South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document

South Carolina Department of Education
Office of Standards and Learning
Summer 2015

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
Overview

The purpose of this document is to provide guidance regarding how all the standards in Algebra 1, Algebra 2, and Geometry may be grouped into units and how those units might look. Since this document is merely guidance, a district should implement the standards in a manner that addresses its curriculum and the specific needs of its students.

The Table of Contents below arranges the *South Carolina College- and Career-Ready Standards for Mathematics* for high school into *Course Coversheets* and *Units*.

- Each high school *Course Coversheet* organizes the high school course standards into possible instructional units and provides links to specific high school course *Units*.
- Each high school course *Unit* contains:
  - Clarifying notes related to the standards within the unit
  - New academic vocabulary in the unit
  - Prior and subsequent knowledge related to the unit
  - Description of the relationship between the standards in the unit
  - Potential instructional strategies and lessons organized by possible teaching sequence
  - Resources for the unit
  - Sample formative assessment tasks and questions organized by possible teaching sequence.
- Important notes about all *Units*:
  - ~~Strikethroughs~~ identify which piece(s) of a standard is not covered in a specific unit. ~~Strikethrough~~ portions should, however, be covered in a different *Unit* before the end of the course.
  - *Including* references content that must be mastered, while *e.g.* references possible illustrative examples. The phrase *i.e.* references the only examples or terms that should be used.
  - Asterisks (*) indicate Graduation Standards. Graduation Standards are not optional.

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Algebra 1 Coversheet

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Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Relationships Between Quantities and Expressions	Reasoning with Linear Equations and Inequalities	Modeling and Analyzing Quadratic Functions	Modeling and Analyzing Exponential Functions	Comparing and Contrasting Functions	Describing Data
Standards	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**
A1.NRNS.1*	A1.ACE.2*	A1.NRNS.1*	A1.FLQE.1*	A1.FLQE.1*	A1.FLQE.5*
A1.NRNS.2*	A1.AREI.3	A1.ASE.2*	A1.FLQE.2*	A1.FLQE.1a	A1.SPID.6*
A1.NRNS.3	A1.AREI.5	A1.ASE.3*	A1.ACE.1*	A1.FLQE.2*	A1.SPID.7*
A1.NQ.1*	A1.AREI.6*	A1.ASE.3a	A1.ACE.2*	A1.FLQE.3*	A1.SPID.8*
A1.NQ.2*	A1.AREI.6a	A1.ACE.1*	A1.FBF.3*	A1.FLQE.5*	
A1.NQ.3*	A1.AREI.6b	A1.ACE.2*	A1.FIF.1a	A1.FBF.3*	
A1.ASE.1*	A1.AREI.10*	A1.ACE.4*	A1.FIF.1b	A1.FIF.1*	
A1.AAPR.1*	A1.AREI.11*	A1.AREI.1*	A1.FIF.1c	A1.FIF.1a	
A1.ACE.1*	A1.AREI.12*	A1.AREI.4*	A1.FIF.2*	A1.FIF.1b	
A1.ACE.2*	A1.FIF.1*	A1.AREI.4a	A1.FIF.4*	A1.FIF.1c	
A1.ACE.4*	A1.FIF.1a	A1.AREI.4b	A1.FIF.5*	A1.FIF.2*	
A1.AREI.1*	A1.FIF.1b	A1.FBF.3*	A1.FIF.6*	A1.FIF.4*	
A1.AREI.3*	A1.FIF.1c	A1.FIF.1*	A1.FIF.7*	A1.FIF.5*	
A1.AREI.10*	A1.FIF.2*	A1.FIF.1a	A1.FIF.8*	A1.FIF.6*	
	A1.FIF.4*	A1.FIF.1b		A1.FIF.7*	
	A1.FIF.5*	A1.FIF.1c		A1.FIF.9*	
	A1.FIF.6*	A1.FIF.2*			
	A1.FIF.7*	A1.FIF.4*			
	A1.FIF.8*	A1.FIF.5*			
	A1.FIF.9*	A1.FIF.6*			
	A1.FLQE.2*	A1.FIF.7*			
		A1.FIF.8*			
		A1.FIF.8a			
		A1.FIF.9*			

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Mathematical Process Standards: The South Carolina College- and Career-Ready (SCCCR) Mathematical Process Standards demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills. As a result, the SCCCR Mathematical Process Standards should be integrated within the SCCCR Content Standards for Mathematics for each grade level and course. Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding.

1. Make sense of problems and persevere in solving them. a. Relate a problem to prior knowledge. b. Recognize there may be multiple entry points to a problem and more than one path to a solution. c. Analyze what is given, what is not given, what is being asked, and what strategies are needed, and make an initial attempt to solve a problem. d. Evaluate the success of an approach to solve a problem and refine it if necessary.	**5. Use a variety of mathematical tools effectively and strategically.** a. Select and use appropriate tools when solving a mathematical problem. b. Use technological tools and other external mathematical resources to explore and deepen understanding of concepts.
2. Reason both contextually and abstractly. a. Make sense of quantities and their relationships in mathematical and real-world situations. b. Describe a given situation using multiple mathematical representations. c. Translate among multiple mathematical representations and compare the meanings each representation conveys about the situation. d. Connect the meaning of mathematical operations to the context of a given situation.	**6. Communicate mathematically and approach mathematical situations with precision.** a. Express numerical answers with the degree of precision appropriate for the context of a situation. b. Represent numbers in an appropriate form according to the context of the situation. c. Use appropriate and precise mathematical language. d. Use appropriate units, scales, and labels.
3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others. a. Construct and justify a solution to a problem. b. Compare and discuss the validity of various reasoning strategies. c. Make conjectures and explore their validity. d. Reflect on and provide thoughtful responses to the reasoning of others.	**7. Identify and utilize structure and patterns.** a. Recognize complex mathematical objects as being composed of more than one simple object. b. Recognize mathematical repetition in order to make generalizations. c. Look for structures to interpret meaning and develop solution strategies.
4. Connect mathematical ideas and real-world situations through modeling. a. Identify relevant quantities and develop a model to describe their relationships. b. Interpret mathematical models in the context of the situation. c. Make assumptions and estimates to simplify complicated situations. d. Evaluate the reasonableness of a model and refine if necessary.	

South Carolina College- and Career-Ready Standards for Mathematics
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Algebra 1 Unit 1: Relationship Between Quantities and Expressions

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Algebra 1 Unit 1 Title
Relationships Between Quantities and Expressions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- A1.NRNS.1* Rewrite expressions involving simple radicals and rational exponents in different forms.
  - Apply properties of exponents to write equivalent expressions that include simple radicals (e.g., square roots and cube roots) and integer exponents.
  - Expand properties of exponents to write equivalent expressions that include rational exponents.
- A1.NRNS.2* Use the definition of the meaning of rational exponents to translate between rational exponent and radical forms.
  - Convert expressions with fractional exponents to equivalent radical forms and vice-versa.
- A1.NRNS.3 Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
  - Use the property of set closure to include rational and irrational numbers under addition and multiplication.
- A1.NQ.1* Use units of measurement to guide the solution of multi-step tasks. Choose and interpret appropriate labels, units, and scales when constructing graphs and other data displays.
  - Convert units of measure, as appropriate (e.g., using like units to compare or combine lengths), to solve multi-step performance tasks.
  - Apply dimensional analysis to convert units of measure.
  - Analyze the context of problems to determine the appropriate unit(s) of measure.
  - Select and interpret appropriate units of measure when solving real-world contexts involving formulas.
- A1.NQ.2* Label and define appropriate quantities in descriptive modeling contexts.
  - Identify the variables or quantities from data displayed in a given model (e.g., text, graph, picture, or algebraic formula)
  - Select the appropriate unit of measure for variables or quantities presented in a given model.
- A1.NQ.3* Choose a level of accuracy appropriate to limitations on measurement when reporting quantities in context.
  - Report solutions to problems with the appropriate level of accuracy, and with precision if necessary, for the unit of measure given in the context of the problem and/or the measuring tool used.

- A1.ASE.1* Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
    - Limit to linear expressions for Unit 1; expand to quadratic in Unit 3 and exponential in Unit 4.
    - Rational functions are not taught in Algebra 1.
    - Recognize that an algebraic expression can be composed of multiple terms and represent unknown real number value(s).
    - Simplify or factor complicated expressions by combining like terms or extracting the Greatest Common Monomial (factor) to show equivalent expressions (e.g., $2x + 2y = 10$ is equivalent to $x + y = 5$).
- A1.AAPR.1* Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations.
    - Limit to linear in Unit 1.
    - Expand the properties and operations of real numbers to include polynomial expressions.
    - Introduce the term *polynomial*.
    - Develop foundational knowledge regarding algebraic terms and polynomial expressions and the properties of operations applied to polynomials.
- A1.ACE.1* Create and solve equations and inequalities in one variable that model real-world problems involving linear, ~~quadratic, simple rational, and exponential~~ relationships. Interpret the solutions and determine whether they are reasonable.
    - Limit to linear in Unit 1
    - Expand to quadratic in Unit 3 and exponential in Unit 4.
    - Rational functions are not taught in Algebra 1.
    - Use real-world contexts to generate and solve equations and inequalities in one variable.
    - Analyze solutions for their meaning and rationale within the given context.
    - Interpreting solutions includes solutions graphed on a number line.
- A1.ACE.2* Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
    - Limit to linear and introduce the terms *direct variation* and *indirect variation* in Unit 1.
    - Expand to quadratic in Unit 3 and exponential in Unit 4.
    - Rational functions are not taught in Algebra 1.
    - Understand that linear equations define the relationship between two variables.
    - Generate and graph equations to represent the relationship between two variables.
    - Use appropriate labels, units, and scales to represent the relationship of two variables in a given real-world context.

- A1.ACE.4* Solve literal equations and formulas for a specified variable including equations and formulas that arise in a variety of disciplines.
  - Apply the properties and operations of real numbers to solve for a specified variable (e.g., solve a linear equation in standard form for y; solve $A = lw$ for w, and include other formulas from a variety of disciplines).
- A1.AREI.1* Understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.
  - State the property or operation being applied that explains why each step of solving an equation generates an equivalent equation.
  - Verify by substitution that the variable's solution in the last step solves the equation for the given problem.
- A1.AREI.3* Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - Apply the properties and operations of real numbers to equations and inequalities to solve for a specified variable (e.g., solve for x in $3x - 9 = 15$; solve the slope-intercept equation $y = mx + b$ for m; solve $y \geq mx + b$ for x).
- A1.AREI.10* Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
  - Use algebraic and graphical formats to justify that the set of solutions is a one-to-one relationship, which can be graphed with ordered pairs (i.e., domain, range).

New Academic Vocabulary for This Unit
• Compound Inequalities (*notation only*) • Direct Variation • Index (Root) • Indirect Variation • Polynomial • Radical • Radicand • Rational Exponents

Prior Knowledge Required for this Unit

In earlier grades, students have developed conceptual knowledge and have had the opportunity to learn how to:

- Understand and apply the constant of proportionality (7.RP.2).
- Determine and apply the constant rate of change (8.F.3; 8.F.4).
- Understand the relationship between independent and dependent variables (6.EEI.9; 8.F.1).
- Be able to evaluate square and cubic roots, and recognize perfect and non-perfect squares as rational and irrational correspondingly (8.EEI.2).
- Transform and apply the Pythagorean Theorem particularly as it relates to rational and irrational squares (8.EEI.2a, b, and d).
- Understand fundamental concepts of functions, including one-to-one relationships, particularly as communicated as domain to range within ordered pairs (8.F.1).
- Understand and apply the properties of exponents (8.EEI.1).
- Graph the solution of one variable inequality on the number line (7.EEI.4c).
- Understand that slope is a rate of change from one quantity in relation to another quantity within real world and mathematical situations (8.EEI.5b).
- Understand the critical attributes of linear and nonlinear functions (8.F.3).
- Represent linear functions, particularly in the form of $y = mx + b$ through table, equation, and graphical form, and identify value and meanings of slope/rate and y-intercept/initial value as found within real-world and mathematical situations (8.F.3, 8.F.4, 8.F.5, 8.EEEI.6).
- Solve for a single variable in a multiple variable equation and inequalities in real-world and mathematical situations (8.EEEI.7a and d).
- Generate and graph linear equations (8.F.1c and e; 8.F.4b; 8.F.5).
- Understand and apply the properties of operations, equality, and inequality.


Understand and
apply the properties (

Subsequent Knowledge Related to this Unit

- Algebra 1 Unit 1 develops one- and two-variable linear equation concepts (A1.ASE.1*; A1.ASE.2*).
  - Will apply and expand to include quadratic (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and exponential equations (Algebra 1 Unit 4: Modeling and Analyzing Exponential Functions).
- Algebra 1 Unit 1 recognizes an early form of factoring is to identify and extract the greatest common numeric or algebraic term, such as $2x + 2y = 10$ can be represented as $x + y = 5$ (A1. ACE.4*; A1.ASE.1*; A1.ASE.2*).
  - Will be extended to factor and simplify polynomials, specifically quadratics (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions).
- Algebra 1 Unit 1 simplifies or factors complicated expressions by combining like terms or extracting the Greatest Common Monomial (factor) to show equivalent expressions (A1.ASE.1*).
  - Will apply to primarily common monomial factoring (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions).
- Algebra 1 Unit 1 graphs one-variable inequalities on a number-line (A1.FIF.5*).
  - Will extend as a possible means to express the domain and range in compound inequality notation in future units.
- Algebra 1 Unit 1 compares functions' graphical, symbolic, or tabular forms (A1.NQ.2*; A1.AREI.10*).
  - Will utilize the application of the functions' graphical, symbolic, or tabular form, particularly to measure the average rate of change (A1.FIF.6* in Algebra 1 Units 2, 3, 4, and 5).
- Algebra 1 Unit 1 introduces direct and indirect variation in linear applications (A1.ACE.2*).
  - Will expand study of linear relationships (Algebra 1 Unit 2: Reasoning with Linear Equations and Inequalities).
- Algebra 1 Unit 1 simplifies radicals and rationalizes denominators involving square roots and extending to cube roots as appropriate (A1.NRNS.1*).
  - Will be applied in simplifying and solving literal equations and quadratics, and rationalizing will be applied in subsequent course of Geometry, such as applications with $30 - 60 - 90$ triangles (Geometry Unit 5: Right Triangles and Trigonometry).
- Algebra 1 Unit 1 defines, rewrites and explores the relationship between rational exponents and simple radicals, and the relationship of irrational numbers as subset of the entire real number systems (A1.NRNS.1*; A1.NRNS.2*; A1.NRNS.3*).
  - Will develop skills found within finding square roots, completing the square, applying the quadratic formula and factoring of quadratic functions using other methods (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions).
- Algebra 1 Unit 1 rewrites and simplifies simple radicals (A1.NRNS.1*).
  - Will be extended, such as simplifying square roots and rationalizing a denominator (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions).

- Algebra 1 Unit 1 develops fluency in variable manipulation (A1.ACE.4*).
  - Will solve for specified variables and substitute equivalent algebraic value(s) to rewrite functions of linear equations (Unit 2; Reasoning with Linear Equations and Inequalities) and quadratic functions (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and to compare such functions (Algebra 1 Unit 5: Comparing and Contrasting Functions).
- Algebra 1 Unit 1 writes equations of linear functions with two variables (A1.ACE.2*).
  - Will be extended with the point-slope form and its various applications (Unit 2: Reasoning with Linear Equations and Inequalities);
  - Will expand to quadratics (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and exponential functions (Unit 4: Modeling and Analyzing Exponential Functions).
- Algebra 1 Unit 1 develops fluency of polynomial operations and foundational knowledge of algebraic terms and polynomial expressions (A1.AAPR.1*).
  - Will facilitate linear applications (Algebra 1 Unit 2: Reasoning with Linear Equations and Inequalities), quadratic applications and factoring (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions), and other functions in units to follow.
- Algebra 1 Unit 1 develops understanding of functions in two variables and the variables' relationship expressed in table, equation and graphical forms (A1.AREI.10*).
  - Will connect to linear functions (Algebra 1 Unit 2: Reasoning with Linear Equations and Inequalities), quadratic functions (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions), and exponential functions (Algebra 1 Unit 4: Modeling and Analyzing Exponential Functions) as students begin to use function notation.
- Algebra 1 Unit 1 (and Grade 8) limits the algebraic form of a linear function to $y = mx + b$.
  - Will apply function notation $f(x)$ in subsequent units and courses.

Relationship Among Standards in this Unit
The standards in Unit 1 provide the foundational knowledge for concepts developed in Algebra 1 in subsequent units. Students will interpret the structure of expressions, equations, and inequalities involving one or more variables and solve problems related to unit analysis. Students will construct meaning about the relationships among variables, including direct and indirect variations, through real-world contexts and through algebraic, verbal, graphic, and tabular models. Tasks will progress from simple equations and inequalities to complex equations in two or more variables. Real-world contexts, relevant to STEM-related or other career fields, will engage students in mathematical practices while applying properties and performing operations with quantities involving given units of measure. Measurement units in these contexts may necessitate a conversion, which will require students to attend to precision and accuracy. Students will write, graph, and solve linear equations or inequalities to represent the relationship between independent and dependent variables. Graphing relationships will require students to use appropriate labels, units, and scales on the axes. They will employ logic and reasoning to interpret and explain the meaning of a solution or a set of solutions. From solving linear equations or inequalities in one-variable to rewriting or solving a formula involving two or more variables, students will fluently solve for given variables. Investigation of compound inequalities (written, symbolic, and number line graphing) will empower students to express domain and range using compound inequality notation. The properties of rational and irrational numbers and operations with polynomials are included as a preparation for working with quadratic functions later in the course. Students will simplify radicals and rationalize denominators involving square roots and extending to cube roots as appropriate.

Potential Instructional Strategies/Lessons
The order of the topics below illustrates a possible instructional order for Unit 1.

Exponent Foundations (A1.NRNS.1*; A1.NRNS.2*; A1.NRNS.3)

a. Basic Exponent Properties Review
   Khan Academy: Basic Exponent Properties Review
b. Relationship Between Rational Exponents and Simple Radicals
   Khan Academy: Rational and Irrational
   Math Practices: Rational and Irrational
   MathBitsNotebook: Exponents
   Purple Math: Relationship Notes
   Rational Exponent Activity


Rational Exponent Activity.pdf

c. Simplifying Radicals and Rationalizing Denominators
   Khan Academy: Rationalizing a Denominator Video
   Math Open Reference: Simplifying Radicals
   MathBitsNotebook: Simplifying and Rationalizing Denominators
   NRICH: Tilted Squares
   Virtual Nerd: Simplifying with Square Roots

Understanding and Representing Quantity (A1.NQ.1*; A1.NQ.2*; A1.NQ.3)

a. Understand the Appropriateness of Unit Size in a Real-World Context
   The *Scale of Universe*: Scale of Universe
   Alysion: Dimensional Analysis Notes and Summary
b. Unit Conversion Analysis
   Virginia: Choosing Appropriate Unit of Measurement


Unit Conversion Analysis.docx


Unit Conversion Analysis.pdf

c.

Interpret the Meanings of Expressions (A1.ASE.1*)

a. Interpreting Expressions
Mathematics Assessment Project – Mathematics Assessment Resource Service: Interpreting Algebraic Expressions: Online Lesson Plan
Interpreting Algebraic Expressions

Interpreting Algebraic Expressions

b. Translation of Expressions
MathBitsNotebook: Expression Translation
MathBitsNotebook: Expression Practice

c. Evaluation of Expressions
Mathematics Assessment Project – Mathematics Assessment Resource Service: Classroom Challenges (Formative Assessment Lessons) – Guide for Teachers and Administrators

Guide for Teachers and Administrators.pd

MathBitsNotebook: Expression Evaluation
Khan Academy: Expression Evaluation
Virtual Nerd: Variable Substitution

Polynomial Operations (A1.AAPR.1*)

a. Polynomial Definition and Concepts
Mathematics Assessment Project – Mathematics Assessment Resource Service: Generating Polynomials from Patterns : Online Lesson Plan
Mathematics Assessment Project – Mathematics Assessment Resource Service: Generating Polynomials from Patterns

Mathematics Assessment Resource

MathBitsNotebook: Defining and Classifying Polynomials

b. Polynomial Addition and Subtraction
MathBitsNotebook: Polynomial Addition and Subtraction

Virtual Nerd: Adding Polynomials
Virtual Nerd: Subtracting Polynomials
Virtual Nerd: Subtracting Polynomials (Difference in Length and Width)

c. Monomial by Polynomials
MathBitsNotebook: Monomial by Polynomial Multiplication
Virtual Nerd: Monomial by Polynomial Multiplication

d. Binomial Multiplication
MathBitsNotebook: Binomial Multiplication
Virtual Nerd: Binomial Multiplication
Virtual Nerd: FOIL Binomial Multiplication
Virtual Nerd: Grid Method Multiplication

e. Polynomial (more) Multiplication
MathBitsNotebook: Special Binomial Multiplication
MathBitsNotebook: Polynomial Multiplication
Virtual Nerd: Polynomial Multiplication
Virtual Nerd: Polynomial Grid Multiplication Application
Georgia Department of Education: Mathematics Framework – Polynomials Multiplication Unit

Mathematics Framework – Polynon

Creating and Solving Equations (A1.ACE.1*; A1.ACE.2*; A1.ACE.4*; A1.AREI.1*; A1.AREI.3*)

a. Direct and Indirect Variation Discussion
Cliffs Notes Notebook: Direct and Inverse Variation Notes and Practice Quiz
Virtual Nerd: Video Discussion on Direct Variation and How to Write an Equation in a Problem Situation
Khan Academy: Video Discussion on Direct and Inverse Variation

b. Solving One-Variable Equations
MathBitsNotebook: Solving Multi-Step Equations
MathBitsNotebook: Solving Multi-Step Equations: Practice
Virtual Nerd: Solving Multi-Step Equations: With Distributive Property

Virtual Nerd: Solving Multi-Step Equations: Clearing Fractions
Virtual Nerd: Solving Multi-Step Equations: With No Solution
Virtual Nerd: Solving Multi-Step Equations: Word Problem
Khan Academy: Solving Multi-Step Equations: Intuition Exercise
Khan Academy: Exercise Activity

c. Analyzing Multi-Step Equations


Analyzing Multi-Step Equations.docx


Analyzing Multi-Step Equations.pdf

Mathematics Assessment Project – Mathematics Assessment Resource Service: Building and Solving Complex Equations: Online Lesson Plan

d. Building and Solving Complex Equations


Building and Solving Complex Equations.p

e. Linear Rates

EngageNY: Linear Rates
EngageNY: Linear Rates


EngageNY Linear Rates.pdf

EngageNY: Linear Rates KEY


EngageNY Linear Rates KEY.pdf

Mathematics Assessment Project – Mathematics Assessment Resource Service: Building and Solving Linear Equations: Online Lesson Plan
Building and Solving Linear Equations

Building and Solving Linear Equations MAR

f. Solving Literal Equations
MathBitsNotebook: Solving Literal Equations
MathBitsNotebook: Solving Literal Equations: Practice Problems
Virtual Nerd: What is a Literal Equation
Virtual Nerd: Solving Literal Equations
Khan Academy: Solving Literal Equations
Khan Academy: Solving Literal Equations: Practice
Khan Academy: Celsius and Fahrenheit

g. Linear Modeling
Linear Equation Modeling

Linear Equation Modeling.docx
Linear Equation Modeling.pdf

Solving, Interpreting, and Graphing Inequalities in One-Variable (A1.ACE.1*; A1.AREI.3*)

a. Inequality Concepts
Interpreting Solutions by Graphing One-Variable Solution

Interpreting Solutions by Graphing
Interpreting Solutions by Graphing

MathBitsNotebook: MathBitsNotebook: Basic Inequalities Information
MathBitsNotebook: MathBitsNotebook: Compound Inequalities

b. Solving One-Variable Inequalities
MathBitsNotebook: Solving One-Variable Inequalities
MathBitsNotebook: Solving One-Variable Inequalities Practice
Virtual Nerd: Solving One-Variable Inequalities: Two Steps
Virtual Nerd: Solving One-Variable Inequalities: Multiple Steps

c. Inequality Applications
MathBitsNotebook: Inequalities Word Problem: Practice
Analyzing Inequality Word Problem


Analyzing Inequality Word Problem.docx


Analyzing Inequality Word Problem.pdf

Graphing Linear Equations (A1.ACE.2*; A1.AREI.10*)

a. Linear Equations
Virtual Nerd: What Is A Linear Equation

b. Table Method
Virtual Nerd: Graphing Table Method
MathBitsNotebook: Graphing Linear Equations Using Table Method

c. Slope-Intercept Method
Virtual Nerd: Graphing By Slope-Intercept
MathBitsNotebook: Graphing Linear Equations Using Slope Intercept Method
MathBitsNotebook: Graphing Linear Equations Using Slope Intercept Method - Practice Problems
Math Open Reference: Lines On Coordinate Plane
Math Open Reference: Slope-Intercept
Math Open Reference: Slope-Intercept Applet
Shodor: Slope-Intercept Slider

d. Intercepts Method
Virtual Nerd: Graphing By Intercepts Method
MathBitsNotebook: Graphing Linear Equations Using Intercept Methods (including calculator guide)

e. Modeling and Applications
MathBitsNotebook: Graphing Linear Equations - Mixed Practice Problems
Linear Equation Modeling


Linear Equation Modeling.docx


Linear Equation Modeling.pdf

	NCTM Illuminations: Bathtub Water Levels (Slope-Intercept: Negative Slope)
f.	Rate of Change Virtual Nerd: Rate Of Change
	Inside Mathematics: Performance Assessment Tasks

Resources
Application Resources (Downloadable Lessons, Video, Applets, and Online Algebra Notes) a. Algebra 1 Skills: Algebra 1 Skills b. Cliff Notes: Algebra 1 c. Emergent Math: Emergent Math d. EngageNY: Algebra 1 Module 1 e. Georgia Department of Education: 9 - 12 Standards Framework f. Khan Academy: Introduction to Algebra g. Math Open Reference Math Open Reference h. MathBitsNotebook: Algebra 1 i. Mathematics Assessment Project – Mathematics Assessment Resource Service: Assessing 21st Century Mathematics j. Virtual Nerd: Algebra 1
Dictionaries, Calculators, and Templates (Graphs, Graphic Organizers) a. A Maths Dictionary for Kids: Math Charts b. A Maths Dictionary for Kids: Math Dictionary c. Math Open Reference: Calculator d. Math Open Reference: Full-Size Calculator e. North Central Regional Educational Laboratory: Graphic Organizers f. University of Georgia Mathematics Education Program: Interactive Mathematics Dictionary g. Web 2.0: Calculator
Teaching Strategies a. Creative Educator: Authentic Tasks - Write a Great Authentic Task b. Creative Educator: Project-Based Learning c. Illustrative Mathematics: Illustrative Mathematics Homepage d. Math Video Instructional Development Source: Authentic Contexts e. Power Up What Works: Math Strategies that Work Research

Sample Formative Assessment Tasks/Questions
Arithmetic with Polynomials and Expressions (A1.AAPR.1*) a. Illustrative Mathematics Task: Powers of 11 b. NRICH: Quadratic Patterns c. NRICH: Square Number Surprises
Building Functions, Solving Equations and Inequalities, and Describing Relationships (A.NQ.2*; A1.ACE.1*; A1.ACE.2*; A1.AREI.10*) a. Illustrative Mathematics: Cash Box b. Illustrative Mathematics: Equations and Formulas c. Illustrative Mathematics: Reasoning with Linear Inequalities d. Illustrative Mathematics: Rewriting Equations e. Illustrative Mathematics: Same Solutions f. Illustrative Mathematics: Traffic Jam g. MathBitsNotebook: Solving One-Variable Equations - Summary Practice
Graphing Equations (A1.ACE.2*; A1.AREI.10*) a. MathBitsNotebook: MathBitsNotebook - Practice Graphing Linear Equations
Interpret the Meanings of Expressions (A.ASE.1*) a. Illustrative Mathematics: Animal Populations b. Illustrative Mathematics: Delivery Trucks c. Illustrative Mathematics: Delivery Trucks (this is a different approach) d. Illustrative Mathematics: Equivalent Expressions e. Illustrative Mathematics: Mixing Candies f. Illustrative Mathematics: Seeing Dots g. MathBitsNotebook: Basic Algebraic Expression Assessment
Real Number System (A1.NRNS.1*; A1.NRNS.2*; A1.NRNS.3) a. Illustrative Mathematics: Calculating the Square Root of 2 b. Illustrative Mathematics: Checking a Calculations of a Decimal Point c. Illustrative Mathematics: Evaluating a Special Exponential Expression d. Illustrative Mathematics: Evaluating Exponential Expressions e. Illustrative Mathematics: Operations with Rational and Irrational Numbers

f. Illustrative Mathematics: Rational or Irrational?
g. Illustrative Mathematics: Sums of Rational and Irrational Numbers
h. New Zealand Maths: It Sounds Like Mah Jong (A1.NRNS.1*)

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
Algebra 1 Unit 2: Reasoning with Linear Equations and Inequalities

Return to High School Overview, High School Table of Contents, or Algebra 1 Coversheet.

Algebra 1 Unit 2 Title
Reasoning with Linear Equations and Inequalities

Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
New Academic Vocabulary for This Unit	Subsequent Knowledge Related to this Unit	Resources
	Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- A1.ACE.2* Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
  - Limit to linear in Unit 1. Expands to quadratic in Unit 3 and exponential in Unit 4. Rational functions are not taught in Algebra 1.
  - Understand that linear equations define the relationship between two variables, and graph equations to represent that.
  - Write an equation of a line given a point and slope, both algebraic in model and application
  - Write an equation of a line given at least two points, both algebraic in model and application
- A1.AREI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - Apply the properties and operations of real numbers to equations and inequalities to solve for a specified variable (e.g., to solve a slope-intercept equation or point-slope equation for x or another specified variable; or $y \geq mx + b$ for x).
  - Apply the properties and operations of real numbers to the standard form of a linear equation to find the x-intercept, the y-intercept, or the slope of the function.
- A1.AREI.5 Justify that the solution to a system of linear equations is not changed when one of the equations is replaced by a linear combination of the other equation.
  - Define *system of equations* and *solution of a system*.
  - Multiply by the same number on both sides of the equal sign to produce equivalent equations.
  - Replace one equation with the sum of that equation and a multiple of the other to create a system with the same solutions as the original equation.
  - Substitute the common solution (if there is one) into a system to validate every equation.

- A1.AREI.6* Solve systems of linear equations algebraically and graphically focusing on pairs of linear equations in two variables.
  - Determine the approximate solution to a system of linear equations by graphing both equations and estimating the point of intersection.
  - Solve a system of linear equations algebraically (by substitution or elimination/linear combinations) to find an exact solution.
  - Explain why some linear systems have no solutions and identify linear systems that have no solutions.
  - Explain why some linear systems have infinitely many solutions and identify linear systems that have infinitely many solutions.
  - Understand that linear systems can be solved multiple ways and that one method might be more efficient than others. (e.g., $y_1 = mx + b$ and $y_2 = mx + b$ suggests the graphing or substitution method, $y_1 = mx + b$ and $Ax + By = C$ suggests the substitution method).
  - Graph the linear equations of a system to determine if the system has one, none, or infinitely many common solutions (points of intersection).
  - Manipulate the equations within a linear system algebraically (through substitution or elimination) to determine the common solution, if any exists.
  - Verify by substitution that the variables' solutions (x, y) solve the original equations.
- A1.AREI.6a Solve systems of linear equations using the substitution method.
  - Solve and verify the exact solution of a system of equations using substitution.
- A1.AREI.6b Solve systems of linear equations using linear combination.
  - Eliminate a variable algebraically to find an exact solution for a system of linear equations.
  - Verify by substitution that the variable's solutions (x, y) solve the original equations.
- A1.AREI.10* Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
  - Verify that any point on a graph will result in a true equation when their coordinates are substituted into the equation.
- A1.AREI.11* Solve an equation of the form $f(x) = g(x)$ graphically by identifying the x-coordinate(s) of the point(s) of intersection.
  - Understand that point of intersection on the graph of a system of equations, $y = f(x)$ and $y = g(x)$, represents a solution to both equations.
  - Infer that since $y = f(x)$ and $y = g(x)$, $f(x) = g(x)$ by the substitution property.
  - Verify that the x-coordinate of the points of intersection for $y = f(x)$ and $y = g(x)$ are also the solutions for $f(x) = g(x)$.
  - Use a graphing calculator to determine the approximate solutions to a system of equations $f(x)$ and $g(x)$.
- A1.AREI.12* Graph the solutions to a linear inequality in two variables.
  - Graph a linear inequality on a coordinate plane, resulting in a boundary line (solid or dashed) and a shaded half-plane.

- A1.FIF.1a Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range.
  - Define a function as a relation in which each input (domain) has exactly one output (range).
  - Determine if a graph, table, or set of ordered pairs represents a function.
  - Determine if stated rules (both numeric and nonnumeric) produce ordered pairs that represent a function.
- A1.FIF.1b Represent a function using function notation and explain that $f(x)$ denotes the output of function f that corresponds to the input x.
  - Introduce the function notation $f(x)$ to represent the output or range values of a function.
  - Understand that $f(x)$represents the corresponding output of the function when x is an element of the input of a function.
- A1.FIF.1c Understand that the graph of a function labeled as f is the set of all ordered pairs (x, y) that satisfy the equation $y = f(x)$.
  - Explain the relationship between the graph of f and the graph of the equation $y = f(x)$.
- A1.FIF.2* Evaluate functions and interpret the meaning of expressions involving function notation from a mathematical perspective and in terms of the context when the function describes a real-world situation.
  - Decode function notation and explain how the output of a function is matched to its input. (e.g., the function $f(x) = 3x^2 + 5$ squares the input, triples the square, and adds five to produce the output).
  - Use order of operations to evaluate a function for a given domain (input) value.
  - Analyze the input and output values of a function based on a problem situation.
  - Identify the real numbers that are not in the domain of a function.
  - Recognize that the domain may change depending upon the context of problem.
- A1.FIF.4* Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative~~; relative maximums and minimums; symmetries; end behavior and periodicity~~.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Convert a table, graph, set of ordered pairs, or description into function notation by identifying the rule used to turn inputs into outputs and writing the rule.

- A1.FIF.5* Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Analyze the input and output values of a function based on a problem situation.
  - Identify the numbers that are not in the domain of a function recognizing that the domain may change depending upon context of problem.
  - Write the domain and range in various formats (e.g., compound inequalities and $\mathbb{R}$).
- A1.FIF.6* Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Explain the relationship between the average rate of change and $m = (y_2 - y_1)/(x_2 - x_1) = \Delta y/\Delta x$
  - Calculate the average rate of change of a function.
  - Compare the rates of change of two or more functions.
- A1.FIF.7* Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; ~~relative maximums and minimums; symmetries; end behavior and periodicity~~. Graph simple cases by hand and use technology for complicated cases.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Identify that the parent function for lines as the line $f(x) = x$.
  - Identify the point-slope form of a linear function as $y - y_1 = m(x - x_1)$.
  - Graph a line in point-slope form and use the graph to show where the starting point (x_1, y_1) and the slope (m) are represented on the graph.
  - Identify the slope-intercept form of a linear function as $f(x) = mx + b$.
  - Graph a line in slope-intercept form and use the graph to show where the y-intercept (b) and the slope (m) are represented on the graph.
  - Explain the effects of change of slope (m) and y-intercept (b) on linear functions $(f(x) = mx + b)$.

- A1.FIF.8* Translate between different but equivalent forms of a function equation to reveal and explain different properties of the function.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Identify the point-slope form of a linear function as $y - y_1 = m(x - x_1)$.
  - Identify the slope-intercept form of a linear function as $f(x) = mx + b$.
  - Identify the standard form of a linear function as $Ax + By = C$.
  - Use definitions of x-intercept and y-intercept to find the intercepts of a standard form line.
  - Relate the constants A, B, and C to the values of the x-intercept, y-intercept, and slope.
- A1.FIF.9* Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal.
  - Limit to linear in Unit 2. Expand to quadratic in Unit 3 and exponential in Unit 4.
  - Use equations, verbal descriptions, graphs, and tables to analyze the relationship between quantities or the properties of two functions.
- A1.FLQE.2* Create symbolic representations of linear ~~and exponential~~ functions, including arithmetic ~~and geometric sequences~~, given graphs, verbal descriptions, and tables.
  - Limit to linear in Unit 2. Expand to exponential in Unit 4.
  - Determine if a function is linear given a graph, table of values, or a description of the relationship.
  - Write a linear function algebraically from a graph, table of values, or a description.
  - Describe the algebraic process used to construct a linear function from two given points.

New Academic Vocabulary for This Unit
• Average Rate Of Change • Boundary • Combinations Method • Function Notation ($f(x)$ *notation for* y) • Half-Plane • Interval • Linear Inequality • Point-Slope Form • Relation • Standard Equation Form (*for linear functions*) • Substitution Property

Prior Knowledge Required for this Unit
In earlier grades/units, students have developed conceptual knowledge and have had the opportunity to learn how to: • Extend previous understandings of Order of Operations (7.EEI.3). • Expand foundational knowledge of inequality solution sets, including compound equalities (6). • Understand function concepts, including one-to-one domain to range, particularly as communicated within ordered pairs (8.F.1). • Apply linear functions (particularly in the form of $y = mx + b$)through table, equation, and graphical form, and identify value and meanings of slope/rate and y-intercept/initial value as found within real-world and mathematical situations (8.F.3; 8.F.4; 8.F.5; 8.EEEI.6). • Extend Grade 8's conceptual knowledge of linear functions and expand the definition of linear function, which was limited to $y = mx + b$, to include function notation $f(x)$. • Solve for a variable in a multiple variable equation or inequality in real-world and mathematical situations (Algebra 1 Unit 1 - A1.ACE.1*; A1.ACE.2*; A1.ACE.4*). • Investigate the concept of linear systems through graphs or algebraic (substitution and elimination) methods. • Understand when one, none, and infinitely many solutions arise through application or inspection of linear systems (8.EEI.7b and c; 8.EEI.8). Unit 2 in Algebra 1 will scaffold this specific concept to improve mastery and extend understanding of linear systems and their solution sets. For example, in Algebra 1, the difficulty of the solution of a linear system (e.g. non-integer answers) may increase, such as expected in standard A1.AREI.11 (which compare $f(x)$ and $g(x)$ functions for linear equations). The additional standards in Unit 2 of Algebra 1 makes linear systems more rigorous in Algebra 1 than when introduced in Grade 8. • Understand and write the concept of inequalities from within real-world and mathematical situations (7.NS.4b).

Subsequent Knowledge Related to this Unit

- Algebra 1 Unit 2 includes creating one and two variable linear equations extended from Algebra 1 Unit 1, which studied the relationships among variables (Algebra 1 Unit 1: Relationships Between Quantities and Expressions) (A1.ASE.1; A1.ASE.2).
    - Will be applied and expanded to include quadratic (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and exponential (Algebra 1 Unit 4: Modeling and Analyzing Exponential Functions).
- Algebra 1 Unit 2 deepens knowledge of linear functions through graphical, symbolic, or tabular forms and how to measure the average rate of change (A1.FIF.6).
    - Will utilize the application of the functions' graphical, symbolic, or tabular form, particularly to measure the average rate of change (A1.FIF.6* in Algebra 1 Units 3, 4, and 5).
- Algebra 1 Unit 1 (A1.ACE.4) requires fluent variable manipulation and empowers students in Algebra 1 Unit 2 to rewrite functions of equations (A1.ACE.2*; A1.AREI.3).
    - Will be extended to rewrite quadratic functions (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and to compare such functions (Algebra 1 Unit 5: Comparing and Contrasting Functions) by solving for and substituting equivalent algebraic value(s).
- Algebra 1 Unit 1 (A1.AAPR.1) involves the development of foundational knowledge regarding algebraic terms and polynomial expressions and the properties of operations applied to polynomials. In Algebra 1 Unit 2, algebraic fluency of these concepts deepens and broadens while studying linear applications.
    - Will be extended to quadratic applications and factoring (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions) and other functions in units to follow.
- Algebra 1 Unit 2 explores linear function relationships in two variables expressed in table, equation and graphical forms (A1.AREI.10).
    - Will continue to be developed as students explore quadratic (Algebra 1 Unit 3: Modeling and Analyzing Quadratic Functions), exponential (Algebra 1 Unit 4: Modeling and Analyzing Exponential Functions), and other function relationships expressed in table, equation and graphical forms.
- Algebra 1 Unit 2 applies the function notation $f(x)$ (A1.FIF.1*).
    - Will extend the function notation $f(x)$ in all subsequent units and courses.
- Algebra 1 Unit 2 integrates linear systems and linear inequality graphing, lending towards extension of linear inequality systems (A1.AREI.12*).
    - Will develop linear inequality systems formally in Algebra 2.

- Algebra 1 Unit 2 develops skills with writing equations of lines (A1.FIF.7*; A1.FIF.8*).
  - Will be extended in Geometry to build on this foundation, such as when writing of lines that are parallel and perpendicular (G.GGPE.5*).

Relationship Among Standards in this Unit
The standards of Unit 2 expand students' prior knowledge of functions, specifically linear functions. Students learn function notation, analyze concepts of domain and range, and explore linear relationships through graphic, tabular, and algebraic representations. Students will identify the critical attributes of linear functions (e.g., rate of change, intercepts, domain, and range) and understand that arithmetic sequences are linear functions. As students further extend their prior knowledge of systems of linear functions and whether or not they have one, none, or infinitely many common solutions (8.EEI.7), they transfer conceptual understandings to apply other algebraic methods (i.e., substitution, combination, and elimination). Students study the relationships between variables and linear functions and linear inequalities in tabular, graphing, and algebraic formats and in real world and mathematical situations. Students also graph two-variable linear inequalities in preparation for subsequent courses. They communicate their understanding of the solution sets of inequalities in algebraic, verbal, and graphic representations. Unit 2 limits standards A1.ACE.2*, A1.FIF.4* through A1.FIF.9*, and A1.FLQE.2* to their linear function applications. This conceptual knowledge, however, is foundational for studies in subsequent units applied to quadratic functions (Unit 3) and exponential functions (Unit 4); therefore, these standards are located in multiple units within this Algebra 2 support document.

Potential Instructional Strategies/Lessons
The order of the topics below illustrates a possible instructional order for Unit 2.

Function Notation and Evaluative Meanings (A1.FIF.1*; A1.FIF.2*; A1.FIF.5*)

a. Instructional Materials
Building Functions


Building Functions.pdf

Solving Equations and Inequalities– PDF will be attached in August, 2015
Describing Variables– PDF will be attached in August, 2015
Best Buy Tickets


Best Buy Tickets.pdf

b. Exploring Functions
Fiona Task


Fiona Task.pdf

Linear Modeling, Creating Equations with Two Variables, and Graphing Linear Functions (A1.ACE.2*; A1.FIF.5*; A1.FIF.6*)

a. Average Rate of Change
Average Rate of Change


Average Rate of Change.pdf

Virtual Nerd: Average Rate of Change Review, Slope, and Table-Method

b. Creating Equations and Graphing Linear Functions
Khan Academy: Linear Function Graphing Videos on Relationships Discussion, Slope Discussion, Equations Example 1, and Equations Example

2
Linear Functions Relationships

Linear Functions Relationships.docx

Linear Functions Relationships.pdf

Writing Equations of Lines (A1.FIF.7*; A1.FIF.8*)

a. Point-Slope Form
   Khan Academy: Introduction To Point-Slope Video
   Virtual Nerd: Rewriting From Slope-Intercept Into Standard Or Point-Slope Formats
   Virtual Nerd: Writing Equations Of Lines In Point-Slope Format, Finding "B" When Given Point And Slope, and Given A Parallel Line And Point
b. Two-Points
   Khan Academy: Writing Equation Of A Line Given In Point-Slope Given Two Points
c. Applications
   Open Middle: Write A Linear Function

Linear Systems (A1.FIF.9*; A1.AREI.5; A1.AREI.6*; A1.AREI.6a*; A1.AREI.6b*; A1.AREI.10*; A1.AREI.11*; A1.FIF.4*)

a. Linear Systems - General Understanding
   Cliffs Notes: Linear Systems General Information
   EngageNY: Creating Systems Of Equations
   EngageNY: Creating Systems Of Equations

EngageNY Creating Systems Of Equations

EngageNY: Creating Systems Of Equations KEY

EngageNY Creating Systems Of Equations

Georgia Department of Education: Georgia Standards Solving Systems By Graphing – "Cara's Candles; page 64" – Georgia Standards Of Excellence Unit 2


Georgia DOE.pdf

Georgia Department of Education: Methods For Solving Systems Of Equations – Georgia Standards Of Excellence Unit 2 – Graphic Organizer – PDF will be attached in August, 2015

Georgia Department of Education: Solve Systems Of Linear Equations By Elimination – Graphic Organizer – PDF will be attached in August, 2015

Georgia Department of Education: Solving Systems By Graphing – "Family Outing; page 131" – Georgia Standards Of Excellence Unit 2


Georgia DOE.pdf

Georgia Department of Education: Solving Systems By Graphing – "Talk Is Cheap; page 143" – Georgia Standards Of Excellence Unit 2


Georgia DOE.pdf

MathEdPage: Systems With Teacher Notes And Applications


MathEdPage Systems.pdf

Mathematics Assessment Project – Mathematics Assessment Resource Service: Maximizing Profit - Online Lesson Plan

Mathematics Assessment Project – Mathematics Assessment Resource Service: Maximizing Profit


MARS Maximizing Profit.pdf

Mathematics Assessment Project – Mathematics Assessment Resource Service: Solving Linear Equations In Two Variables - Online Lesson Plan

Mathematics Assessment Project – Mathematics Assessment Resource Service: Solving Linear Equations In Two Variables

Solving Linear Equations In Two Var

Graphing Inequalities with Two-Variables (A1.AREI.12*)

a. Graphing Two-Variable Inequalities

EngageNY: Graphing Inequalities with Two-Variables

EngageNY: Graphing Inequalities with Two-Variables

EngageNY Graphing Inequalities with Two

EngageNY: Graphing Inequalities with Two-Variables KEY

EngageNY Graphing Inequalities with Two

Extension: Graphing and Solving Linear Inequality Systems

Georgia Department of Education: Georgia Standards of Excellence – Unit 2

Georgia DOE.pdf

Mathematics Assessment Project – Mathematics Assessment Resource Service: Representing Inequalities Graphically - Online Lesson Plan

Mathematics Assessment Project – Mathematics Assessment Resource Service: Representing Inequalities Graphically

Representing Inequalities Graphical

Virtual Nerd: Graphing Two-Variable Inequalities Videos - Determining Boundary Line and Graphing Two-Variable Inequalities

Resources
• A Maths Dictionary for Kids: Math Charts • Algebra 1 Skills: Algebra 1 Skills • Cliff Notes: Algebra 1 • Desmos: Explore Math with Desmos • Emergent Math: Emergent Math • EngageNY: Algebra 1 • Georgia Department of Education: 9 - 12 Standards Framework • Georgia Department of Education: Georgia Instructional Framework Teacher's Edition (TE) • Graphing Stories: Graphing Stories Homepage • Illuminations: Resources for Teaching Math By NCTM • Khan Academy: Introduction to Algebra • Math Education Page: Math Education Homepage • Math Open Reference: Math Open Reference Homepage • MathBitsNotebook: Algebra 1 Online Study Resources • Virtual Nerd: Algebra 1 • Virtual Nerd: Algebra Skills Videos

Sample Formative Assessment Tasks/Questions

Solving Linear Equations and Systems of Equations (A1.ACE.2*; A1.AREI.1*; A1.AREI.3*; A.AREI.6*; A.AREI.11*)

a. Illustrative Mathematics: Accurately Weighing Pennies I
b. Illustrative Mathematics: Collinear Points (A1.AREI.10*)
c. Illustrative Mathematics: Estimating a Solution Via Graphs
d. Illustrative Mathematics: Find a System
e. Illustrative Mathematics: Fishing Adventures 3 (systems of linear inequalities)
f. Illustrative Mathematics: Pairs of Whole Numbers
g. Illustrative Mathematics: Solution Sets (systems of linear inequalities)
h. Illustrative Mathematics: Solving Two Equations in Two Unknowns
i. Illustrative Mathematics: Taxi (A1.AREI.10*)
j. New Zealand Maths: Renting a Car
k. NYC Department of Education: The Cycle Shop
l. Task: A Typical Envelope

A Typical Envelope.doc

Interpreting Functions (A1.FIF.1a; A1.FIF.1b; A1.FIF.1c; A1.FIF.2*; A1.FIF.4*; A1.FIF.5*; A1.FIF.6*; A1.FIF.7*; A1.FIF.8*; A1.FIF.9*)

a. Georgia Department of Education: Functioning Well (A1.FIF.1)

Functioning Well.pdf

b. Georgia Department of Education: Performance Task GA Resource - Which is Which? (A1.FIF.2)

Which is Which.pdf

c. Illustrative Mathematics: 10000 is Half of 2000 (A1.FIF.6*)
d. Illustrative Mathematics: Cell Phones (A1.FIF.2*)
e. Illustrative Mathematics: Domains

f. Illustrative Mathematics: Function Notation I (A1.FIF.1b)
g. Illustrative Mathematics: Hoisting the Flag I
h. Illustrative Mathematics: Hoisting the Flag II
i. Illustrative Mathematics: How is the Weather? (A1.FIF.5)
j. Illustrative Mathematics: Interpreting the Graph
k. Illustrative Mathematics: Laptop Battery Charge (A1.FIF.6*)
l. Illustrative Mathematics: Mathemafish Population (A1.FIF.6*)
m. Illustrative Mathematics: Pizza Place Promotion
n. Illustrative Mathematics: Playing Catch
o. Illustrative Mathematics: Points on a Graph
p. Illustrative Mathematics: Random Walk I (A1.FIF.2*)
q. Illustrative Mathematics: Random Walk II (A1.FIF.2*)
r. Illustrative Mathematics: Temperature Change (A1.FIF.6*)
s. Illustrative Mathematics: The Customers (A1.FIF.1a)
t. Illustrative Mathematics: The High School Gym (A1.FIF.6*)
u. Illustrative Mathematics: The Parking Lot (A1.FIF.1a)
v. Illustrative Mathematics: Warming and Cooling
w. Illustrative Mathematics: Words-Tables-Graphs (A1.FIF.9*)
x. Illustrative Mathematics: Yam in the Oven (A1.FIF.2*)
y. Illustrative Mathematics: Your Father (A1.FIF.1a)
z. Practice Task - Understanding and Using Function Notation (A1.FIF.2) – PDF will be attached in August, 2015

Understanding and Using Function Notati

Symbolic Representation of Linear Function (A1.FLQE.2*)

a. Illustrative Mathematics Task: Do Two Points Always Determine a Linear Function?
b. Open Middle problem - Write a Linear Function

Inside Mathematics: Performance Assessment Tasks

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
Algebra 2 Coversheet

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Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Functions: Arithmetic/Geometric Sequences and Absolute Value, Step, and Piece-Wise Functions	Linear Equations/Inequalities and Systems of Equations/Inequalities	Polynomials	Quadratic Functions, Equations, and Inequalities	Radical and Simple Rational Functions and Equations	Exponential Functions and Equations
Standards	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**
A2.FBF.1a A2.FBF.2* A2.FBF.3* A2.FIF.3* A2.FIF.7* A2.FIF.9* A2.FLQE.2* A2.FLQE.5*	A2.ACE.1* A2.ACE.2* A2.ACE.3 A2.ACE.4*	A2.AAPR.1* A2.AAPR.3 A2.ASE.1* A2.ASE.2*	A2.ACE.1* A2.ACE.2* A2.ACE.3 A2.ACE.4* A2.AREI.4b* A2.AREI.7 A2.AREI.11* A2.ASE.3b* A2.FBF.1a* A2.FBF.1b* A2.FBF.3* A2.FIF.4* A2.FIF.5* A2.FIF.6* A2.FIF.8* A2.FIF.9* A2.NCNS.1* A2.NCNS.7*	A2.ACE.1* A2.ACE.4* A2.AREI.2* A2.AREI.11* A2.FBF.1a* A2.FBF.1b* A2.FBF.3* A2.FIF.4* A2.FIF.5* A2.FIF.6* A2.FIF.7* A2.FIF.8*	A2.ACE.1* A2.ACE.2* A2.ACE.4* A2.ASE.3c* A2.AREI.11* A2.FBF.1a* A2.FBF.1b* A2.FBF.2* A2.FBF.3* A2.FIF.3* A2.FIF.4* A2.FIF.5* A2.FIF.6* A2.FIF.8b* A2.FLQE.1b* A2.FLQE.2* A2.FLQE.5*

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
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Mathematical Process Standards: The South Carolina College- and Career-Ready (SCCCR) Mathematical Process Standards demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills. As a result, the SCCCR Mathematical Process Standards should be integrated within the SCCCR Content Standards for Mathematics for each grade level and course. Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding.

1. Make sense of problems and persevere in solving them. a. Relate a problem to prior knowledge. b. Recognize there may be multiple entry points to a problem and more than one path to a solution. c. Analyze what is given, what is not given, what is being asked, and what strategies are needed, and make an initial attempt to solve a problem. d. Evaluate the success of an approach to solve a problem and refine it if necessary.	**5. Use a variety of mathematical tools effectively and strategically.** c. Select and use appropriate tools when solving a mathematical problem. d. Use technological tools and other external mathematical resources to explore and deepen understanding of concepts.
2. Reason both contextually and abstractly. a. Make sense of quantities and their relationships in mathematical and real-world situations. b. Describe a given situation using multiple mathematical representations. c. Translate among multiple mathematical representations and compare the meanings each representation conveys about the situation. d. Connect the meaning of mathematical operations to the context of a given situation.	**6. Communicate mathematically and approach mathematical situations with precision.** a. Express numerical answers with the degree of precision appropriate for the context of a situation. b. Represent numbers in an appropriate form according to the context of the situation. c. Use appropriate and precise mathematical language. d. Use appropriate units, scales, and labels.
3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others. e. Construct and justify a solution to a problem. f. Compare and discuss the validity of various reasoning strategies. g. Make conjectures and explore their validity. h. Reflect on and provide thoughtful responses to the reasoning of others.	**7. Identify and utilize structure and patterns.** d. Recognize complex mathematical objects as being composed of more than one simple object. e. Recognize mathematical repetition in order to make generalizations. f. Look for structures to interpret meaning and develop solution strategies.
4. Connect mathematical ideas and real-world situations through modeling. e. Identify relevant quantities and develop a model to describe their relationships. f. Interpret mathematical models in the context of the situation. g. Make assumptions and estimates to simplify complicated situations. h. Evaluate the reasonableness of a model and refine if necessary.	

Algebra 2 Unit 1 Title
Functions: Arithmetic/Geometric Sequences and Absolute Value, Step, and Piece-Wise Functions

Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
New Academic Vocabulary for This Unit	Subsequent Knowledge Related to this Unit	Resources
	Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- A2.FLQE.2* Create symbolic representations of linear ~~and exponential~~ functions, including arithmetic ~~s~~equences, given graphs, verbal descriptions, and tables.
  - Representation of exponential functions will be addressed in Unit 6.
  - Focus for arithmetic sequences in Algebra 2 is on the arithmetic sequences and its connection to linear functions.
  - Engage prior knowledge by beginning with linear functions to describe features and representations, making the connection to arithmetic sequences, then extending to geometric, piece-wise and step functions.
- A2.FIF.3* Define functions recursively and recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
  - Emphasize understanding of what a recursive function is.
- A2.FBF.2* Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, translate between the two forms.
  - Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.
  - Understand that linear functions are the explicit form of recursively-defined arithmetic sequences and that exponential functions are the explicit form of recursively-defined geometric sequence.
  - Emphasize understanding of why the recursive formula for an arithmetic sequence uses addition and the explicit form uses multiplication.
  - Emphasize understanding of why the recursive formula for a geometric sequence uses multiplication and why the explicit form uses exponential.
  - Distinguish between explicit and recursive formulas.
    - Recursive formulas exhibit how a sequence starts and how to use the previous value(s) to generate the next element.
    - Explicit formulas allow one to find any element of a sequence without knowing the previous element.

- A2.FBF.1*a Write a function that models a relationship between two quantities using both explicit expressions and a recursive process and by combining standard forms using addition, subtraction, multiplication and division to build new functions.
    - Provide multiple applied contexts and opportunities in which to explore these functions. Use real-world examples, so students can not only describe what they see in a table, equation, or graph, but also relate the key features to real-life meanings.
    - Distinguish between relationships that are functions and are not functions (first introduced in Grade 8) and examine graphs and tables of non-functions versus functions. Often students have the misconception that all relationships having an input and output are functions and therefore misuse the function terminology.
    - A2.FBF.1a is not a Graduation Standard.
- A2.FIF.7* Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior ~~and periodicity.~~ Graph simple cases by hand and use technology for complicated cases.
    - Included functions are absolute value, arithmetic sequence, piece-wise, and step.
    - Graph functions, both with and without a calculator. Students could begin by examining graphs, describing the characteristics (intercepts, increasing/decreasing intervals, relative maxima, minima, symmetry, end behavior, and asymptotes) and then transition to using a given set of characteristics to sketch the graph of a function.
    - Understand that absolute value and step functions are part of the piece-wise family of functions
        - Absolute value and step functions have linear pieces
        - General piece-wise functions may have quadratic and exponential pieces.
    - Discussion of periodicity will take place in Pre-Calculus.
- A2.FBF.3* Describe the effect of the transformations (x), $(x) + k$, $f(x + k)$, and combinations of such transformations on the graph of $y = f(x)$ for any real number k. Find the value of k given the graphs and write the equation of a transformed parent function given its graph.
    - Included functions are absolute value, arithmetic sequence, piece-wise, and step.
- A2.FIF.9* Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal.
    - Included functions are absolute value, arithmetic sequence, piece-wise, and step.
- A2.FLQE.5* Interpret the parameters in a linear ~~or exponential~~ function in terms of the context.
    - Included functions are absolute value, arithmetic sequence, piece-wise, and step.
    - Relate the domain of a function to its graph and where applicable, to the quantitative relationship it describes. For example, if the function $f(x)$ gives the number of person-hours it takes to assemble x engines in a factory, then the positive integers would be an appropriate domain for the function.

New Academic Vocabulary for This Unit
• Arithmetic Sequence • Composition of Functions • End Behavior • Explicit Formula • Geometric Sequence • Greatest Integer Function • Piece-Wise Defined Function • Recursive Formula • Sequence • Step Function

Prior Knowledge Required for this Unit
In earlier grades/courses, students have developed conceptual knowledge and have had the opportunity to learn how to: • Representing functions in multiple ways – mappings, tables, graphs, equations and verbal descriptions (8.F.1 – 5). • Create symbolic representations of linear functions (A1.FLQE.2). • Graphing functions and indicating key features with quadratic and linear only (A1.FIF.7). • Effects of transformation with linear, quadratic, and exponential with integer exponents (A1.FBF.3). • Comparing the properties of two functions given in different forms for linear, quadratic, and exponential with integer exponents (A1.FIF.9). • Interpret the parameters in a linear function in terms of context (A1.FLQE.5).

Subsequent Knowledge Related to this Unit

- Algebra 2 Unit 1 creates symbolic representations of functions given graphs, verbal descriptions, and tables (A2.FLQE.2*).
  - Will also be addressed in Algebra 2 Unit 6: Exponential Functions and Equations.
- Algebra 2 Unit 1 defines functions recursively and recognize that sequences are functions (A2.FIF.3*).
  - Will also be addressed in Algebra 2 Unit 6: Exponential Functions and Equations.
  - Geometric Sequences are included in Algebra 2 Unit 1 but can also be repeated in Algebra 2 Unit 6: Exponential Functions and Equations.
- Algebra 2 Unit 1 writes a function that models a relationship between two quantities (A2.FBF.1a; *note: IA.FBF.1a is not a Graduation Standard.).*
  - Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations, Algebra 2 Unit 5: Rational and Simple Rational Functions and Equations, and Algebra 2 Unit 6: Exponential Functions and Equations.
- Algebra 2 Unit 1 graphs functions from their symbolic representations (A2.FIF.7*).
  - Will also be addressed in Algebra 2 Unit 5: Rational and Simple Rational Functions and Equations.
- Algebra 2 Unit 1 describes the effect of the transformations on the graph of y = (x) and writes the equation of a transformed parent function given its graph (A2.FBF.3*).
  - Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations, Algebra 2 Unit 5: Rational and Simple Rational Functions and Equations, and Algebra 2 Unit 6: Exponential Functions and Equations.
- Algebra 2 Unit 1 compares properties of two functions given in different representations (A2.FIF.9*).
  - Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations.
- Algebra 2 Unit 1 interprets the parameters in a linear function in terms of the context (A2.FLQE.5*).
  - Will also be addressed in Algebra 2 Unit 6: Exponential Functions and Equations.

Relationship Among Standards in this Unit
The standards in this unit include functions not specifically covered in the subsequent Algebra 2 units. Students are expected to write, graph, apply, and interpret these functions. The focus in Unit 1 is on the characteristics, similarities and differences in the following functions: linear, absolute value, arithmetic/geometric sequence, piece-wise, and step functions. The goal is for students to develop, understand, and make connections between a variety of function forms: equations, graphs, verbal descriptions, and tables. The terms recursively and explicitly are introduced for the first time, along with arithmetic/geometric sequences. Focus is placed on real world applications and contextual situations that students can relate to. Emphasis is also placed on the transformation of these functions in the coordinate plane.

Potential Instructional Strategies/Lessons *The order of the topics below illustrates a possible instructional order for Unit 1.*
Arithmetic Sequences (A.2.FBF.1 and 2; A2.FIF.3) a. Writing Arithmetic Sequences Recursively and Explicitly Algebra Lab: Arithmetic Sequences LearnZillion: Model Arithmetic Sequences And Situations By Using Both Recursive And Explicit Formulas b. Writing Geometric Sequences Recursively and Explicitly Algebra Lab: Geometric Sequences Algebra Lab: Algebra 2 Recipe: Geometric Sequences c. Graphing Calculator Exploration of Arithmetic Sequences TI Education: Arithmetic Sequences & Series
Geometric Sequences (A.2.FBF.1 and 2; A2.FIF3) a. Writing Geometric Sequences Recursively And Explicitly Algebra Lab: Geometric Sequences Algebra Lab: Algebra 2 Recipe: Geometric Sequences
Piece-Wise Functions (A2.FIF.7*) a. Connecting Piece-Wise, Absolute Value, and Step Functions Birdville Schools: Extension Activity For Piece-Wise Functions Math Is Fun: Piece-Wise MathBits Notebook: Piece-Wise Rowe Math Wiki: Piece-Wise Module
Functions – Linear, Absolute Value, Arithmetic Sequences, Piece-Wise, and Step (A.2.FBF.1a, 2, and 3; A.2.FBF.3; A2.FIF3) a. Videos On Graphs And Their Transformations Virtual Nerd: Absolute Value and Piece-Wise Functions b. Examples For Piece-Wise, Step, Greatest Integer, And Absolute Value Glencoe McGraw-Hill: Special Functions c. Extension Activity For Piece-Wise Functions Birdville Schools: Analyzing Piece-Wise Functions d. Key Features of Graphs MathBits Notebook: Function Features

e. Writing Functions Given A Situation

Writing Functions Given A Situation.pdf

f. Combining Standard Forms of Functions Using Operations – Practice

Combining Standard Forms of Functions U:

Resources
Activity Resources a. Illustrative Mathematics: Activities For All Levels b. Robert Kaplinksy: Problem-based Learning Activities
Algebra 2 Course Content Resources from Other States a. EngageNY: Algebra 2 Resources b. Georgia Department of Education: Algebra 2 Resources c. Regents Prep: Algebra 2 and Trig d. Virginia Department of Education: Algebra 2 Resources
Graphing Calculator Resources a. Desmos: Online Graphing Calculator with Many Pre-Made Activities b. Texas Instruments: Texas Instruments Algebra 2 Graphing Calculator Activities c. Wabbit: Online TI-84 Silver Edition Graphing Calculator Emulator
Interactive Resources a. Emergent Math: Emergent Math b. ExploreLearning: Gizmo Online Simulations c. Interactive Quizzes: Interactive Quizzes for High School Assessments
Practice Tests and Assessment Resources a. California Department of Education: California Algebra Released Test Questions b. Jefferson Lab: Practice Tests from Virginia for All Levels of Math c. Problem-Attic: Problem-Attic d. XL Math: XL Math for Algebra 2
Video Resources a. Virtual Nerd: Videos for Algebra 2 b. LearnersTV: Videos for Algebra 2 c. HippoCampus: Videos for Algebra 2

Sample Formative Assessment Tasks/Questions
Functions – Linear, Absolute Value, Arithmetic/Geometric Sequences, Piece-Wise, and Step Functions (A2.FBF.1, 2, and 3; A2.FBF.3; A2.FIF.3) a. Describe key characteristics of the graph of $f(x) = \|x - 1\| + 3$ b. Sketch the graph and identify key characteristics of $f(x) = \begin{cases} x + 2, x \geq 0 \\ -x^2, x < -1 \end{cases}$ c. What is the difference between a recursive and an explicit representation of a sequence?
Transformations: Linear, Absolute Value, Arithmetic Sequences, Piece-Wise, Step (A2.FBF.3) a. She Loves Math: Parent Functions and Transformations b. On the axes, graph $f(x) = \|x\|$. If $g(x) = f(x) - 2$, then how is the graph of $f(x)$ translated to form the graph of $g(x)$? If $h(x) = f(x - 4)$, then how is the graph of $f(x)$ translated to form the graph of $h(x)$?
Piece-Wise Functions (A2.FIF.7) a. CPM Educational Program: Connecting Piece-wise Functions to Continuity Extension b. Graphing And Writing Piece-Wise Functions Activity Graphing And Writing Piece-Wise Functions
Arithmetic/Geometric Sequences (A.2.FBF.1 and 2; A2.FIF.3) a. Algebra Lab: Algebra 2 Practice b. Mathematics Vision Project: Arithmetic and Geometric Sequences Module/Activity c. NRICH: Activity on Comparing Two Arithmetic Sequences d. Virginia Department of Education: Sequence Matching Activity with Information on Differentiation and Essential Questions e. Writing Arithmetic Sequences Explicitly and Recursively: Gumball Mural Activity Writing Arithmetic Sequences Explicitly a
Inside Mathematics: Performance Assessment Tasks

Algebra 2 Unit 2 Title
Linear Equations/Inequalities and Systems of Equations/Inequalities

Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
New Academic Vocabulary for This Unit	Subsequent Knowledge Related to this Unit	Resources
	Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

For all standards in this unit, Algebra 2 must extend the knowledge and applications of linear equations/inequalities/relationships that were begun in Algebra 1. It is important to apply and extend skills learned in Algebra 1 and not to simply reteach already covered in Algebra 1. Students should experience real-world applications of linear equations/inequalities/relationships in a much more complex contextual situation than they experienced in Algebra 1. Students are introduced to linear inequalities in Algebra 1, and in Algebra 2 the concept of linear inequalities is extended to include compound inequalities, absolute value inequalities, and systems of inequalities. Importance should be placed on consideration of the constraints on domain and range, particularly when applied to real-world contextual situations.

- A2.ACE.1* Create and solve equations and inequalities in one variable that model real-world problems involving linear, ~~quadratic, simple rational, and exponential~~ relationships. Interpret the solutions and determine whether they are reasonable.
    - Extend (not re-teach) what was learned in Algebra 1. Students learned to solve and graph linear equations and inequalities in Algebra 1. In Algebra 2, emphasis is placed on the application of these skills to real-world and contextual situation type scenarios.
    - Provide examples that are real world applications and more complex than those begun in Algebra 1.
    - Included in the study of Inequalities in Algebra 2 are compound inequalities and absolute value inequalities.
    - Emphasize the meaning of the variables in the situational and real-world applications.
- A2.ACE.2* Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
    - Extend knowledge and applications of linear equations/relationships begun in Algebra 1.
    - Emphasize the importance of appropriate labels, units, and scales. Appropriate labels, units, and scales are essential for accurately modeling the relationship between the two quantities (mathematical process standard #6). Incorrect scales on the graph will distort the visual appearance of the relationship. Labels and units are important to accurately understand and interpret graphs.
    - Emphasize the meaning of the variables in the situational and real-world applications.

- A2.ACE.3 Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programing. Interpret the solution within the context of the situation. (Limit to linear programming.)
  - Extend knowledge of graphing inequalities learned in Algebra 1 to graphing systems of inequalities.
  - Included in this unit are linear systems of equations and inequalities. Unit 4 (Quadratic Functions/Equations/Inequalities) will address systems that include quadratic equations and inequalities.
  - Include solving and analytical method applications to linear programming.
  - Emphasize the meaning of the variables in the situational and real-world applications.
  - Ensure understanding of the difference in meaning and appearance of the graph for an inequality or system of inequalities that include $\geq, \leq, >, <$, and $\neq$.
- A2.ACE.4* Solve literal equations and formulas for a specified variable including equations and formulas that arise in a variety of disciplines.
  - Extend knowledge and applications of linear equations/relationships begun in Algebra 1.
  - Provide applications that allow students to see the usefulness/purpose of rewriting a formula by solving for one of the variables in the formula.

New Academic Vocabulary for This Unit
● Break-Even Point ● Constraints ● Feasible Region ● Linear Programming ● Optimization ● Systems of Inequalities ● Unbounded System

Prior Knowledge Required for this Unit
Working with expressions and equations, including formulas, is an integral part of the curriculum in Grades 7 and 8. In high school, students explore in more depth the use and application of equations and inequalities to model real-world problems, including restricting domains and ranges to fit the problem's context, as well as rewriting formulas for a variable of interest. In Algebra 1, the primary focus is on graphing and solving linear equations and inequalities. Algebra 1 also includes systems of equations, but does not include systems of inequalities. In Algebra 2, these skills are extended to more complex situations and modeling of real-world applications to include linear programming (not to be re-taught). Below are the linear equations and inequalities standards students had the opportunity to learn in Algebra 1: • Create and solve equations and inequalities in one variable (A1.ACE.1*). • Create and graph equations in two or more variables (A1.ACE.2*). • Solve literal equations and formulas for specified variable (A1.ACE.4*). • Solve linear equations and inequalities with coefficients represented by letters (A1.AREI.3*). • Justify the solution to a system of linear equations (A1.AREI.5). • Solve a system of linear equations graphically and algebraically (A1.AREI.6*). • Graph the solutions of a linear inequality in two variables (A1.AREI.12*).

Subsequent Knowledge Related to this Unit
• A2.ACE.1* Create and solve equations and inequalities in one variable that model real-world problems involving linear, ~~quadratic, simple rational, and exponential relationships~~. Interpret the solutions and determine whether they are reasonable. o Will also be addressed in Algebra 2 Unit 5: Radical and Simple Rational Functions and Equations and Algebra 2 Unit 6: Exponential Functions and Equations. • A2.ACE.2* Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. o Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations) and Algebra 2 Unit 6: Exponential Functions and Equations. • A2.ACE.3 Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programing. Interpret the solution within the context of the situation. (Limit to linear programming.) o Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations. • A2.ACE.4* Solve literal equations and formulas for a specified variable including equations and formulas that arise in a variety of disciplines. o Will also be addressed in Algebra 2 Unit 4: Quadratic Functions and Equations, Algebra 2 Unit 5: Rational and Simple Rational Functions and Equations, and Algebra 2 Unit 6: Exponential Functions and Equations.

Relationship Among Standards in this Unit
All standards in this unit address linear equations/inequalities and systems of linear equations/inequalities. The focus is on creating and solving these systems with an emphasis on linear programming and real-world applications. It is important to note that this unit also includes compound inequalities and absolute value inequalities.

Potential Instructional Strategies/Lessons
The order of the topics below illustrates a possible instructional order for Unit 2.

Linear Equations (A2.ACE.1*; A2.ACE.2*)

a. Activities for Creating an Equation Given a Situation
   Illustrative Mathematics: Planes and Wheat
   Illustrative Mathematics: Paying the Rent
   Illustrative Mathematics: Buying a Car
   Illustrative Mathematics: Clea on an Escalator

Compound/Absolute Value Inequalities (A2.ACE.1*)

a. CK – 12: Overview of Solving Compound Inequalities
b. Great Valley School District: Absolute Value Inequality Word Problems for Assessment
c. Monterey Institute: Explanation of Compound Inequalities as a Union or Intersection of Inequalities
d. Purple Math: Overview Of Solving Absolute Value Inequalities

Systems of Equations and Inequalities and Linear Programming (A2.ACE.3)

a. Algebra-Class: Systems of Inequalities Practice Problems
b. Henrico County Public Schools: Linear Programming PowerPoint from Henrico/Virginia


Linear Programming
PPT from Henrico Virg

c. Illuminations: Using TI-83/84 to Develop Understanding of Linear Programming: Dirt Bike Dilemma
d. Linear Programming Examples with Answers

Linear Programming
Examples with Answe

Literal Equations and Formulas (A2.ACE.4*)

a. Illustrative Mathematics: Equations and Formulas
b. *When teaching solving literal equations, educators should make connections to relevant science, business, and CATE applications (STEM). Collaboration with teachers within such disciplines is encouraged.*

Resources
Algebra 2 Course Content Resources from Other States a. Henrico County Public Schools: Algebra 2 Resources b. EngageNY: Algebra 2 Resources c. Georgia Department of Education: 9 – 12 Resources d. Regents Prep: Algebra 2 and Trig

Activity Resources a. Illustrative Mathematics: Activities For All Levels b. Robert Kaplinksy: Problem-Based Learning Activities
Graphing Calculator Resources a. Desmos: Online Graphing Calculator with Many Pre-Made Activities b. Texas Instruments: Texas Instruments Algebra 2 Graphing Calculator Activities c. Wabbit: Online TI-84 Silver Edition Graphing Calculator Emulator
Interactive Resources a. Emergent Math: Emergent Math b. Explore Learning: Gizmo Online Simulations c. Interactive Quizzes: Interactive Quizzes for High School Assessments
Practice Tests and Assessment Resources a. California Department of Education: California Algebra Released Test Questions b. Practice Tests from Virginia for All Levels of Math - http://education.jlab.org/solquiz/ c. Problem-Attic: Sample Problems d. XL Math for Algebra 2 - XL Math for Algebra 2
Video Resources a. HippoCampus: Videos for Algebra 2 b. LearnersTV: Videos for Algebra 2 c. Virtual Nerd: Videos for Algebra 2

Sample Formative Assessment Tasks/Questions
Linear Equations, Inequalities, and Systems of Equations and Inequalities (A2.ACE.1*; A2.ACE.2*; A2.ACE.3; A2.ACE.4*) a. A local snack company makes circular cakes. The average circumference of the snack cakes is supposed to be 18.85 inches. When reviewing a recent batch of the snack cakes, the quality control manager thinks the cakes are not measuring the correct circumferences. To pass inspection, the circumferences of the cakes need to be within 0.5 inches of the average. i. Write an inequality to represent the situation. ($\lvert x - 18.85\rvert < 0.5$ ii. Solve the inequality to find the appropriate range of circumferences for the snack cakes. ($-0.5 < x - 18.85 < 0.5$ so $18.35\ inches < x < 19.35\ inches$) b. Give students geometric, science, or business formulas and have them solve the equation for each of the different variables in the formula. For example: Solve the formula $C = \frac{5}{9}(F - 32)$ that relates degrees Fahrenheit to degrees Celsius for F. Then then convert -5 degrees Celsius to Fahrenheit. c. Which equation states that the temperature, t, in a room is less than 30 from 680? i. $\lvert 3 - t\rvert < 68$ ii. $\lvert 3 + t\rvert < 68$ iii. $\lvert 68 - t\rvert < 3$ (correct answer) iv. $\lvert 68 + t\rvert < 3$ d. CK – 12: Multiple Choice Problems for Absolute Value Inequalities e. Illuminations: Dirt Bike Dilemma (*Addresses the development and assesses the conceptual understanding of linear programming; can be used for a resource for teaching the lesson or a formative assessment.*) f. Illustrative Mathematics: Activities For Writing A System Of Inequalities With Constraints g. Illustrative Mathematics: How Much Folate?
Inside Mathematics: Performance Assessment Tasks

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
Geometry Coversheet

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Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Points, Lines, Planes, Angles, and Proofs	Triangles	Quadrilaterals	Similarity	Right Triangles and Trigonometry	Area and Volume	Circles	Statistics
Standards	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**
G.GCO.1*	G.GCI.3	G.GCO.10a*	G.GCO.2*	G.GM.1*	G.GCI.5*	G.GCI.1	G.SPID.1*
G.GCO.8a*	G.GCO.2*	G.GCO.10b*	G.GCO.5*	G.GM.2	G.GCO.1*	G.GCI.2*	G.SPID.2*
G.GCO.8b*	G.GCO.3*	G.GCO.10c*	G.GCO.9c*	G.GSRT.4c*	G.GCO.11*	G.GCI.3	G.SPID.3*
G.GCO.8d*	G.GCO.4*	G.GCO.10d*	G.GCO.11*	G.GSRT.6*	G.GGPE.7*	G.GCI.4	
G.GCO.11*	G.GCO.5*	G.GCO.10e*	G.GM.1*	G.GSRT.7	G.GGMD.1*	G.GGPE.1*	
G.GGPE.4*	G.GCO.6*	G.GCO.11*	G.GM.2	G.GSRT.8*	G.GGMD.2	G.GM.1*	
G.GGPE.5*	G.GCO.7*	G.GGPE.4*	G.GSRT.1		G.GGMD.3*	G.GM.2	
G.GGPE.6	G.GCO.8c*	G.GGPE.7*	G.GSRT.2*		G.GGMD.4*		
G.GGPE.7*	G.GCO.9a*	G.GM.1*	G.GSRT.3*		G.GM.1*		
G.GM.1*	G.GCO.9b*	G.GM.2	G.GSRT.4a*		G.GM.2		
G.GM.2	G.GCO.9d*	G.GSRT.5*	G.GSRT.4b*				
	G.GCO.11*		G.GSRT.5*				
	G.GM.1*						
	G.GM.2						
	G.GSRT.5*						

South Carolina College- and Career-Ready Standards for Mathematics
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Mathematical Process Standards: The South Carolina College- and Career-Ready (SCCCR) Mathematical Process Standards demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills. As a result, the SCCCR Mathematical Process Standards should be integrated within the SCCCR Content Standards for Mathematics for each grade level and course. Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding.

a. Make sense of problems and persevere in solving them. a. Relate a problem to prior knowledge. b. Recognize there may be multiple entry points to a problem and more than one path to a solution. c. Analyze what is given, what is not given, what is being asked, and what strategies are needed, and make an initial attempt to solve a problem. d. Evaluate the success of an approach to solve a problem and refine it if necessary.	**5. Use a variety of mathematical tools effectively and strategically.** e. Select and use appropriate tools when solving a mathematical problem. f. Use technological tools and other external mathematical resources to explore and deepen understanding of concepts.
2. Reason both contextually and abstractly. a. Make sense of quantities and their relationships in mathematical and real-world situations. b. Describe a given situation using multiple mathematical representations. c. Translate among multiple mathematical representations and compare the meanings each representation conveys about the situation. d. Connect the meaning of mathematical operations to the context of a given situation.	**6. Communicate mathematically and approach mathematical situations with precision.** a. Express numerical answers with the degree of precision appropriate for the context of a situation. b. Represent numbers in an appropriate form according to the context of the situation. c. Use appropriate and precise mathematical language. d. Use appropriate units, scales, and labels.
3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others. i. Construct and justify a solution to a problem. j. Compare and discuss the validity of various reasoning strategies. k. Make conjectures and explore their validity. l. Reflect on and provide thoughtful responses to the reasoning of others.	**7. Identify and utilize structure and patterns.** g. Recognize complex mathematical objects as being composed of more than one simple object. h. Recognize mathematical repetition in order to make generalizations. i. Look for structures to interpret meaning and develop solution strategies.
4. Connect mathematical ideas and real-world situations through modeling. i. Identify relevant quantities and develop a model to describe their relationships. j. Interpret mathematical models in the context of the situation. k. Make assumptions and estimates to simplify complicated situations. l. Evaluate the reasonableness of a model and refine if necessary.	

Geometry Unit 1 Title
Unit 1 – Points, Lines, Planes, Angles, and Proofs

Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
New Academic Vocabulary for This Unit	Subsequent Knowledge Related to this Unit	Resources
	Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- G.GCO.1* Define angle, perpendicular line, parallel line, line segment, ray, circle, and skew in terms of the undefined notions of point, line, and plane. Use geometric figures to represent and describe real-world objects.
- G.GCO.8a* Prove, and apply in mathematical and real-world contexts, theorems about lines and angles, including the following: vertical angles are congruent.
- G.GCO.8b* Prove, and apply in mathematical and real-world contexts, theorems about lines and angles, including the following: when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and consecutive interior angles are supplementary.
    - Establish the Corresponding Angles Postulate first and use this postulate to prove the other theorems.
- G.GCO.8d* Prove, and apply in mathematical and real-world contexts, theorems about lines and angles, including the following: perpendicular lines form four right angles.
- G.GCO.11* Construct geometric figures using a variety of tools, including a compass, a straightedge, dynamic geometry software, and paper folding, and use these constructions to make conjectures about geometric relationships.
- G.GGPE.4* Use coordinates to prove simple geometric theorems algebraically
    - Relate point, line, and plane to Coordinate Geometry.
- G.GGPE.5* Analyze slopes of lines to determine whether lines are parallel, perpendicular, or neither. Write the equation of a line passing through a given point that is parallel or perpendicular to a given line. Solve geometric and real-world problems involving lines and slope.
- G.GGPE.6 Given two points, find the point on the line segment between the two points that divides the segment into a given ratio.
    - To divide a segment into lengths that have a ratio of $\frac{a}{b}$, use the formula $P = (\frac{ax_1+bx_2}{a+b}, \frac{ay_1+by_2}{a+b})$ and relate this formula to the midpoint formula.
- G.GGPE.7* Use the distance and midpoint formulas to determine distance and midpoint in a coordinate plane, as well as areas of triangles and rectangles, when given coordinates.
    - Students should be able to explain how the distance formula relates to the Pythagorean Theorem.
- G.GM.1* Use geometric shapes, their measures, and their properties to describe real-world objects.
    - This standard is used throughout the course. Include shapes, measures, and properties applicable to this unit.
- G.GM.2 Use geometry concepts and methods to model real-world situations and solve problems using a model.
    - This standard is used throughout the course. Include concepts and methods applicable to this unit.

New Academic Vocabulary for This Unit
• Alternate exterior angles • Alternate interior angles • Conjecture • Consecutive interior angles • Construction • Postulate • Proof • Skew • Theorem • Transversal • Vertical angles

Prior Knowledge Required for this Unit
In earlier grades/courses, students have developed conceptual knowledge and have had the opportunity to learn how to: • Students should know basic geometric terminology from elementary and middle school, such as point, line, plane, ray, segment, angle, supplementary angles, complementary angles, parallel lines, and perpendicular lines. • Students should know how to plot points on a coordinate plane (5.G.1). • Students should know how to write linear equations given two points or given a point and the slope (8.F.4c). • Students should know how to measure accurately using a ruler and a protractor (4.MDA.5). • Students should have general application knowledge of parallel lines and transversal (8.GM.5c).

Subsequent Knowledge Related to this Unit
• Foundational definitions will be extended and applied in subsequent units; for example, angle bisector and perpendicular bisectors will be utilized in incenter and circumcenter of triangles (Geometry Unit 2: Triangles). • Students will use the relationships involving lines and angles that are established in this unit when they explore relationships and prove theorems that involve triangles, quadrilaterals, and other polygons in future units. • Constructions and coordinate geometry are introduced here and are meant to be applied throughout the course in order for students to make critical connections among geometric relationships synthetically (without coordinates) and analytically (with coordinates). • Students will construct logical arguments and formal proofs of geometric relationships throughout the course as they develop their deductive reasoning skills and understanding of more sophisticated theorems based on the simpler axioms introduced in Geometry Unit 1.

Relationship Among Standards in this Unit
This unit includes all of the standards that involve the most basic geometric shapes. The standards focus on analyzing geometric relationships both with and without coordinates that will carry through the rest of the course.

Potential Instructional Strategies/Lessons
The order of the topics below illustrates a possible instructional order for Unit 1.

Logic, Reasoning, and Proof (G.GCO.8*; G.GM.1*; G.GM.2)

a. Euclidean Foundation
   Khan Academy: Euclidean Geometry Beginnings
   Math Open Reference: Euclid
b. Venn Diagram Reasoning
   NCTM Illuminations: Venn Diagrams and Logic
   Virtual Nerd: Venn Diagrams
c. Reasoning and Proof
   Dictionary.Reference.Com: Syllogism
   Khan Academy: Deductive Reasoning
   Khan Academy: Proof by Contradiction (see problems 4 and 6)
   Math Goodies: Conditional Statement and Truth Tables
   Math Goodies: Extension: Conditional Statement
   MathBitsNotebook: Indirect Proof (Proof by Contradiction) and More Proof By Contradiction
   MathBitsNotebook: Types of Direct Proofs
   Virtual Nerd: Conditional Statement and Converse, Inverse, and Contrapositive
   Virtual Nerd: Inductive Reasoning
   Virtual Nerd: Law of Detachment

Undefined Terms and Foundational Geometry Properties (G.GCO.1*; G.GCO.8*; G.GM.1*; G.GM.2)

a. Point, Line, Plane (Undefined Terms), and Collinear/Coplanar
   Cliff Notes Math: Point, Line, Plane, and Collinear And Coplanar
   Grade A Math Help: Undefined Terms and Key Concepts
   Khan Academy: Drawing with 3D Plane Diagrams
   Math Open Reference: Introduction to Plane Geometry
   Math Open Reference: Point, Line, Collinear, and Coplanar applets
   Math Open Reference: Point, Line, Plane, Collinear, and Coplanar
   MathBitsNotebook: Point, Line, Plane, and Collinear And Coplanar
   Virtual Nerd: Point and Plane

b. Definitions: Segments, Midpoints, Rays, Angles, Angle Bisector, and Perpendicular Bisector
Cliffs Notes Math: Midpoints and Rays (Including Ruler Postulate and Segment Addition) and Angles (Including Adjacent and Angle Addition)
Grade A Math Help: Segments, Rays, and Angles
Khan Academy: Lines, Segments, Rays and Angles
Math Open Reference: Segment, Midpoint, Segment Bisector, Intersecting Lines, Ray, Opposite Rays, Angles, Angle Interior, and Angle Bisector
MathBitsNotebook: Explanations of Definition Concept
MathBitsNotebook: Segment, Midpoint, Intersecting Lines, Segment Bisector, Ray, Opposite Rays, Angle , Angle Interior, and Angle Bisector applets
Virtual Nerd: Segment, Ray, Angle, and Perpendicular Bisector

c. Symbols: Points, Lines, Segments, Rays, and Angles
Khan Academy: Basic Language and Symbols
MathBitsnotebook: Key Symbols

d. Foundational Postulates
Cliff Notes Math: Postulates
EngageNY: Review of Geometry Assumptions
EngageNY: Review of Geometry Assumptions

EngageNY Review of Geometry Assumptior

EngageNY: Review of Geometry Assumptions KEY

EngageNY Review of Geometry Assumptior

MathBitsNotebook: Postulates and Auxiliary Lines

e. Measuring Segments And Angles
Grade A Math Help: Measuring Angles
Khan Academy: Measuring Angles
MathBitsNotebook: Angle Measures and Classifications

MathBitsNotebook: Notation of Measurements and Congruence
MathBitsNotebook: Notes Include Segment Length and Ruler Postulate
Math Open Reference: Congruence, Congruent Segments, and Congruent Angles
Math Open Reference: Congruent Segments and Congruent Angles applets
Virtual Nerd: What Does Congruence Mean?
Virtual Nerd: What Does Degree Represent? and Acute, Right, Obtuse And Right Angles

Segment Relationships (G.GCO.8*; G.GM.1*; G.GM.2)

a. Segment Addition Postulate
   Cliffs Notes Math: Notes in Ruler and Segment Addition Postulates
   Khan Academy: Segment Addition Postulate Example
   MathBitsNotebook: Notes Include Segment Addition Postulate and Segment Bisector
b. Segment Bisector
   Khan Academy: Midpoint Example
   Math Open Reference: Midpoint, Segment Bisector, and Perpendicular Bisector
   Math Open Reference: Midpoint, Segment Bisector, and Perpendicular Bisector applets
   MathBitsNotebook: Practice With Segment Lengths (Including Segment Addition And Midpoint)

Angle Relationships (G.GCO.8*; G.GCO.8a*; G.GCO.8d*; G.GM.1*; G.GM.2)

a. Right Angle and Perpendicular Lines
   Cliffs Notes Math: Intersecting, Parallel, and Perpendicular Lines
   Math Open Reference: Perpendicular Lines and Right Angles
   Math Open Reference: Perpendicular Lines and Right Angles Applet
   Mathbitsnotebook: Perpendicular Lines and Related Theorems
   Mathbitsnotebook: Practice with Right Angles
   Virtual Nerd: Parallel and Perpendicular Lines Application
   Virtual Nerd: Perpendicular Lines Have Four Right Angles – Explanation
b. Complementary and Supplementary Angles
   Cliffs Notes Math: Notes Include Complementary and Supplementary Angles
   Math Open Reference: Complementary and Supplementary Angles
   Math Open Reference: Complementary and Supplementary Angles applets
   MathBitsNotebook: Notes Include Complementary and Supplementary Angles
   Virtual Nerd: Complementary Angles and Supplementary Angles
c. Adjacent Angles and Angle Addition Postulate
   Cliffs Notes Math: Notes Include Angle Addition and Angle Bisector
   Khan Academy: Angle Addition Postulate Example
   Math Open Reference: Adjacent Angles
   Virtual Nerd: Angle Addition Postulate Example

e. Angle Bisector
Math Open Reference: Angle Bisector applet

d. Linear Pairs with Linear Pair Postulate and Vertical Angles With Vertical Angle Theorem
Cliffs Notes Math - Notes Include Vertical Angles
Khan Academy: Linear Pair And Vertical Angles
Math Open Reference: Linear Pair and Vertical Angles
Math Open Reference: Linear Pair and Vertical Angles applets
MathBitsNotebook - Pair Types Of Angles (Including Linear Pair) and Vertical Angles
MathBitsNotebook: Practice With Angle Measures
Virtual Nerd: Vertical Angles

e. Proofs with Segments and Angles (G.GCO.8*)
EngageNY: Angle Proof Applications
MathBitsNotebook: Proofs With Segments and Angles

Parallel Lines and Transversals (G.GCO.8*; G.GCO.8a*; G.GM.1*; G.GM.2)

a. Parallel Concepts
MathBitsNotebook: Parallel Postulate (Euclid's 5th Postulate) and Parallel, Perpendicular and Transversal Lines
Virtual Nerd: Parallel Lines and Skew Lines

b. Corresponding Angles Postulate
Grade A Math Help: Parallel Lines and Transversal Notes
Math Open Reference: Corresponding Angles (Two Parallel Lines and a Transversal)
Math Open Reference: Corresponding Angles (Two Parallel Lines and a Transversal) applet
Virtual Nerd: Corresponding Angle Postulate and Converse of Corresponding Angle Postulate

c. Parallel Lines and Transversal Theorems
Angle Proof With Parallel Lines And Transversal Applications


Angle Proof With Parallel Lines And Tra

Angle Proof With Parallel Lines And Transversal Applications KEY


Angle Proof With Parallel Lines And Tra

EngageNY: Angle Proof With Parallel Lines and Transversal Applications
EngageNY: Review Of Corresponding Angles With Parallel Lines and Transversal
Khan Academy: Parallel Lines and Transversal Explanations and Unique Parallel and Perpendicular Lines Example
MathBitsNotebook: Angle Pair With Two Parallel Lines and Transversal Identifying Angle Pairs and Notes
Review of Corresponding Angles With Parallel Lines and Transversal


Review of Corresponding Angles

Review of Corresponding Angles With Parallel Lines and Transversal KEY


Review of Corresponding Angles

Virtual Nerd: Finding Angle Measure Within Parallel Lines and Transversal Example

Coordinate Plane Geometry (G.GGPE.4*; G.GGPE.5*; G.GGPE.6; G.GGPE.7*)

a. Point-Line-Plane Coordinate Geometry
   Cliffs Notes Math: General Coordinate Information
   Math Open Reference: Coordinate Plane
   Math Open Reference: Coordinate Plane applet
   Math Open Reference: Introduction Coordinate Plane
   Math Open Reference: Points On Coordinate Plane
   Math Open Reference: Points On Coordinate Plane applet
   Virtual Nerd: Endpoints Of A Segment On Coordinate Plane
b. Midpoint, Slope and Distance Formulas
   Cliffs Notes Math: Midpoint With Equal Distance Shown and Distance Formula
   EngageNY: Using Distance Formula to Find Perimeter And Area


EngageNY Using Distance Formula to F

EngageNY: Using Distance Formula to Find Perimeter And Area (extension in Unit 1; see again in Unit 6)
EngageNY: Using Distance Formula to Find Perimeter And Area KEY


EngageNY Using Distance Formula to F

Khan Academy: Midpoint and Distance formulas examples
Math Open Reference: Midpoint and Distance Formula
Math Open Reference: Midpoint and Distance formulas applets
Virtual Nerd: Midpoint Explanation, Midpoint Example, Distance Formula Explanation, and Distance Formula Example

c. Divide a Segment into Lengths that have a Ratio of $\frac{a}{b}$

Khan Academy: Ratio of Distances on a Segment, and Find Point with Given Ratio Lengths

d. Parallel and Perpendicular Lines

Cliffs Notes Math: Slope and Slope of Line review; Parallel and Perpendicular Segments
EngageNY: Parallel And Perpendicular Lines – PDF will be attached in August, 2015
EngageNY: Parallel And Perpendicular Lines KEY – PDF will be attached in August, 2015
EngageNY: Parallel And Perpendicular Lines Varied Applications
Khan Academy: Introduction To Parallel And Perpendicular Lines, and Verifying Two Lines Are Parallel, Perpendicular, Or Neither
Math Open Reference: Point-Slope Form applet
Math Open Reference: Point-Slope Form review
Virtual Nerd: Point-Slope Form review, and Writing Equations Of Lines Parallel or Perpendicular

Constructions (G.GCO.11*; G.GM.1*; G.GM.2)

MathBitsNotebook: Basic Construction Information
Math Open Reference: Euclid And Constructions

a. Segment Congruence

EngageNY: Equilateral Triangle Construction
EngageNY: Equilateral Triangle Construction


EngageNY Equilateral Triangle Construction

EngageNY: Equilateral Triangle Construction KEY


EngageNY Equilateral Triangle Construction

Math Open Reference: Constructing A Segment Into Congruent Parts extension
Math Open Reference: Constructing Congruent Segments and extension: Construct Equilateral Triangle
Math Open Reference: Constructing Congruent Segments applet
Math Open Reference: Constructing Congruent Triangles (SSS Congruence)
Math Open Reference: Constructing Congruent Triangles applet
Math Open Reference: Construction A Segment Into Congruent Parts applet
MathBitsNotebook: Constructing Congruent Segments (Plus Congruent Angles) and Constructing Equilateral Triangle

b. Segment Bisector and Perpendicular Lines

EngageNY: Segment Bisector Construction
EngageNY: Segment Bisector Construction


EngageNY Segment Bisector Construction

EngageNY: Segment Bisector Construction Key


EngageNY Segment Bisector Construction

Math Open Reference: Construct Segment Bisector; Constructing A Line Perpendicular To Another Line (Point On) and (Point Off) applet
Math Open Reference: Constructing a 90-Degree Angle applet
Math Open Reference: Constructing a 90-Degree Angle Extension
Math Open Reference: Constructing Segment Bisector; Constructing A Line Perpendicular To Another Line (Point On) and (Point Off)

MathBitsNotebook: Constructing Segment Bisector (Plus Angle Bisector) and Constructing Perpendicular Lines
Virtual Nerd: Perpendicular Bisector

c. Angle Congruence and Line Parallel to Another (Corresponding Angle-Transversal Method)
MathBitsNotebook: Constructing Congruent Angles (Plus Previous Congruent Segments) And Construction Similar Triangles
Math Open Reference: Constructing Congruent Angles and Constructing A Line Parallel To Another Line (Congruent Angle Method)
Math Open Reference: Constructing Congruent Angles and Constructing A Line A Parallel To Another Line (Corresponding Angle-Transversal Method) applet
Math Open Reference: Angle Addition (Using Congruent Angles) extension
Math Open Reference: Angle Addition (Using Congruent Angles) applet extension

d. Angle Bisector
MathBitsNotebook: Constructing Angle Bisector (Plus Previous Segment Bisector)
Math Open Reference: Constructing An Angle Bisector
Math Open Reference: Constructing An Angle Bisector applet
EngageNY: Angle Constructions
EngageNY: Angle Constructions


EngageNY Angle Constructions.pdf

EngageNY: Angle Constructions KEY


EngageNY Angle Constructions KEY.pd

Math Open Reference: Constructing A 30-Degree Angle and Constructing A 45-Degree Angle extensions
Math Open Reference: Constructing A 30-Degree Angle and Constructing A 45-Degree Angle extensions

Resources
• Cliff Notes Math: Geometry • Emergent Math: Emergent Math • EngageNY: Geometry • Grade A Math Help: Geometry • Grade A Math Help: Geometry Resources • Illuminations: Grades 9 - 12 Resources • Khan Academy: Geometry • Math Education Page: Geometry Book of Labs  Math Education Page Geometry Book of Lab • Math Education Page: Sum of the Angles in a Triangle • Math Goodies: Math Goodies • Math Open Reference: Geometry Resources • MathBitsNotebook: Geometry Online Study Resources • Patty Paper – *Patty Paper Geometry* by Michael Serra; resource of activities and discovery lessons utilizing (patty paper can be purchased, or possibly donated from your local butcher or grocer's meat department) • Virtual Nerd: Geometry Skills Videos

Sample Formative Assessment Tasks/Questions
Undefined Terms and other foundational properties (G.GCO.1*; G.GCO.8*; G.GM.1*; G.GM.2) Grade A Math Help – Unit 1 Material Resources Grade A Math Help – Unit 1 Material Resou Khan Academy: Point, Line, Plane, and Other Terms Point - Line - Plane (Undefined Terms)
Parallel Lines and Transversals (G.GCO.8*; G.GCO.8a*; G.GM.1*; G.GM.2) Grade A Math Help – *look for parallel lines and transversal examples and proofs within worksheets* Grade A Math Help.pdf Illustrative Mathematics: Find the Missing Angle Find the Missing Angle.docx Find the Missing Angle.pdf Special Angle Pairs – *possible exit slip* Special Angle Pairs.docx Special Angle Pairs.pdf Special Angles Investigation Special Angles Investigation.docx Special Angles Investigation.pdf
Axiom System Review EngageNY: Review of Assumptions EngageNY: Review of Assumptions


EngageNY Review of Assumptions.pdf

EngageNY: Review of Assumptions KEY


EngageNY Review of Assumptions KEY.pdf

Inside Mathematics: Performance Assessment Tasks

South Carolina College- and Career-Ready Standards for Mathematics
High School Support Document
Geometry Unit 2: Triangles

Return to High School Overview or High School Table of Contents.

Geometry Unit 2 Title
Triangles

Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
New Academic Vocabulary for This Unit	Subsequent Knowledge Related to this Unit	Resources
	Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- G.GCI.3 Construct the inscribed and circumscribed circles of a triangle using a variety of tools, including a compass, a straightedge, and dynamic geometry software, and prove properties of angles for a quadrilateral inscribed in a circle.
- G.GCO.2* Represent translations, reflections, rotations, and dilations of objects in the plane by using paper folding, sketches, coordinates, function notation, and dynamic geometry software, and use various representations to help understand the effects of simple transformations and their compositions.
    - Omit dilations which will be used in Unit 4 Similarity.
- G.GCO.3* Describe rotations and reflections that carry a regular polygon onto itself and identify types of symmetry of polygons, including line, point, rotational, and self-congruence, and use symmetry to analyze mathematical situations.
- G.GCO.4* Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
    - Now that formal axiom process has been established in Unit 1, these basic transformation can be re-investigated under necessary descriptions. For example, in a reflection, a line segment that joins a point to its image is perpendicular to the line of reflection and the line of reflection will pass through the midpoint of the segment joining the point to its image. OR the line of reflection is the perpendicular-bisector of the segment connect each pre-image to image points.
- G.GCO.5* Predict and describe the results of transformations on a given figure using geometric terminology from the definitions of the transformations, and describe a sequence of transformations that maps a figure onto its image.
- G.GCO.6* Demonstrate that triangles and quadrilaterals are congruent by identifying a combination of translations, rotations, and reflections G.GCI.3 - Construct the inscribed and circumscribed circles of a triangle using a variety of tools, including a compass, a straightedge, and dynamic geometry software, and prove properties of angles for a quadrilateral inscribed in a circle. in various representations that move one figure onto the other.
- G.GCO.7* Prove two triangles are congruent by applying the Side-Angle-Side, Angle-Side-Angle, Angle-Angle-Side, and Hypotenuse-Leg congruence conditions.
    - Include the Side-Side-Side congruence condition.
- G.GSRT.5* Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
    - Congruence criteria only in this unit. Similarity criteria will be used in Unit 4 Similarity.
- G.GCO.8* Prove, and apply in mathematical and real-world contexts, theorems about lines and angles.

  - This overarching standard is used to verify many essential properties, such as Angle-Bisector Theorem - any point that in the interior of an angle that is equidistant from the sides of the angle must be on the angle's bisector.
- G.GCO.8c* Prove, and apply in mathematical and real-world contexts, theorems about lines and angles, including the following: any point on a perpendicular bisector of a line segment is equidistant from the endpoints of the segment.
- G.GCO.9 Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles.
  - This overarching standard is applied throughout the Geometry course as the axiom system continuous to validate itself with prior knowledge. For example, verifying that an exterior angle of a triangle is equal to the sum of its non-adjacent (remote) interior angles.
- G.GCO.9a* Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles, including the following: measures of interior angles of a triangle sum to 180°.
- G.GCO.9b* Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles, including the following: base angles of isosceles triangles are congruent.
- G.GCO.9c* Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles, including the following: the segment joining midpoints of two side of a triangle is parallel to the third side and half the length.
  - Prove and use the Midsegment Theorem of a triangle
- G.GCO.9d* Prove, and apply in mathematical and real-world contexts, theorems about the relationships within and among triangles, including the following: the medians of a triangle meet at a point.
  - Include the perpendicular bisectors of a triangle meet at a point.
- G.GCO.11* Construct geometric figures using a variety of tools, including a compass, a straightedge, dynamic geometry software, and paper folding, and use these constructions to make conjectures about geometric relationships.
  - Omit proving properties of angles for a quadrilateral inscribed in a circle, as this will be explored in Unit 7 Circles.
- G.GM.1* Use geometric shapes, their measures, and their properties to describe real-world objects.
  - This standard is used throughout the course. Include shapes, measures, and properties applicable to this unit.
- G.GM.2 Use geometry concepts and methods to model real-world situations and solve problems using a model.
  - This standard is used throughout the course. Include concepts and methods applicable to this unit.
- G.GSRT.5* Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometry figures.
  - Much of the Geometry course depends on triangle congruence to verify later properties, such as seen in G.GCO.9b* with the Isosceles Triangle Base Angle Theorem, and also in application to verify other congruences such as applied with corresponding parts of congruent triangles are congruent.

New Academic Vocabulary for This Unit
• Bisect, Bisector • Circumscribe • Concurrent • Congruent • Inscribe • Median of a Triangle

Prior Knowledge Required for this Unit
In earlier grades/courses/units, students have developed conceptual knowledge and have had the opportunity to learn how to: • Students should be able to classify triangles (7.GM.2). • Students should know and be able to apply relationships of alternate interior angles between parallel lines from previous unit, and build upon their Grade 8 experience with triangle sum and angle relationships (8.GM.5a; 8.GM.5b; G.GCO.8b*). • Students should know that translations, rotations, and reflections are rigid transformations that preserve length and angle measures, and understand how it relates to congruency (8.GM.1b, c, and d).

Subsequent Knowledge Related to this Unit
• Students will use properties of triangles and congruence of triangles to prove other geometric relationships later in the course; for example, the diagonals of rectangle ABCD can be proven congruent by showing that $\Delta ACD \cong \Delta BDC$. • Transformations are applicable to algebraic concepts of function families and their graphs that students encounter in Algebra 2 and Pre-Calculus courses.

Relationship Among Standards in this Unit
In this unit, students will explore the common characteristics of all triangles, discover ways to prove that two triangles are congruent, and then use these congruence relationships to prove properties of isosceles and equilateral triangles.

Potential Instructional Strategies/Lessons

The order of the topics below illustrates a possible instructional order for Unit 2.

Triangle Angle Sum and Exterior Angle Theorems (G.GCO.9; G.GCO.9a*)

Cliffs Notes Math: Exterior Angle Theorem

EngageNY: Interior And Exterior Angles Of A Triangle

EngageNY: Interior And Exterior Angles Of A Triangle

EngageNY Interior And Exterior Angles C

EngageNY: Interior And Exterior Angles Of A Triangle KEY

EngageNY Interior And Exterior Angles C

Extension: Geometry Book of Labs - Section 1 - Complete Lab 1.4 To Review Triangle Sum As The Base Of Polygon Angle Sum

Geometry Book of Labs Section 1.pdf

Geometry Book of Labs: Section 1; Complete Lab 1.5 Angles in a Triangle to Explore Classification and Interior Angles

Geometry Book of Labs Section 1.pdf

Geometry Book of Labs: Section 1; Complete Lab 1.6 Exterior Angle Theorem

Geometry Book of Labs Section 1.pdf

Khan Academy: Triangle Angle Sum Theorem Verification with Examples 1, 2, 3, and Challenging 4

Math Education Page: Triangle Sum Theorem applet

MathBitsNotebook: Exterior Angle Theorem with Verification-Proof

MathBitsNotebook: Triangle Angle Sum Theorem with Many Varied Verification-Proofs
Triangle Sum Theorem: Discovery Activity


Triangle Sum Theorem Discovery A


Triangle Sum Theorem Discovery A

Virtual Nerd: Triangle Angle Sum Theorem and Extension with Equilateral Triangle Angles Are 60-Degrees Each

Congruency and Triangle Congruence (G.GCO.7*)

a. Congruence Concept
Cliffs Notes Math: Triangle Congruence Summary Of Notes
Math Open Reference - Congruence Concept, SSS Postulate, SAS Postulate, ASA Postulate, AAS Theorem, and HL Theorem
Math Open Reference: Congruence Concept, SSS Postulate, SAS Postulate, ASA Postulate, AAS Theorem, and HL Theorem applets
Math Open Reference: Why These Concepts Do Not Work For Congruence? SSA (ASS) attempt and AAA attempt
Math Open Reference: Why These Concepts Do Not Work For Congruence? SSA (ASS) attempt and AAA attempt applet
MathBitsNotebook: Concept of Congruence, and Triangle Congruence Properties

b. Congruence Theorems, Applications, and Proof
NOTE: Review EngageNY rigid motions (attached in Transformations and Congruence section) for possible SAS, ASA, SSS, AAS, and HL introduction.
EngageNY: Triangle Congruence Proofs-1 and Triangle Congruence Proofs-2
EngageNY: Triangle Congruence Proofs-1 and Triangle Congruence Proofs-2 – PDFs will be attached in August, 2015
EngageNY: Triangle Congruence Proofs-1 KEY and Triangle Congruence Proofs-2 KEY – PDFs will be attached in August, 2015
Mathematics Assessment Project – Mathematics Assessment Resource Service: Evaluating Conditions for Congruency


MARS Evaluating Conditions for Congru

Khan Academy: Discussion Video on More On SSA Failure with Establishment Of Special Exception Of Hypotenuse-Leg
Khan Academy: Discussion Videos on SSS Postulate and SAS And ASA Postulates (Includes AAA And SSA Congruence Failures)
Khan Academy: Manipulating AAA Triangles And Demonstrating Failed Congruency applet
Khan Academy: Outline of a Specific Two-Column Proof (Note: "Reasons" Within Reason Column Are Not Typical Geometry Language)
MathBitsNotebook: Triangle Congruence Proofs Structuring (Includes Rigid Motions), and Analyzing Strategies For Congruence Proofs

MathBitsNotebook: Two Column Proof Problems, Proof Steps, and Applying CPCTC To Produce Another Pair Of Congruency
Mathematics Assessment Project – Mathematics Assessment Resource Service: Evaluating Conditions for Congruency
Teaching Proofs:


Teaching Proofs.pdf

Isosceles Triangle Base Angles Theorem (G.GCO.9b*; G.GSRT.5*)

EngageNY: Rigid Motion Of Isosceles Triangle Base Angles Theorem
EngageNY: Rigid Motion Of Isosceles Triangle Base Angles Theorem


EngageNY Rigid Motion Of Isosceles T

EngageNY: Rigid Motion Of Isosceles Triangle Base Angles Theorem KEY


EngageNY Rigid Motion Of Isosceles T

MathBitsNotebook: If Two Sides Of A Triangle Are Congruent, Then The Angle Opposite (Base Angles) Are Congruent

Transformation and Congruence (G.GCO.2*; G.GCO.4*; G.GCO.5*; G.GCO.6*)

a. Translations, Reflections, Rotations, and Combinations
   Mathematics Assessment Project – Mathematics Assessment Resource Service: Transformations review
   Transformations – PDF will be attached in August, 2015
b. Congruency Within Transformations
   Math Education Page: Rigid Motions; Translations, Reflections, and Rotations applets
   Math Education Page: Translation
   Math Open Reference: Modeled Demonstration Of Preserved Congruence With All Combinations Of Rigid Motions applet
   MathBitsNotebook: Rigid Motions (Transformations) And Congruence and Triangle Congruence Proofs Structuring Including Rigid Motions
c. Congruence and Similarity
   – PDF will be attached in August, 2015
   EngageNY: Rigid Motion For SAS Postulate (*can be used to introduce SAS postulate*)

EngageNY: Rigid Motion For SAS Postulate

EngageNY Rigid Motion For SAS Postu

EngageNY: Rigid Motion For SAS Postulate KEY

EngageNY Rigid Motion For SAS Postu

EngageNY: Rigid Motion For ASA And SSS Postulates (*can be used to introduce ASA and SSS postulates*)

EngageNY: Rigid Motion For ASA And SSS Postulates

EngageNY Rigid Motion For ASA And S

EngageNY: Rigid Motion For ASA And SSS Postulates Key

EngageNY Rigid Motion For ASA And S

EngageNY: Rigid Motion For AAS And HL Theorems (*can be used to introduce AAS and HL Theorems*)

EngageNY: Rigid Motion For AAS And HL Theorems

EngageNY Rigid Motion For AAS And H

EngageNY: Rigid Motion For AAS And HL Theorems KEY

EngageNY Rigid Motion For AAS And H

Points of Concurrency and Triangle Midsegment (G.GCI.3; G.GCO.8*; G.GCO.8c*; G.GCO.9*; G.GCO.9c*; G.GCO.9d*; G.GSRT.5*)

a. Angle Bisector and Perpendicular Bisector Theorems

Khan Academy: Video Discussion on A Point On An Angle Bisector Is Equidistant From The Sides And Proof Or Theorem
Math Open Reference: Equidistant Points (Models Perpendicular Bisector Theorem)
Math Open Reference: Equidistant Points applet
Virtual Nerd: Perpendicular Bisector Theorem application

b. Incenter, Circumcenter, Orthocenter, and Centroid
Cliffs Notes Math: Altitude, Median, And Angle Bisectors Within A Triangle
Khan Academy: Lesson Videos of Incenter and Circumcenter
Math Open Reference: Angle Bisectors - Incenter, Incenter Circle , Perpendicular Bisectors - Circumcenter, and Circumcenter Circle applets
Math Open Reference: Angle Bisectors - Incenter, Incenter Circle, Perpendicular Bisectors - Circumcenter, and Circumcenter Circle
Math Open Reference: Incenter On Coordinate Plane; applet: Incenter On Coordinate Plane
Math Open Reference: Orthocenter and Centroid
Math Open Reference: Orthocenter and Centroid applets
MathBitsNotebook: Median-Centroid, Altitude-Orthocenter, Angle Bisector-Incenter, And Perpendicular Bisector-Circumcenter Notes
Virtual Nerd: Incenter, Circumcenter, and Median-Centroid

c. Median-Centroid Applications
Virtual Nerd: Application of Median-Centroid

d. Midsegment and Midsegment of a Triangle Theorem
EngageNY: Midsegment of a Triangle and Extensions

EngageNY: Midsegment of a Triangle and Extensions KEY

EngageNY: Midsegments Of A Triangle And Extensions
Math Open Reference: Midsegment Is Half The Length Of The Parallel Side
Math Open Reference: Midsegment Is Half The Length Of The Parallel Side applet
MathBitsNotebook: Midsegment Theorem And Different Proofs

Virtual Nerd: Triangle Midsegment Theorem Explained On Coordinate Plane

Constructions of Incenter and Circumcenter (G.GCI.3)

EngageNY: Construct a Square and a Nine-Point Circle

EngageNY Construct a Square and a Nine-

EngageNY: Construct a Square and a Nine-Point Circle KEY

EngageNY Construct a Square and a Nine-

EngageNY: Construct a Square and Nine-Point Circle
EngageNY: Constructions of Points of Concurrencies and Related Theorems
EngageNY: Points of Concurrencies

EngageNY Points of Concurrencies.pdf

EngageNY: Points of Concurrencies KEY

EngageNY Points of Concurrencies KEY.pc

Math Open Reference: Constructions of Incenter and Circumcenter
Math Open Reference: Constructions of Incenter and Circumcenter applets
Math Open Reference: Constructions of Orthocenter and Centroid
Math Open Reference: Constructions of Orthocenter and Centroid applets

Constructions of with Triangle Congruence (G.GCO.11*)

Geometry Book of Labs: Section 6; Complete Lab 6.1 Constructing Non-Congruent Triangles


Geometry Book of Labs Section 6.pdf

Math Open Reference: Constructing Congruent Triangles using SSS
Math Open Reference: Constructing Congruent Triangles using SSS applet

Resources
• Cliff Notes Math: Geometry • Emergent Math: Emergent Math • EngageNY: Geometry • Grade A Math Help: Geometry • Grade A Math Help: Geometry Resources • Illuminations: Grades 9 - 12 Resources • Khan Academy: Geometry • Math Education Page: Geometry Book of Labs  Geometry Book of Labs Activities.pdf • Math Education Page: Sum of the Angles in a Triangle • Math Goodies: Math Goodies • Math Open Reference: Geometry Resources • MathBitsNotebook: Geometry Online Study Resources • Mathematics Assessment Project: Mathematics Assessment Resource Service • Virtual Nerd: Geometry Skills Videos

Sample Formative Assessment Tasks/Questions
Triangle Angle Sum and Exterior Angles of a Triangle (G.GCO.9*; G.GCO.9a*)
Grade A Math Help – PDF will be attached in August, 2015; *look for triangle sum examples within worksheets*
Congruency and Triangle Congruence (G.GCO.7*)
Grade A Math Help – PDF will be attached in August, 2015; *look for triangle congruence proofs within the worksheets*
MathBitsNotebook: Varied Congruence Questions and Full Two-Column Proofs
Constructions of with Triangle Congruence (G.GCO.11*)
MathBitsNotebook: Rigid Motion Triangle Congruence
Math Education Page: Determining Type of Transformations Examples 1, 2, 3, and 4; applets
Proofs using segments and angles within a triangle - not congruence proofs (G.GCO.8*, G.GCO.9*, G.GCO.9c*)
MathBitsNotebook: Proofs Using Segments And Angles Within A Triangle (Not Congruence Proofs)
Points of Concurrency and Triangle Midsegment (G.GCI.3; G.GCO.9*)
MathBitsNotebook: Segments within a Triangle and Triangle Midsegment practice
Inside Mathematics: Performance Assessment Tasks

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