in a triangle using the other two angles
7. Working alone or with a partner, have students complete the Parallel Lines activities found on the website (see Links) in order to discover properties of angles created by two parallel lines cut by a transversal.
8. Have students work with a partner to investigate why SSS, SAS, and ASA show congruence. Have them build two triangles using straws or toothpicks with three corresponding congruent sides (SSS) as a way of visualizing SSS congruence. Have them repeat the activity to investigate SAS and ASA congruence. Have them justify their findings.



[Parallel Lines activities](#)



[Mathematical Movements ~ Flips, Slides & Turns ~ 4 Day](#)

[Lesson](#)



[Learn Zillion ~ Common Core Videos](#)

Working with a partner, students will use graph paper and make drawings that show each of the following and write an explanation for each.

- a. prove two figures are similar after a dilation
- b. prove two figures are congruent after a series of reflections, rotations or dilations
- c. describe a sequence of transformations

Interior and Exterior Angles

Formative: Cooperative Group Work

Working with a partner, students will use graph paper and make drawings of angles that are created when parallel lines are cut by a transversal.

Write an explanation for each.

- a. find the measure of exterior angle
- b. find the measurements of corresponding angles
- c. find the side length of a triangle using angle-angle criterion
- d. find the measurements of vertical and adjacent angles
- e. find the measurements of alternate interior and alternate exterior angles
- f. find the measurement of an angle in a triangle using the other two angles

Parallel Lines Cut By Transversal

Formative: Homework

Students will complete the Parallel Lines activities found on the Links in order to discover properties of angles created by two parallel lines cut by a transversal.

SSS, SAS, ASA

Formative: Cooperative Group Work

Students will work with a partner to investigate why SSS, SAS, and ASA show congruence. They will build two triangles using straws or toothpicks with three corresponding congruent sides (SSS) as a way of visualizing SSS congruence. They will repeat the activity to investigate SAS and ASA congruence. Finally, they will justify their findings.

Resources (Suggested)

1. iPad Resources
2. Literature Connection
Angles Are Easy As Pie by Robert Froman and Byron Barton
Catherine, Called Birdy by Karen Cushman
Chasing Vermeer by Blue Balliett
Saturday Night at the Dinosaur Stomp by Carol Diggory Shields

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

and Scott Nash

A Drop of Water: A Book of Science and Wonder by Walter Wick

The Greedy Triangle by Marilyn Burns

3. Internet Resources



[Congruent Triangle Activities](#)



[Library of Virtual Manipulatives](#)



[The Khan Academy](#)



[iLearn Ohio](#)



[Learn Zillion ~ Common Core Videos](#)



[Ohio Resource Center](#)



[Math Concepts, Tips, Games and Worksheets](#)

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.
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Mathematics Curriculum ~ Grade Eight

Diocese of Cleveland



Unit 6: Understand and Apply the Pythagorean Theorem

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 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.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Geometry

8.G Understand and apply the Pythagorean Theorem.

- 8.G.6. Explain a proof of the Pythagorean Theorem and its converse.
- 8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- 8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

DOC: Mathematics, DOC: Grade 8, Geometry and Spatial Sense

A. Characteristics and Properties

- 6. Use relationships found in right triangles to solve problems.

Essential Questions

- How can I use the Pythagorean Theorem to find the distance between two points on a coordinate plane?
- When is the Pythagorean Theorem used?
- In what ways is geometry, and specifically the Pythagorean Theorem, present in our everyday world?
- What are the real-life applications of the Pythagorean Theorem?

Content

The students will know

1. The Pythagorean Theorem
2. The converse of the Pythagorean Theorem
3. Distance between two points in the coordinate plane using the Pythagorean Theorem
4. Right triangle relationships
5. Special right triangles
 - 30-60-90 right triangle
 - 45-45-90 right triangle
6. Trigonometric ratios
 - Sine
 - Cosine
 - Tangent
7. Distance formula
8. Midpoint formula

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Prove the Pythagorean Theorem.
2. Prove the converse of the Pythagorean Theorem in words, symbolically, and illustrations.
3. Apply the Pythagorean Theorem to find the distance between two points on the coordinate plane.
4. Prove the relationships in right triangles to solve real-world and mathematical problems.
5. Derive the distance formula using the Pythagorean Theorem.
6. Construct a logical argument using the relationships found in right triangles to solve real-world and mathematical problems.
7. Apply concepts of sine, cosine, and tangent to solve right triangle problems.
8. Apply previous knowledge to formulate the midpoint formula.

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. Pythagorean Theorem
2. Converse
3. Distance
4. Properties of right triangles
5. Special right triangle
6. 30-60-90 right triangle
7. 45-45-90 right triangle
8. Isosceles right triangle
9. Trigonometric ratio
10. Hypotenuse
11. Sine
12. Cosine
13. Tangent
14. SOH-CAH-TOA
 - sine = opposite/hypotenuse
 - cosine = adjacent/hypotenuse
 - tangent = opposite/adjacent
15. Distance formula

Additional Vocabulary

1. Coordinate plane
2. Right triangle
3. Ratio
4. Solving one-step equations
5. Simplifying radicals and square roots
6. Dimensions
7. Midpoint
8. Distance between two points on a coordinate plane
9. Opposite side
10. Adjacent side
11. Angle

<p>16. Midpoint formula</p>	
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Introduce the unit with the You Tube video <i>The Best Pythagorean Theorem Rap Ever</i>. (See Links) 2. Class activity/Online learning. Engage students in developing an understanding of the Pythagorean Theorem and its converse. Use the videos for Standards 8.G.7 and 8 found in the <i>Learn Zillion</i> site or another appropriate site. (See Links) 3. Have students work with a partner to solve several problems in which they must apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. For each problem, have them make a drawing and write an explanation of the reasoning they used to solve the problem. 4. Have students work with a partner to solve several problems in which they must apply the Pythagorean Theorem to find the distance between two points in a coordinate system. For each problem, have them make a drawing and write an explanation of the reasoning they used to solve the problem. 5. Working in cooperative groups, have students explore right triangles in real-life situations such as roofing, architecture, landscaping, and package design. Ask them to write a problem for one of these situations, make a drawing for it, and solve the problem by applying the Pythagorean Theorem. 6. Have students work with a partner to complete the Pythagorean Theorem Activities and Lessons found in the Links. <p> Pythagorean Theorem Activities and Lessons</p> <p> The Best Pythagorean Theorem Rap Ever</p>	<p>Assessment (Suggested)</p> <p>Proof of Pythagorean Theorem Formative: Technology Project</p> <p>Students will use technology to write a proof of the Pythagorean Theorem and its converse. Students will then present their proofs to the class using technology.</p> <p>Working with the Pythagorean Theorem Formative: Class Work</p> <p>Students will work with a partner to solve several problems in which they must apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. For each problem, they will make a drawing and write an explanation of the reasoning used to solve the problem.</p> <p>Applying the Pythagorean Theorem Formative: Homework</p> <p>Students will solve several problems in which they must apply the Pythagorean Theorem to find the distance between two points in a coordinate system. For each problem, they will make a drawing and write an explanation of the reasoning used to solve the problem.</p> <p>Applying the Pythagorean Theorem Summative: Cooperative Group Work</p> <p>Working in cooperative groups, students will explore right triangles in real-life situations such as roofing, architecture, landscaping, and package design. They will write a problem for one of these situations, make a drawing for it, and solve the problem by applying the Pythagorean Theorem.</p> <p>Pythagorean Theorem Activities and Lessons Summative: Cooperative Group Work</p> <p>Students will work with a partner to complete the Pythagorean Theorem Activities and Lessons found in the Links.</p>
<p>Resources (Suggested)</p> <ol style="list-style-type: none"> 1. iPad Resources 2. Literature Connection <i>What's Your Angle, Pythagoras? A Math Adventure</i> by Julie Ellis and Phyllis Hornung <i>Weslandia</i> by Paul Fleischman (Author), Kevin Hawkes <i>Sir Cumference and the Great Knight of Angleland</i> by Cindy Neuschwander and Wayne Geehan 3. Internet Resources <p> Pythagorean Theorem Game</p> <p> Pythagorean Theorem Activities and Lessons</p>	<p>Catholic Identity</p> <p>Social Justice Teachings</p> <ul style="list-style-type: none">  Life And Dignity Of The Human Person  Call To Family, Community, And Participation  Rights And Responsibilities  Solidarity  Care For God's Creation <p>Rights of Children</p> <ul style="list-style-type: none">  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.



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Mathematics Curriculum ~ Grade Eight

Diocese of Cleveland



Unit 7: Solve Surface Area and Volume 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 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.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Geometry

8.G Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

- 8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

DOC: Mathematics, DOC: Grade 8, Measurement

B. Measurement Techniques and Tools

- 10. Determine the surface area and volume of prisms, pyramids, cylinders, spheres, and cones.
- 11. Use conventional formulas to find the surface area and volume of prisms, pyramids, and cylinders and the volume of spheres and cones to a specified level of precision.

Essential Questions

- How are area and volume related?

- In what ways is a 3-D shape related to its surface area?
- How are volume and surface area related?
- In what ways is geometry present in my everyday world?
- To what extent can I use my knowledge of basic geometrical shapes to derive formulas for finding surface area and volume of three-dimensional objects?

Content

The students will know

1. Types of
 - Prisms
 - Pyramids
2. Surface Area Formulas
 - Prisms
 - Pyramids
 - Cylinders
 - Cones
 - Spheres
3. Volume Formulas
 - Prisms
 - Pyramids
 - Cylinders
 - Cones
 - Spheres

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Determine the conventional formulas to find the surface area of
 - prisms
 - pyramids
 - cylinders
 - cones
 - spheres
2. Calculate the surface area of 3-dimensional geometric figures using the conventional formula for each.
3. Determine the conventional formulas to find the volume of
 - prisms
 - pyramids
 - cylinders
 - cones
 - spheres
4. Calculate the volume of 3-dimensional geometric figures using the conventional formula for each.
5. Use the formulas for the surface area and volume of 3-dimensional geometric figures to solve real-world problems.

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. Surface area
2. Volume
3. Prism
4. Pyramid
5. Cylinder
6. Cone
7. Sphere

Additional Vocabulary

1. Vertex
2. Edge
3. Face
4. Formula
5. Radius
6. Diameter
7. Area of a square
8. Area of a rectangle
9. Area of a circle
10. Area of a triangle
11. Circumference of a circle
12. Lateral area
13. Perimeter

Learning Experiences (Suggested)

1. Class activity. Review the conventional formulas for finding the surface area of prisms, pyramids, cylinders, cones, and spheres. Have students identify the formula, draw the object with given dimensions, and solve for the surface area. Justify the reasoning they used in solving each problem.
2. Have students use graph paper to construct a net for a prism, a pyramid, and a cylinder. Using the nets, have students work with a partner to write a process statement for finding surface area. Discuss the findings and develop a chart or graphic organizer that can be used to find surface area of the various figures.
3. Have students solve a number of problems that involve finding the surface area of prisms, pyramids, cylinders, cones, and spheres. Have them justify the reasoning used to solve the problems.
4. Students will be given directions on how to construct a paper cone and cylinder having the same radius. Students will then work with a partner to construct the cone and cylinder. Once constructed, the students will use popcorn to discover the relationship between the volume of a cone and the volume of a cylinder. When completed the class will engage in a discussion of the results, thus deriving the volume formula of a cone.
5. Class activity. Using plastic polyhedron shapes with known dimensions of height, length, diameter, etc., have students (a) fill them with colored sand or water in order to measure volume and (b) actually calculate the mathematical volume. Have the students compare the volumes derived by formulas with the actual measured volumes. Write an explanation for the differences found.
6. Have the students create a T-chart to compare the similarities and differences between the formulas for area, surface area and volume of 2- and 3-dimensional shapes.
7. Project. Working in cooperative groups, have students create a 3-D package design for a group chosen product. The package will have a specific, teacher chosen volume. Students will generate a budget for the production of their package by creating a spreadsheet and following the cost guidelines given to the students. After designing and creating their package, students will use a spreadsheet to create a production budget including cost per square inch, printing costs, labor, and profit. Students will then use a word processing program to write a business letter explaining the process they followed to find the volume and surface area, and an explanation of how they calculated the cost per box and the total cost of production. (Every package should be sketched and formulas and correct calculations shown.)

Assessment (Suggested)

Surface Area and/or Volume Lab Formative: Lab Assignment

Students will work in groups to discover the formulas for surface area and volume. They will then apply these formulas to solve real-world and mathematical problems.

Surface Area Formative: Homework

Students will identify the formula, draw the object with given dimensions, and solve for the surface area. They will justify the reasoning they used in solving each problem.

Surface Area Formative: Class Work

Students will use graph paper to construct a net for a prism, a pyramid, and a cylinder. Using the nets, they will work with a partner to write a process statement for finding surface area. They will discuss the findings and develop a chart or graphic organizer that can be used to find surface area of the various figures.

Finding Surface Area Formative: Homework

Students will solve a number of problems that involve finding the surface area of prisms, pyramids, cylinders, cones, and spheres. They will justify the reasoning used to solve the problems.

What is the Volume? Formative: Class Work

Students will be given directions on how to construct a paper cone and cylinder having the same radius. Students will then work with a partner to construct the cone and cylinder. Once constructed, the students will use popcorn to discover the relationship between the volume of a cone and the volume of a cylinder. When completed the class will engage in a discussion of the results, thus deriving the volume formula of a cone.

Designing Your Product Summative: Project

Project. Working in cooperative groups, students will create a 3-D package design for a group chosen product. The package will have a specific, teacher chosen volume. Students will generate a budget for the production of their package by creating a spreadsheet and following the cost guidelines given to the students. After designing and creating their package, students will use a spreadsheet to create a production budget including cost per square inch, printing costs, labor, and profit. Students will then use a word processing program to write a business letter explaining the process they followed to find the volume and surface area, and an explanation of how they calculated the cost per box and the total cost of production. (Every package should be sketched and formulas and correct calculations shown.)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
3D, 2D, 1D by David A. Adler
A Wrinkle in Time by Madeleine L'Engle
Mummy Math: An Adventure in Geometry by Cindy Neuschwander and Bryan Langdo
Saturday Night at the Dinosaur Stomp by Carol Diggory Shields and Scott Nash
Sir Cumference and the Sword in the Cone by Cindy Neuschwander and Wayne Geehan
3. Internet Resources



[Surface Area Activities](#)



[Surface Area and Volume Activities](#)



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Social Justice Teachings

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- Call To Family, Community, And Participation
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- Solidarity
- Care For God's Creation

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- THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.
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Mathematics Curriculum ~ Grade Eight

Diocese of Cleveland



Unit 8: Investigate Patterns of Association in Data

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 8, Mathematical Practice

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- 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.
- 7. Look for and make use of structure.

CCSS: Mathematics (2011), OH: CCSS: Grade 8, Statistics & Probability

8.SP Investigate patterns of association in bivariate data.

- 8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
- 8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
- 8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Essential Questions

- Why is data collected?
- What is an outlier and how does it influence a data set?

- How can graphs be used to examine data?
- How do I conduct and analyze a probability experiment?
- How are data collection and statistics used in relevant real-world activities?
- How can the knowledge of scatter plots help me in the decision-making process?

Content

The students will know

1. Scatter plots
2. Trends in scatter plots
 - Positive correlation
 - Negative correlation
 - No correlation
3. Trend line
4. Relative frequencies

Skills

Bloom's Taxonomy

DOK Links

The students will be able to

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
2. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
3. Construct and interpret a two-way table.
4. Create scatter plots from the collection of data.
5. Recognize that straight lines are widely used to model relationships between two quantitative variables.
6. Judge the closeness of the data points to the line on a scatter plot.
7. Analyze scatter plots to determine the trend.
8. Construct an equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
9. Recognize that patterns of association can be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.
10. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.
11. Use relative frequencies calculated for rows or columns to describe possible association between two variables.
12. Solve real-world problems involving bivariate data.

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. Bivariate
2. Scatter plot
3. Correlation
4. Positive correlation
5. Negative correlation
6. No correlation
7. Trend line
8. Frequency
9. Relative frequency

Additional Vocabulary

1. Slope
2. Y-intercept
3. Slope-intercept equation of a line
4. Table of values

<ul style="list-style-type: none"> 10. Linear association 11. Non-linear association 12. Quantitative variables 13. Two-way table 	
<p>Learning Experiences (Suggested)</p> <ol style="list-style-type: none"> 1. Class activity/Online learning. Engage students in constructing and interpreting scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. Use the videos for Standard 8.SP.1-2 found at the <i>Learn Zillion</i> site or another appropriate site. (See Links) 2. Working with a partner, have students gather data to determine if there is a relationship between the height of an adult and his or her shoe size. Using the data make two scatter plots – one for the males and one for the females. Investigate, describe and analyze the patterns of association. Share with the class. 3. Have students use the <i>Interactive Regression Activity</i> found in the Links to create a scatter plot, draw the line of best fit, and compare their line of best fit with a computer-generated line of best fit. Have them write an explanation of how a scatter plot and a line of best fit are related. Share with the class. 4. Class activity/Online learning. Engage students in an activity designed to help them understand (a) that straight lines are widely used to model relationships between two quantitative variables, and (b) one uses the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. Use the videos for Standard 8.SP.3-4 found at the <i>Learn Zillion</i> site or another appropriate site. (See Links) 5. Cooperative group work. Have students use the lesson <i>Impact of a Superstar</i> in the Links to (a) use technology tools to plot data, identify lines of best fit, and detect outliers, and (b) compare the lines of best fit when one element is removed from a data set, and interpret the results. Following the activity, engage students in a discussion of the questions provided in the lesson and use the teacher reflection questions as a way of gathering information about the project. 6. Online learning. Working with a partner, have students gain an understanding that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table by using the videos for Standard 8.SP.4 found at the <i>Learn Zillion</i> site or another appropriate site. (See Links) 7. Group Project. Have students construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Have them use relative frequencies calculated for rows or columns to describe possible association between two variables. Have students use the following situation or determine one of their own. <i>Collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?</i> Have students share the results of their investigation with the class and explain the reasoning used to come to their conclusions. 	<p>Assessment (Suggested)</p> <p>Scatter Plot Lab Summative: Lab Assignment</p> <p>Students will work in groups to create scatter plots using technology. They will then describe any information that is present in their scatter plot. Students will present their plots to the class.</p> <p>Height and Shoe Size Formative: Cooperative Group Work</p> <p>Students will gather data to determine if there is a relationship between the height of an adult and his or her shoe size. Using the data they will make two scatter plots – one for the males and one for the females. They will investigate, describe and analyze the patterns of association they find in the data and share this information with the class.</p> <p>Regression Formative: Class Work</p> <p>Students will use the <i>Interactive Regression Activity</i> found in the Links to create a scatter plot, draw the line of best fit, and compare their line of best fit with a computer-generated line of best fit. They will write an explanation of how a scatter plot and a line of best fit are related and share this with the class.</p> <p>Impact of a Superstar Formative: Cooperative Group Work</p> <p>Cooperative group work. Students will use the lesson <i>Impact of a Superstar</i> in the Links to (a) use technology tools to plot data, identify lines of best fit, and detect outliers, and (b) compare the lines of best fit when one element is removed from a data set, and interpret the results. Following the activity, students will engage in a discussion of the questions provided in the lesson and use the teacher reflection questions as a way of gathering information about the project.</p> <p>Patterns of Association in Bivariate Data Summative: Project</p> <p>Group Project. Students will construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. They will use relative frequencies calculated for rows or columns to describe possible association between two variables. They will use the following situation or determine one of their own. <i>Collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?</i> Students will share the results of their investigation with the class and explain the reasoning used to come to their conclusions.</p>



[Scatter Plot Creator](#)



[Interactive Regression Activity](#)



[Algebraic Project ~ Drip, Drop, Drip, Drop](#)



[Impact of a Superstar](#)

Resources (Suggested)

1. iPad Resources
2. Literature Connection
A Million Fish...More or Less by Patricia McKissack
A Wrinkle in Time by Madeleine L'Engle
Anno's Hat Tricks by Akihiro Nozaki
Factastic Book of 1,001 Lists by Russell Ash
The Phantom Tollbooth by Norton Juster
Tikki Tikki Tembo by Arlene Mosel

3. Internet Resources



[Scatter Plot Activity](#)



[Scatter Plot Creator](#)



[Scatter Plot Activities](#)



[NCTM Illuminations Site](#)



[The National Library of Virtual Manipulatives](#)



[The Khan Academy](#)



[Learn Zillion ~ Common Core Videos](#)



[iLearn Ohio](#)



[Ohio Resource Center](#)



[Math Concepts, Tips, Games and Worksheets](#)

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.
- THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

PARENT GUIDE

GRADE EIGHT MATHEMATICS CURRICULUM

DIOCESE OF CLEVELAND

Below is a list of skills your child will be taught in Grade Eight Mathematics.
As parents, you are encouraged to support the work of your child's teacher in helping your child acquire each of these skills.

NUMBER SYSTEM	
KNOW THAT THERE ARE NUMBERS THAT ARE NOT RATIONAL, AND APPROXIMATE THEM BY RATIONAL NUMBERS.	
	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
EXPRESSIONS AND EQUATIONS	
WORK WITH RADICALS AND INTEGER EXPONENTS.	
	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
UNDERSTAND THE CONNECTIONS BETWEEN PROPORTIONAL RELATIONSHIPS, LINES, AND LINEAR EQUATIONS.	
	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .
ANALYZE AND SOLVE PAIRS OF SIMULTANEOUS LINEAR EQUATIONS.	
	Solve linear equations in one variable.
	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
	Solve real-world and mathematical problems leading to two linear equations in two variables.

FUNCTIONS	
DEFINE, EVALUATE, AND COMPARE FUNCTIONS.	
	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
USE FUNCTIONS TO MODEL RELATIONSHIPS BETWEEN QUANTITIES.	
	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
GEOMETRY	
UNDERSTAND CONGRUENCE AND SIMILARITY USING PHYSICAL MODELS, TRANSPARENCIES, OR GEOMETRY SOFTWARE.	
	Verify experimentally the properties of rotations, reflections, and translations:
	Lines are taken to lines, and line segments to line segments of the same length.
	Angles are taken to angles of the same measure.
	Parallel lines are taken to parallel lines.
	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
UNDERSTAND AND APPLY THE PYTHAGOREAN THEOREM.	
	Explain a proof of the Pythagorean Theorem and its converse.
	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
SOLVE REAL-WORLD AND MATHEMATICAL PROBLEMS INVOLVING VOLUME OF CYLINDERS, CONES, AND SPHERES.	
	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

STATISTICS & PROBABILITY	
INVESTIGATE PATTERNS OF ASSOCIATION IN BIVARIATE DATA.	
	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
DOC: Numbers, Number Sense and Operations	
NUMBER AND NUMBER SYSTEMS	
	Recognize that natural numbers, whole numbers, integers, rational numbers, and irrational numbers are subsets of the real number system.
	Demonstrate an understanding of the properties of the rational number system; e.g., order, and reciprocals.
MEANING OF OPERATIONS	
	Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.
COMPUTATION AND ESTIMATION	
	Add, subtract, multiply, divide, and compare numbers written in scientific notation.
DOC: Patterns, Functions and Algebra	
PATTERNS, RELATIONS, AND FUNCTIONS	
	Describe and represent relations and functions with tables, graphs, words, and symbols.
	Identify functions as linear or nonlinear based on information given in a table, graph, or equation.
ALGEBRAIC REPRESENTATION	
	Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change.
	Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems.
	Write, simplify, and evaluate algebraic expressions (including formulas) to generalize situations and solve problems.
	Solve linear equations and inequalities graphically, symbolically, and using technology.
	Solve systems of linear equations graphically and by simple substitution.
	Interpret the meaning of the solution for a system of equations; i.e., point, line, no solution.
ANALYZE CHANGE	
	Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, direct variation vs. inverse variation.
	Describe and compare how changes in an equation affect the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.
	Use calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.

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DOC: Geometry and Spatial Sense

CHARACTERISTICS AND PROPERTIES

	Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-dimensional objects.
	Explore inductive and deductive arguments concerning geometric ideas and relationships.
	Use SSS, SAS, ASA, to prove congruency of triangles.
	Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal.
	Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures).
	Use relationships found in right triangles to solve problems.

VISUAL AND GEOMETRIC MODELS

	Recognize and apply geometric ideas and relationships outside the mathematics classroom in areas such as art, science, and everyday life.
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DOC: Measurement

MEASUREMENT TECHNIQUES AND TOOLS

	Determine the surface area and volume of prisms, pyramids, cylinders, spheres, and cones.
	Use conventional formulas to find the surface area and volume of prisms, pyramids, and cylinders and the volume of spheres and cones to a specified level of precision.

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.
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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.
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OH: CCSS: Literacy: Writing

TEXT TYPES AND PURPOSES

	Use precise language and domain-specific vocabulary to inform about or explain the topic.
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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.
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(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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MATHEMATICS CURRICULUM

GRADE EIGHT

CHECKLIST FOR COMMON CORE STATE STANDARDS & DIOCESAN CURRICULUM

DATE TAUGHT	
NUMBER SYSTEM	
KNOW THAT THERE ARE NUMBERS THAT ARE NOT RATIONAL, AND APPROXIMATE THEM BY RATIONAL NUMBERS.	
	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
EXPRESSIONS AND EQUATIONS	
WORK WITH RADICALS AND INTEGER EXPONENTS.	
	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
UNDERSTAND THE CONNECTIONS BETWEEN PROPORTIONAL RELATIONSHIPS, LINES, AND LINEAR EQUATIONS.	
	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .
ANALYZE AND SOLVE PAIRS OF SIMULTANEOUS LINEAR EQUATIONS.	
	Solve linear equations in one variable.
	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
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	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
	Solve real-world and mathematical problems leading to two linear equations in two variables.

DATE TAUGHT	
FUNCTIONS	
DEFINE, EVALUATE, AND COMPARE FUNCTIONS.	
	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
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	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
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UNDERSTAND CONGRUENCE AND SIMILARITY USING PHYSICAL MODELS, TRANSPARENCIES, OR GEOMETRY SOFTWARE.	
	Verify experimentally the properties of rotations, reflections, and translations:
	Lines are taken to lines, and line segments to line segments of the same length.
	Angles are taken to angles of the same measure.
	Parallel lines are taken to parallel lines.
	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
UNDERSTAND AND APPLY THE PYTHAGOREAN THEOREM.	
	Explain a proof of the Pythagorean Theorem and its converse.
	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
SOLVE REAL-WORLD AND MATHEMATICAL PROBLEMS INVOLVING VOLUME OF CYLINDERS, CONES, AND SPHERES.	
	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

DATE TAUGHT		
STATISTICS & PROBABILITY		
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	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	
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DOC: Numbers, Number Sense and Operations		
NUMBER AND NUMBER SYSTEMS		
	Recognize that natural numbers, whole numbers, integers, rational numbers, and irrational numbers are subsets of the real number system.	
	Demonstrate an understanding of the properties of the rational number system; e.g., order, and reciprocals.	
MEANING OF OPERATIONS		
	Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.	
COMPUTATION AND ESTIMATION		
	Add, subtract, multiply, divide, and compare numbers written in scientific notation.	
DOC: Patterns, Functions and Algebra		
PATTERNS, RELATIONS, AND FUNCTIONS		
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	Interpret the meaning of the solution for a system of equations; i.e., point, line, no solution.	
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	Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, direct variation vs. inverse variation.	
	Describe and compare how changes in an equation affect the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.	
	Use calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.	

DATE TAUGHT	
DOC: Geometry and Spatial Sense	
CHARACTERISTICS AND PROPERTIES	
	Make and test conjectures about characteristics and properties (e.g., sides, angles, symmetry) of two-dimensional figures and three-dimensional objects.
	Explore inductive and deductive arguments concerning geometric ideas and relationships.
	Use SSS, SAS, ASA, to prove congruency of triangles.
	Recognize the angles formed and the relationship between the angles when two lines intersect and when parallel lines are cut by a transversal.
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	Use relationships found in right triangles to solve problems.
VISUAL AND GEOMETRIC MODELS	
	Recognize and apply geometric ideas and relationships outside the mathematics classroom in areas such as art, science, and everyday life.
DOC: Measurement	
MEASUREMENT TECHNIQUES AND TOOLS	
	Determine the surface area and volume of prisms, pyramids, cylinders, spheres, and cones.
	Use conventional formulas to find the surface area and volume of prisms, pyramids, and cylinders and the volume of spheres and cones to a specified level of precision.

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	
	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.

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