Algebra 1

Mathematics

Grade(s) 9th - 12th, Duration 1 Year, 1 Credit
Required Course

Course Overview

Algebra I is a foundation course for higher mathematics. Students will learn to use multiple representations in problem solving with linear, quadratic, and exponential functions, and factoring concepts. Skills developed during the class enable students to master essential skills needed later in Algebra II and higher mathematics courses.

Scope And Sequence

Timeframe	Unit	Instructional Topics
20 Day(s)	Expressions and Equations	1. Order of operations/ Algebraic properties 2. Solving equations 3. Solving equations with variables on both sides problem solving 4. Literal equations_Copy 5. Representations of inequalities 6. Solving inequalities 7. Compound inequalites
16 Day(s)	Linear Equations (graphing and writing equations)	1. slope-intercept equations 2. Point-slope form 3. Graphing standard form equations 4. Writing Equations of Lines Applications
14 Day(s)	Introduction to functions	1. Relations and Functions 2. Linear functions 3. Evaluating functions 4. Arithmetic Sequences-recursive and explicit notation 5. Arithmetic sequences-explicit
14 Day(s)	Systems of Equations	1. Solving systems by elimination 2. Solving systems by graphing 3. Solve systems of equations by substitution 4. Solving systems, mixed methods 5. Solving systems word problems 6. Graphing Inequalities 7. Systems of inequalities
15 Day(s)	Exponents and Exponential Functions	1. Rational Exponents and Properties of exponents 2. exponential functions 3. exponential growth and decay
20 Day(s)	Polynomials and Factoring	1. Adding and subtracting polynomials 2. Multiplying polynomials 3. GCF 4. Factoring polynomials
12 Day(s)	Graphing Quadratics and Function Transformations	1. Key features of a parabola 2. quadratics functions in standard form 3. Transformations of functions 4. Comparing linear, quadratic, and exponential functions 5. Quadratic Functions in Vertex form
18 Day(s)	Solving Quadratics	1. Quadratic equation in context 2. Solving Quadratics using graphs and tables 3. Solving Quadratics with Factoring 4. Completing the Square 5. Quadratic Formula and the Discriminant
16 Day(s)	Working with Functions	1. Analyzing Functions graphically 2. Function translations 3. Compressions and stretches of functions

Materials and Resources

8th grade math

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Prerequisites

Why are order of operations important?
When solving an equation, what is the goal for the variable?
How are polynomial operations similar to combining like terms?
How is multiplying polynomials similar to multiplying multi digit numbers?
How does the distributive property apply to multiplying polynomials and exponents?
How is factoring related to multiplying polynomials?
What does prime mean when working with polynomials?
How are one variable inequalities represented in real life scenarios?
How do you determine if there is no solution or infinite solutions in one or two variable equations and inequalities?
What are the relationships between the variables in real life scenarios and the x and y intercepts of the equations represented by those scenarios?
Students will write equations of lines given a graph, given a point and a slope, or given two points (DOK 2)
Students will interpret information from context to write linear equations (DOK 3)
What does the number of solutions (none, one or infinite) of a system of linear equations represent?
What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?
How can systems of equations be used to represent situations and solve problems?
How would you describe the way discrete and continuous functions similar and different?
Why do we use function notation instead of just writing equations with x and y?
How do you interpret function notation from an equation and a graph?
How do the graphs of the following equations vary: y=x, y=x^2, y=2^x
What causes a graph to shift vertically or horizontally?
How does changing the leading coefficient of the an equation change the steepness and reflection of a graph?
How are the solutions of a quadratic equation related to a rocket being launched?
How does the structure of the equation determine the method of solving the equation?
In what way the discriminant shorten the process when solving with the quadratic formula?
Given a graph, what the key features of the graph? (DOK 1)
Given a graph of the path describe when will a rocket reach its maximum height, when will it land, and where will it land.? (DOK 2)
Explain how a projectile travels given an equation. (DOK 3)
Using given information predict specified terms in arithmetic and geometric sequences.
How do you determine whether a sequence is a linear function, exponential function, or neither?
When working with simple and compound interest, what happens to the final balance of an account when the rate, term, or number of compounds is adjusted?
How does the shape of the data best describe the center of the data (median, mean, mode) and the spread of the data (standard deviation) accounting for possible extremes?
What associations and trends are there when looking at two categories of data (joint, marginal, and conditional relative frequencies)?
When modeling bivariate quantitative data, can you determine the best fit line for the data (both linear and exponential)?

Course Details

Unit: Expressions and Equations

Duration: 20 Day(s)

Unit Description

1. Analyze polynomials to create equivalent expressions or equations (SSE.A1.A.2)
2. Understand solving equations as a process, and solve equations and inequalities in one variable. (REI.A1.A)
3. Perform operations on polynomials. (APR.A1.A)
4. Solve literal equations and formulas for a specified variable that highlights a quantity of interest. (CED.A1.A.4)

Academic Vocabulary

equation
formula
expression
ratio
variable
coefficient
proportion
inequality
intersection
union

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Topic: Order of operations/ Algebraic properties **Duration:** Ongoing

Topic Description (short)
Review solving problems using order of operations
Associative, commutative, and distributive property

THIS WILL BE ONGOING--> CREATE HANDOUTS/NOTES TO REFER TO THROUGHOUT THE YEAR

Learning Targets
I can add, subtract, and multiply polynomials.

Learning Targets linked to Priority Standard =

Topic: Solving equations **Duration:** 2 Day(s)

Topic Description (short)
Solving equations:
Briefly review simple equations with variables on 1 side
Review solving equations with variables on both sides using the properties.

Learning Targets
MA.A1.REI.A.1 Understand solving equations as a process, and solve equations and inequalities in one variable.

Learning Targets linked to Priority Standard =

Topic: Solving equations with variables on both sides problem solving **Duration:** 2 Day(s)

Topic Description (short)
Students will solve word problems and application problems using equations with variables on both sides of the equations. Problems will include contexts such as perimeter.

Learning Targets
MA.A1.REI.A.1 Understand solving equations as a process, and solve equations and inequalities in one variable.

Learning Targets linked to Priority Standard =

Topic: Literal equations_Copy **Duration:** 2 Day(s)

Topic Description (short)
Solve literal equations for a specific variable

Learning Targets
MA.A1.CED.A.4 Create equations that describe linear, quadratic and exponential relationships.
- Solve literal equations and formulas for a specified variable that highlights a quantity of interest.

Learning Targets linked to Priority Standard =

Topic: Representations of inequalities **Duration:** 1 Day(s)

Topic Description (short)
Identifying how to say and write inequalities

Learning Targets
Represent constraints by equations or inequalities and by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context.

Learning Targets linked to Priority Standard =

Topic: Solving inequalities **Duration:** 2 Day(s)

Topic Description (short)
Solving simple inequalities
Solving inequalities that include dividing by a negative
Solving inequalities that result in no solution or all real numbers (special cases)

Learning Targets
MA.A1.REI.A.1 -- Understand solving equations as a process, and solve equations and inequalities in one variable.
- Explain how each step taken when solving an equation or inequality in one variable creates an equivalent equation or inequality that has the same solution(s) as the original.

Learning Targets linked to Priority Standard =

Topic: Compound inequalites **Duration:** 3 Day(s)

Topic Description (short)
Solving inequalities involving "and" and "or"

Learning Targets
Create equations that describe linear, quadratic and exponential relationships.
- Create equations and inequalities in one variable and use them to model and/or solve problems.

Learning Targets linked to Priority Standard = ✣

Unit: Linear Equations (graphing and writing equations)

Duration: 16 Day(s)

Unit Description
Writing and solving equations in one variable; Graphing linear equations in two variables

Academic Vocabulary
domain
range
function
linear function
relation
scatter plot
vertical line test

Topic: slope-intercept equations

Duration: 2 Day(s)

Topic Description (short)
Graphing Slope intercept form
Writing equations in slope intercept form

Learning Targets
Create and graph linear, quadratic and exponential equations in two variables

Learning Targets linked to Priority Standard = ✣

Topic: Point-slope form

Duration: 2 Day(s)

Topic Description (short)
Write an equation in point slope form
Graph an equation in point slope form

Learning Targets
Create and graph linear, quadratic and exponential equations in two variables

Learning Targets linked to Priority Standard = ✣

Topic: Graphing standard form equations

Duration: 2 Day(s)

Topic Description (short)
Graphing lines in standard form by rewriting the equation in slope-intercept form and by graphing the x and y intercepts

Learning Targets
Represent and solve linear and exponential equations and inequalities graphically.
- Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.

Learning Targets linked to Priority Standard = ✣

Topic: Writing Equations of Lines Applications

Duration: 2 Day(s)

Topic Description (short)
Given a word problem create an equation either in slope intercept form, using a point and slope or by identifying 2 points.

Learning Targets
Create equations that describe linear, quadratic and exponential relationships.
- Create and graph linear, quadratic and exponential equations in two variables.

Learning Targets linked to Priority Standard = ✣

Unit: Introduction to functions

Duration: 14 Day(s)

Unit Description
Introduction to function notation, reading and interpreting functions from equations, graphs and tables, working with domain and range, and looking at functions in context.

Academic Vocabulary
domain
range
linear function
slope

x-intercept
y-intercept
parallel line
perpendicular lines

Materials and Resources (optional)

textbook

Topic: Relations and Functions **Duration:** 2 Day(s)

Topic Description (short)

Express relations as tables, ordered pairs, graphs, or mappings
Identify continuous and discrete functions
Domain and range of a function

Learning Targets

- Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities.

Learning Targets linked to Priority Standard =

Topic: Linear functions **Duration:** 2 Day(s)

Topic Description (short)

Using the form f(x)= to name a function
graph in terms of domain and range
interpret functions represented by graphs, tables, verbal descriptions, and function notation in terms of context

Learning Targets

Understand the concept of a function and use function notation.
- Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.
- Represent a function using function notation.
- Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x).

Learning Targets linked to Priority Standard =

Topic: Evaluating functions **Duration:** 4 Day(s)

Topic Description (short)

Use function notation to evaluate functions from an equation or a graph.
given the domain, find the range
given the range, find the domain

Learning Targets

Understand the concept of a function and use function notation.
- Use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Learning Targets linked to Priority Standard =

Topic: Arithmetic Sequences-recursive and explicit notation **Duration:** 1 Day(s)

Topic Description (short)

When given one term in the pattern, find the next term
When given the 1st term in a sequence, find a given term.

Learning Targets

Use arithmetic and geometric sequences.
- Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.

Learning Targets linked to Priority Standard =

Topic: Arithmetic sequences-explicit **Duration:** 2 Day(s)

Topic Description (short)

Find the nth term in a sequence

Learning Targets

Use arithmetic and geometric sequences.
- Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.

Learning Targets linked to Priority Standard =

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Unit: Systems of Equations

Duration: 14 Day(s)

Unit Description

Solve systems of equations:
-linear systems algebraically with elimination and substitution as well as graphically
-linear and quadratic system algebraically and graphically

Academic Vocabulary

consistent system
solution of a system
system of linear inequality

Materials and Resources (optional)

textbook

Topic: Solving systems by elimination

Duration: 2 Day(s)

Topic Description (short)

Given 2 equations, solve by elimination.

Learning Targets

Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.
- Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities.

MA.A1.NQ.B.3 Use units to solve problems.
- Use units of measure as a way to understand and solve problems involving quantities.
- Identify, label and use appropriate units of measure within a problem.
- Convert units and rates.
- Use units within problems.
- Choose and interpret the scale and the origin in graphs and data displays.

Understand the concept of a function and use function notation.
- Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.
- Represent a function using function notation.
- Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x).

Learning Targets linked to Priority Standard =

Topic: Solving systems by graphing

Duration: 1 Day(s)

Topic Description (short)

Graph two equations to determine the solution

Learning Targets

Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Topic: Solve systems of equations by substitution

Duration: 1 Day(s)

Topic Description (short)

Given two equations, solve a system by using substitution.

Learning Targets

Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Topic: Solving systems, mixed methods

Duration: 1 Day(s)

Topic Description (short)

Given two equations determine which method to solve is the best.

Learning Targets

Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Topic: Solving systems word problems

Duration: 2 Day(s)

Topic Description (short)

Given a real world problem, write and solve a system of equations

Learning Targets
Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Topic: Graphing Inequalities **Duration:** 2 Day(s)

Topic Description (short)
Graphing inequalities in slope intercept form and in standard form

Learning Targets
Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Topic: Systems of inequalities **Duration:** 1 Day(s)

Topic Description (short)
Given two inequalities, solve the system using graphing.

Learning Targets
Solve systems of equations.
- Solve a system of linear equations algebraically and/or graphically.

Learning Targets linked to Priority Standard =

Unit: Exponents and Exponential Functions **Duration:** 15 Day(s)

Unit Description
Identify, write and transform exponential functions.
Students use exponential functions to model real-world situations, make predictions, and determine how parameters im affect the function.
Students will make the connection that a geometric sequence is an exponential function.

Academic Vocabulary
asymptote
compound interest
constant ratio
decay factor
exponential decay
exponential factor
geometric sequence
growth factor
rational exponent

Summative Assessment
chapter test, page 674

Topic: Rational Exponents and Properties of exponents **Duration:** 2 Day(s)

Topic Description (short)
extending properties of integer exponents to rational exponents to rewrite radical expressions
solve equations with rational exponents using the properties of exponents

Learning Targets
Explain how the meaning of rational exponents extends from the properties of integer exponents.

Learning Targets linked to Priority Standard =

Topic: exponential functions **Duration:** 2 Day(s)

Topic Description (short)
sketch graphs of exponential functions
write exponential functions as tables and graphs
compare linear and exponential functions

Learning Targets
Understand the concept of a function and use function notation.
- Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.
- Represent a function using function notation.
- Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x).

Topic: exponential growth and decay **Duration:** 2 Day(s)

Topic Description (short)
conduct exponential growth and decay functions based on descriptions of relationships
recognize if a situation can be modeled with exponential growth or decay, and interpret the parameters of the model in context.

Learning Targets
Analyze linear, quadratic and exponential functions using different representations.
- Graph functions expressed symbolically and identify and interpret key features of the graph.

Learning Targets linked to Priority Standard =

Unit: Polynomials and Factoring **Duration:** 20 Day(s)

Unit Description
Students will work with polynomials to rewrite them in different forms including adding, multiplying and factoring
Students will use model with polynomial expressions to solve problems.

Academic Vocabulary
binomial
degree
coefficient
variable
trinomial
monomial
standard form

Materials and Resources (optional)
textbook

Topic: Adding and subtracting polynomials **Duration:** 2 Day(s)

Topic Description (short)
Using combining like terms to add and subtract polynomials.

Learning Targets
Students will add and subtract polynomials

Learning Targets linked to Priority Standard =

Topic: Multiplying polynomials **Duration:** 4 Day(s)

Topic Description (short)
Multiplying a polynomial by a monomial
Multiplying two polynomials using an area model and distribution
Special cases

Learning Targets
Perform operations on polynomials.
- Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.

Learning Targets linked to Priority Standard =

Topic: GCF **Duration:** 2 Day(s)

Topic Description (short)
Finding the greatest common factor of expressions using prime factorization

Learning Targets
MA.A1.APR.A.2 Perform operations on polynomials.
- Divide polynomials by monomials.

Learning Targets linked to Priority Standard =

Topic: Factoring polynomials **Duration:** 4 Day(s)

Topic Description (short)
Factor polynomials when a=1,a is not 1, special cases and combinations.

Learning Targets
MA.A1.SSE.A.1 Interpret and use structure.
- Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.

MA.A1.SSE.A.2 Interpret and use structure.
- Analyze the structure of polynomials to create equivalent expressions or equations.

Learning Targets linked to Priority Standard = ✙

Unit: Graphing Quadratics and Function Transformations

Duration: 12 Day(s)

Unit Description

Analyzing the forms of quadratic equations and how they can be used for graphing, how to find the key features of a parabola (maximum/minimum, axis of symmetry, vertex, roots/zeros, y-intercept) and how to graph them. How the graph of a parabola relates to real life scenarios and apply those graphs to answer questions and draw conclusions.

Academic Vocabulary

axis of symmetry
maximum
minimum
parabola
quadratic equation
quadratic function
vertex
zero
domain
range

Summative Assessment

chapter test

Topic: Key features of a parabola

Duration: 1 Day(s)

Topic Description (short)

vertex, axis of symmetry, roots, y-intercept domain, and range
Identify from a graph
Identify in context (rocket type problems)

Learning Targets

Understand the concept of a function and use function notation.
- Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.
- Represent a function using function notation.
- Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x).

Learning Targets linked to Priority Standard = ✙

Topic: quadratics functions in standard form

Duration: 2 Day(s)

Topic Description (short)

graph quadratic functions in f(x) = ax^2+bx+c
use the equation to find the axis of symmetry x=-b/2a
c is the y-intercept of the graph

Learning Targets

Analyze linear, quadratic and exponential functions using different representations.
- Graph functions expressed symbolically and identify and interpret key features of the graph.

Learning Targets linked to Priority Standard = ✙

Topic: Transformations of functions

Duration: 4 Day(s)

Topic Description (short)

transformations of linear, quadratic and exponential functions
reflections, vertical shifts, steepness, and horizontal shifts

Learning Targets

Build new functions from existing functions (limited to linear, quadratic and exponential).
- Analyze the effect of translations and scale changes on functions.

Learning Targets linked to Priority Standard = ✙

Topic: Comparing linear, quadratic, and exponential functions

Duration: 2 Day(s)

Topic Description (short)

Using data sets to determine the type of function

Learning Targets

Analyze linear, quadratic and exponential functions using different representations.
- Compare the properties of two functions given different representations.

Learning Targets linked to Priority Standard = ✙

Topic: Quadratic Functions in Vertex form **Duration:** 2 Day(s)

Topic Description (short)
using f(x)=a(x-h)^2 +k to graph a parabola
understand how a, h, and k transform the parabola in vertex form

Learning Targets
Analyze linear, quadratic and exponential functions using different representations.
- Graph functions expressed symbolically and identify and interpret key features of the graph.

Learning Targets linked to Priority Standard = ✙

Unit: Solving Quadratics

Duration: 18 Day(s)

Unit Description
Solving quadratic equations using square roots, factoring, the quadratic formula, completing the square and determining which method is appropriate in for the given problem.
Solving the equations in context.
Solving systems of linear and quadratic equations.

Enduring Understandings (Knowledge & Skills)
Graphs
Chromebooks
DESMOS
calculators
whiteboards and markers

Academic Vocabulary
axis of symmetry
maximum
minimum
parabola
quadratic equation
quadratic functions
domain
range
zero

Topic: Quadratic equation in context **Duration:** 2 Day(s)

Topic Description (short)
Writing and solving quadratic equations in context

Learning Targets
Interpret and use structure.
- Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.
- Find the zeros of a quadratic function by rewriting it in factored form.
- Find the maximum or minimum value of a quadratic function by completing the square.

Learning Targets linked to Priority Standard = ✙

Topic: Solving Quadratics using graphs and tables **Duration:** 2 Day(s)

Topic Description (short)
use given graphs and tables to answer questions and solve quadratic equations

Learning Targets
Interpret and use structure.
- Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.
- Find the zeros of a quadratic function by rewriting it in factored form.
- Find the maximum or minimum value of a quadratic function by completing the square.

Learning Targets linked to Priority Standard = ✙

Topic: Solving Quadratics with Factoring **Duration:** 2 Day(s)

Topic Description (short)
Factor and the Zero-Product property to solve

Learning Targets

Interpret and use structure.
- Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.
- Find the zeros of a quadratic function by rewriting it in factored form.
- Find the maximum or minimum value of a quadratic function by completing the square.

Learning Targets linked to Priority Standard = ✙

Topic: Completing the Square **Duration:** 2 Day(s)

Topic Description (short)
Solve quadratic equations using completing the square

Learning Targets
Interpret and use structure.
- Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.
- Find the zeros of a quadratic function by rewriting it in factored form.
- Find the maximum or minimum value of a quadratic function by completing the square.

Learning Targets linked to Priority Standard = ✙

Topic: Quadratic Formula and the Discriminant **Duration:** 2 Day(s)

Topic Description (short)
derive the quadratic formula
use the discriminant to determine the number of solutions
solve quadratic equations using the quadratic formula

Learning Targets
Interpret and use structure.
- Analyze the structure of polynomials to create equivalent expressions or equations.

Learning Targets linked to Priority Standard = ✙

Unit: Working with Functions **Duration:** 16 Day(s)

Unit Description
graph and transform quadratic functions

Academic Vocabulary
vertex
domain
range
standard form of a quadratic function

Topic: Analyzing Functions graphically **Duration:** 2 Day(s)

Learning Targets
Build new functions from existing functions (limited to linear, quadratic and exponential).
- Analyze the effect of translations and scale changes on functions.

Learning Targets linked to Priority Standard = ✙

Topic: Function translations **Duration:** 2 Day(s)

Topic Description (short)
Use equations to describe translations from parent functions (vertical, horizontal, reflection)

Learning Targets
Build new functions from existing functions (limited to linear, quadratic and exponential).
- Analyze the effect of translations and scale changes on functions.

Learning Targets linked to Priority Standard = ✙

Topic: Compressions and stretches of functions **Duration:** 2 Day(s)

Topic Description (short)
steepness of a function

Learning Targets
Use and interpret functions.
- Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

Learning Targets linked to Priority Standard = ✙