

Algebra 1

Community

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Progress

Purpose

DESCRIPTION OF COURSE

This course continues student investigations of functions and algebra that began when students in Kindergarten began to explore algebraic concepts using informal representations). In this Algebra I course students will continue their investigations by progressing to more abstract representations such as linear and nonlinear functions, algebraic expressions, and equality. Students will find that a central theme of this course is the study of patterns which in turn leads to an understanding of relations and functions. Students will recognize, describe, and generalize patterns and build mathematical models to describe, interpret, and predict the behavior of real-world phenomenon.

MAJOR CONCEPTS

- Expressions, Equations and Functions
- Properties of real numbers
- Solving Linear Equations
- Graphing Linear Equations and Functions
- Writing Linear Equations
- Solving and Graphing Linear Inequalities
- Systems of Equations and Inequalities
- Exponents and exponential functions
- Polynomials and Factoring
- Quadratic Functions and Modeling
- Probability and Data Analysis

DISCIPLINE COURSE COMPETENCIES

Mathematical Process

Mathematical Modeling

Mathematical Communication

Mathematical Application

COURSE CONTENT LEARNING TARGETS

- Students will be able to evaluate expressions, apply order of operations, write expressions, equations and inequalities and represent functions as rules, tables and graphs
- Students will be able to add, subtract, multiply and divide real numbers and apply the distributive property
- Students will be able to solve one, two and multi-step equations, as well as equations with variables on both sides.
- Students will be able to write and solve proportion and percent problems
- Students will be able to graph linear equations using tables, intercepts and slope-intercept form.
- Students will be able to find the slope of a line and model direct variation
- Students will be able to write linear equations in slope- intercept form, point=slope form and standard form
- Students will be able to write equations of parallel and perpendicular lines
- Students will be able to solve and graph multi-step, compound and absolute value inequalities and inequalities in two variables
- Students will be able to solve linear equations by graphing, substitution and/or elimination.

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- Students will be able to solve systems of inequalities
- Students will be able to apply exponent properties
- Students will be able to write and graph exponential growth and decay functions
- Students will be able to add, subtract and multiply polynomials
- Students will be able to factor and solve polynomials in $x^2 + bx + c$ and $ax^2 + bx + c$ forms
- Students will be able to graph basic quadratic equations using tables
- Students will be able to find probabilities and odds, use permutations, use combinations and find probabilities of compound events
- Students will be able to use measures of central tendency and interpret stem-and-leaf and box –and- whisker plots

COMMON CORE STANDARDS:

- Students will use the properties of rational numbers to show that $x^{1/n}$ means the n th root of x and I will be able to use the properties of exponents to rewrite expressions involving radicals and rational exponents N.RN.1, N.RN.2
- Students will be able to explain why the sum or product of rational numbers is rational, and that the sum or product of a rational and irrational number is irrational N.RN.3
- Students will be able to choose and interpret units to understand the solution of multi-step problems, formulas, and to interpret graphs and displays and I will be able to define appropriate quantities for descriptive modeling as well as choose an appropriate level of accuracy on measurement when reporting quantities N.Q.1, N.Q.2, N.Q.3
- Students will be able to interpret parts of an expression, and interpret complicated expressions by viewing one or more of their parts as a single entity and I will be able to use the structure of an expression to identify ways to rewrite it A.SSE.1a, A.SSE.2
- Students will be able to factor a quadratic expression to reveal the zeroes of the function, complete the square in a quadratic expression to reveal the max or min, and use properties of exponents to transform expressions for exponential functions A.SSE.3a, A.SSE.3b, A.SSE.3c
- Students will be able to add, subtract and multiply polynomials A.APR.1
- Students will be able to create equations and inequalities in one or more variables, use them to solve problems, and graph equations on the coordinate axes with labels and scales. I will also be able to represent constraints by equations/inequalities and by systems and interpret solutions as viable or non-viable and I will be able to rearrange formulas to highlight a quantity of interest A.CED.1, A.CED.2, A.CED.3, A.CED.4
- Students will be able to explain each step in solving a simple equation and construct a viable argument to justify a solution method A.REI.1
- Students will be able to solve linear or quadratic equations and inequalities in one variable using appropriate methods A.REI.3, A.REI.4a, A.REI.4b
- Students will be able to solve systems of two linear equations in two variables by elimination, substitution, or graphically as well as systems of quadratic equations graphically A.REI.5, A.REI.6, A.REI.7
- Students will be able to understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (or line), and the graph of an inequality in two variables as half a plane, and the graph of the solution set of two inequalities in two variables as the intersection of two half planes. I will also be able to explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect

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are the solutions of the equation $f(x) = g(x)$ for cases of linear equations A.REI.10, A.REI.11, A.REI.12

- Students will be able to show that a function has a domain and a range and for every input there is one and only one output and evaluate these functions in function notation F.1F.1, F.1F.2, F.1F.3
- Students will be able to interpret key features of graphs and tables in terms of the quantities, sketch graphs showing key features given a verbal description of the relationship (intercepts, symmetries, end behavior, increasing, decreasing, etc.), relate the domain of a function to its graph and to the quantitative relationship it describes (time to distance), and calculate and interpret the average rate of change of a function F.1F.4, F.1F.5, F.1F.6
- Students will be able to graph linear, quadratic, square root, cube root, polynomial, and exponential functions and show intercepts, maxima, minima, and explain end behavior. I will be able to use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and use properties of exponents to interpret expressions for exponential functions and classify them as exponential growth or decay. I will also be able to compare properties of two functions each represented in a different way F.1F.7a, F.1F.7b, F.1F.7c, F.1F.8a, F.1F.8b, F.1F.9
- Students will be able to write a function that describes a relationship between two quantities and combine standard function types using arithmetic operations and I will be able to write arithmetic and geometric sequences and use them to model situations as well as translate between the two forms F.BF.1a, F.BF.1b, F.BF.2
- Students will be able to identify the effect on the graph of $f(x)$ by replacing it with $f(x) + k$, $f(kx)$, $k \cdot f(x)$, and $f(x + k)$, find the value of k given the graph by hand as well as with technology. I will also be able to solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse F.BF.3, F.BF.4a,
- Students will be able to prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals, and recognize situations in which one quantity changes at a constant rate per unit interval or when situations grow or decay by a constant percent per unit interval. I will also be able to construct linear and exponential functions given a graph, description, or two input-output pairs, and observe that a quantity increasing exponentially eventually exceeds a quantity increasing any other way F.LE.1a, F.LE.1b, F.LE.1c, F.LE.2, F.LE.3
- Students will be able to interpret the parameters in a linear or exponential function in terms of a context F.LE.5
- Students will be able to represent numbers on the real number line, create a data distribution, and compare two data sets using measures of central tendency. And I will be able to interpret differences in data in terms of shape, spread, standard deviation as well as recognize outliers S.ID.1, S.ID.2, S.ID.3
- Students will be able to set up a probability distribution for a random variable representing payoff values in a game of chance and I will be able to make decisions based on expected values, use expected values to compare long term benefits of several decisions and explain how the decisions were reached +S.MD.6, +S.MD.7

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Competency 1: Mathematical Communication (MC)

The student can use the language of mathematics, either written and/or orally, to express their ideas precisely, coherently and clearly. This competency is assessed in all of the course content learning targets.

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Sample Performance Assessment (SPA #1)	You want to put up a square fence in your back yard for your dog with one of the sides being against your house. - If you have 36 feet of fencing, what would the area of the fenced in yard be? Draw a picture to support your answer. - You want to increase the square area for your dog to 196 square feet. What would be the new dimensions of the enclosure? Explain (in words) how you know that new dimensions. (The portion of this problem being assessed under the mathematical communications competency is the explanation in part b.)		
SPA #1 Rubric			
<u>Proficient with Distinction</u> - Uses sophisticated mathematical terminology or vocabulary in order to construct viable arguments and critique the reasoning of others - Uses relevant mathematical facts to justify conclusions - Uses correct grammar, punctuation and spelling	<u>Proficient</u> - Uses mathematical terminology or vocabulary in order to construct viable arguments and critique the reasoning of others - Uses relevant mathematical facts to justify conclusions - Grammatical, punctuation and spelling errors do not detract from the meaning	<u>Partially Proficient</u> - Can construct viable arguments and critique the reasoning of others, with some evidence of relevant vocabulary - Minimal use of mathematical facts to justify conclusions - Several grammatical, punctuation and/or spelling errors detract from the meaning	<u>Not Proficient</u> - Argument does not support the conclusion or is incomplete - Inaccurate or no mathematical facts used to justify conclusions - Several grammatical, punctuation and/or spelling errors detract from the meaning

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Competency 2: Mathematical Application (MA)			
Students will recognize, explore and develop mathematical connections and transfer those skills and concepts to solve real-world scenarios. This competency is assessed in all of the course content learning targets.			
Sample Performance Assessment (SPA #2)	You want to put up a square fence in your back yard for your dog with one of the sides being against your house. - If you have 36 feet of fencing, what would the area of the fenced in yard be? Draw a picture to support your answer. - You want to increase the square area for your dog to 196 square feet. What would be the new dimensions of the enclosure? Explain (in words) how you know that new dimensions. (The portion of this problem being assessed under the mathematical application competency is determining the new dimensions for the square pen when given a new desired area)		
SPA #2 Rubric			
<u>Proficient with Distinction</u> Accurately and efficiently transfers content knowledge to correctly solve unfamiliar real-world scenarios	<u>Proficient</u> Accurately transfers content knowledge to correctly solve real-world scenarios	<u>Partially Proficient</u> Can transfer content knowledge to correctly solve real-world scenarios, with minimal assistance	<u>Not Proficient</u> Cannot transfer content knowledge to correctly solve real-world scenarios, with minimal assistance

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Competency 3: Mathematical Modeling (MM)			
The student is able to represent a problem using graphs, diagrams, expressions, equations and/or inequalities. This competency is assessed in all of the course content learning targets.			
Sample Performance Assessment (SPA #3)	You want to put up a square fence in your back yard for your dog with one of the sides being against your house. - If you have 36 feet of fencing, what would the area of the fenced in yard be? Draw a picture to support your answer. - You want to increase the square area for your dog to 196 square feet. What would be the new dimensions of the enclosure? Explain (in words) how you found the new dimensions. (The portion of this problem being assessed under the Mathematical Modeling Competency is in part a when asked to draw a picture to support your answer)		
SPA #3 Rubric			
<u>Proficient with Distinction</u> - Correctly represents a real world situation in the form of a picture, diagram, graph, equation, inequality or expression - Uses correct labels with units when appropriate or declares all variables	<u>Proficient</u> - Correctly represents a real world situation in the form of a picture, diagram, graph, equation, inequality or expression - Uses correct labels when appropriate	<u>Partially Proficient</u> Represents a real world situation in the form of a picture, diagram, graph, equation, inequality or expression with minor errors	<u>Not Proficient</u> Represents a real world situation in the form of a picture, diagram, graph, equation, inequality or expression with major errors

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Competency 4: Mathematical Process (MP)			
In order to solve a problem, the student is able to follow a logical mathematical sequence, concluding with the correct answer. This competency is assessed in all of the course content learning targets.			
Sample Performance Assessment (SPA #4)	You want to put up a square fence in your back yard for your dog with one of the sides being against your house. - If you have 36 feet of fencing, what would the area of the fenced in yard be? Draw a picture to support your answer. - You want to increase the square area for your dog to 196 square feet. What would be the new dimensions of the enclosure? Explain (in words) how you know that new dimensions. (The portion of this problem being assessed under the Mathematical Process Competency is the process of correctly finding the dimensions and using them in the area formula to arrive at the correct area)		
SPA #4 Rubric			
<u>Proficient with Distinction</u> - Follows correct process/sequence - Shows all relevant work - Where appropriate, chooses more sophisticated and/or efficient processes - Contains no mathematical errors - Arrives at correct answer	<u>Proficient</u> - Follows correct process/sequence - Shows all relevant work - Completes task with minimal mathematical errors	<u>Partially Proficient</u> - Errors in process/sequence - Shows all relevant work - Task is mostly complete	<u>Not Proficient</u> - No evidence of proper process/sequence - Does not complete task