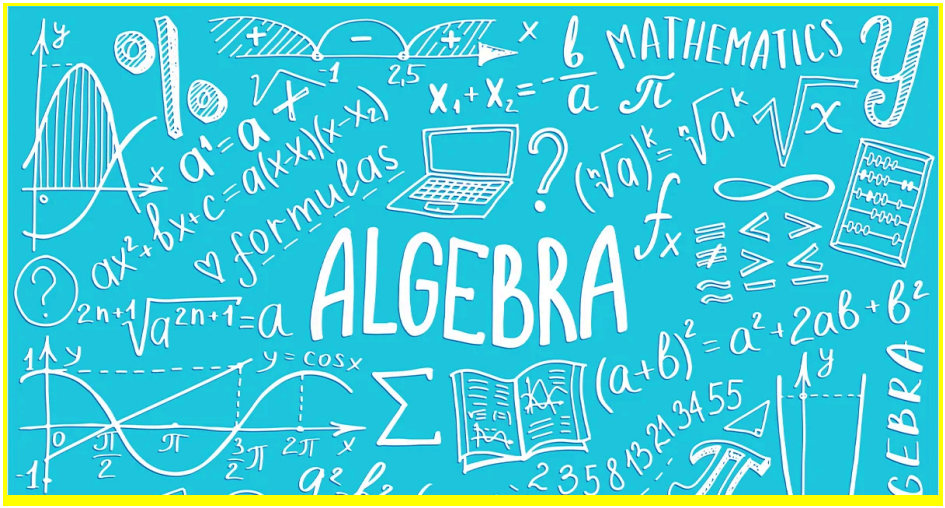
Algebra 1 CURRICULUM

(Refer to the Curriculum Template Explanation document while writing curriculum)



Grade Level(s): 9-10	**Curriculum Author(s):** Shannon Belanger, Nicole Cowles, and Lauren O'Brien

Course Description: In Algebra 1, students will learn through cooperative investigations of the major topics of Algebra. Student literacy in the structure and application of Algebra 1 is the goal of the course. Topics include: one- and two-variable statistics, linear equations in one and two variables, systems of linear equations and inequalities, functions, exponential relationships, and quadratic functions. This course is designed to improve student discourse and critical thinking skills.

Year At A Glance			
Unit Title	**Overarching Essential Question**	**Overarching Enduring Understanding**	**Vision of A Learner "I Can" Statements**
Solving Linear Equations & Inequalities	How can equations and inequalities be used to model information?	To obtain a solution to an equation, no matter how complex, it always involves the process of undoing the operation. Each step in solving an equation must maintain the equality of the statement.	DE1(9-12); DE4(9-12)
Introduction to Functions	How can mathematical functions be used to represent, analyze, and solve real-world problems, and what insights do different forms of representation provide?	Understanding the different representations of functions—verbal, graphical, using tables, and algebraic—allows us to model real-world situations, identify relationships, make predictions, and solve problems effectively. Different representations provide unique insights into the behavior and characteristics of functions.	TCC1(9-12); AA1(9-12)
Linear Functions	How can understanding linear functions and their multiple representations help us model real-world situations, interpret relationships, and solve problems effectively?	Linear functions describe relationships and quantities with a constant additive rate of change, known as the slope.	CCE4(9-12); AA1(9-12)
Systems of Equations and Inequalities	How do systems help us solve real-world problems with multiple constraints?	A solution to a system of equations is the point where all equations intersect. A solution to a system of inequalities is the region of the coordinate plane that contains the ordered pairs that satisfy all of the inequalities.	TCC3(9-12); TCC4(9-12); AA1(9-12)

Introduction to Statistics	How can we use statistics to summarize and describe sets of data?	Graphs and summary statistics can be used to describe one variable data; scatterplots and trend lines can be used to describe two variable data.	TCC3(9-12)
Exponential Functions	What are the characteristics of exponential growth and decay and how is this reflected in real-world phenomena?	Exponential functions represent relationships involving a constant multiplicative rate of change, which represent rapid growth or decay.	TCC3(9-12); TI3(9-12); CCE4(9-12)
Operations with Polynomial Expressions	How can you verify two algebraic expressions that appear to be different are equivalent?	Polynomial expressions can be simplified and factored using different strategies.	TCC2(9-12); CCE4(9-12)
Introduction to Quadratic Functions	What are the characteristics of quadratic functions and how can they be used to model real-world phenomena?	Understanding multiple representations—graphical, numerical, algebraic, and contextual—of quadratic relationships allows us to analyze and solve real-world problems involving solutions and maximum or minimum values.	TCC3(9-12); AA1(9-12)

Unit 1 - Solving Linear Equations & Inequalities

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear*** *and quadratic functions, and simple rational and exponential* ***functions.***
- **A.CED.A.3 Represent constraints by equations on inequalities,** and by systems of equations and/or inequalities, and **interpret solutions as viable or nonviable options in a modeling context**.
- **A.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
- **A.REI.A.1** Explain each step in solving a simple equation as follows from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- **A.REI.B.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- **A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.*
    - **A.SSE.A.1.A** Interpret parts of an expression, such as terms, factors, and coefficients.
- **A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it.
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
- **N.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas;** choose and interpret the scale and the origin in graphs and data displays.
- **N.Q.A.2** Define appropriate quantities for the purpose of describing modeling.
- **N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **DE1(9-12):** I can acknowledge, process, and respond appropriately to others' comments and perspectives.
- **DE4(9-12):** I can work respectfully with all members of my community and support the needs of others.

Understandings: Students will understand that...

- Algebra consists of numbers, variables, operations, and rules for relationships between those entities.
- A variable represents an unknown quantity.
- Real-life situations can be modeled algebraically.
- To obtain a solution to an equation, no matter how complex, it always involves the process of undoing the operation. Each step in solving an equation must maintain the equality of the statement.
- Inequalities express a range of possible solutions, rather than a single answer.

Essential Questions:

- How can the algebraic properties of real numbers extend beyond integers?
- What methods or strategies do you use to decide how to solve a problem? How does this extend to the validity of a solution to a problem?
- Does each equation have a distinct solution and how do you know?
- How can equations and inequalities be used to model information?
- How do inequality properties compare to those of equations? How are they similar? How are they different? What characteristics drive using an inequality instead of an equal sign?
- What is a solution set for a linear inequality?

Students will know...

- Explain the steps in solving equations.
- Understand how the properties of equality and inverse operations are used to solve equations and inequalities in one-variable.
- Understand the difference between the properties of equality vs. combining like terms and when to use each (seeing structure).
- The order of operations and apply it when simplifying expressions or solving equations.
- Explain the steps in solving inequalities.
- Understand how the properties of inequalities and inverse operations are used to solve inequalities.
- Understand the difference between the properties of equations vs the properties of inequalities (i.e.: multiplying or dividing by a negative).
- The difference between equations and inequalities.
- Some equations have no solution, one solution, or infinitely many solutions.

Students will be able to...

- Solve multi-step equations, justifying each step in the solving process.
- Solve equations with variables on both sides, including examples of special cases with no solutions or infinite solutions.
- Rewrite and explain literal equations (equations with formulas).
- Translate real-world problems into algebraic equations.
- Solve absolute value equations and apply to real-world situations such as tolerance or error analysis.
- Solve and graph multi-step inequalities in one-variable.
- Solve and graph compound inequalities in one-variable.
- Model real-world situations using inequalities. Apply compound inequalities to real-world situations.

• Inequalities express a range of possible solutions rather than a single answer.	

Key Vocabulary:
Part 1 Solving Equations: Argument, Coefficient, Combine Like Terms, Constant, Difference, Distributive Property, Expressions, Equation, Equality, Infinite Solutions, Interpret, Inverse Operation, Justify, Like Terms, Modeling, No Solution, Order of Operations, PEMDAS, Persevere, Product, Properties of Equality, Proportional, Quotient, Rate, Ratio, Solve, Solution, Sum, Term, Variable

Part 2 Solving Inequalities: At Least, Compound Inequality, Greater Than, Inequality, Interpret Less Than, Modeling, No More Than, Solution, Solution Set

Assessment Evidence

Performance Tasks:

Summative Assessment: Unit 1 Test **DE1(9-12); DE4(9-12)**
- Solving multi-step equations
- Solving multi-step inequalities
- Solving compound inequalities
- Modeling equations and inequalities

Other Evidence:

Building Thinking Classrooms Problem Sets:

Common Formative/Interim Assessment:
- Applications of one and two step equations
- Multi-step equations and with variables on both sides (include absolute value)
- Types of solutions
- Multi-step inequalities
- Literal Equations
- Solving compound Inequalities

Learning Plan

Given the wide-range of student abilities entering Nonnewaug High School from our multiple sending districts, this first unit is split into two key ideas: solving linear equations in one-variable and solving linear inequalities in one-variable. Our students are entering NHS with varying mathematical experiences, some students using Illustrative Math, while others have different 8th grade math experiences from their sending school district. Therefore, there is a need to utilize just-in-time intervention opportunities throughout this first unit. By spiraling in review of middle school concepts, such as distributive property, combining like terms, and solving simple one-, two-, and multi-step equations teachers will scaffold in learning opportunities and can adjust to meet students' learning needs. The beginning of the school year is paramount to establishing routines, including the use of Building Thinking Classrooms in Mathematics as an instructional strategy, building community, and integrating to the expectations at the high school.

Part 1: Solving Linear Equations in One-Variable. Prerequisite skills for just-in-time intervention could include: adding/subtracting or multiplying/dividing with positive and negative numbers, simplifying expressions using the order of operations, combining like terms, the

distributive property.

- Solve multi-step equations, justifying each step in the solving process and deepening an understanding of opposite operations and preserving equality. **DE1(9-12); DE4(9-12)**
- Solve equations with variables on both sides, including examples of special cases with no solutions or infinite solutions.
- Rewrite and explain literal equations (equations with formulas). This practices “seeing structure” which is a critical skill assessed on the SAT.
- Translate real-world problems into algebraic equations to model and solve application questions.
- Solve absolute value equations and apply to real-world situations such as tolerance or error analysis.

Part 2: Solving Linear Inequalities in One-Variable. Prerequisite skills for just-in-time intervention could include: plotting points on a number line and revising the idea of less than and greater than (i.e. x>-4 means that x could be -3, -2, -1.5, etc.)

- Solve and graph multi-step inequalities in one-variable.
- Solve and graph compound inequalities in one-variable.
- Model real-world situations using inequalities including applying compound inequalities to real-world situations.

Teacher Resources: Algebra 1 Textbooks; IM Algebra 1 Unit 2: Linear Equations, Inequalities, and Systems; State of CT Algebra 1 Model Curriculum Unit 2; Desmos; IXL; TI Smartview Software; Teacher created in-class notes, activities, and problem sets

Unit 2 - Introduction to Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **F.IF.A.1** 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. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y = f(x).*
- **F.IF.A.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of
- **F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative;*** *relative maximums and minimums; symmetries; end behavior; and periodicity.**
- **F.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
- **F.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).** *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- **F.BF.A.1** Write a function that describes two quantities.
- **F.LE.A.2 F.LE.A.2 Construct linear** and exponential functions**, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).**
- **A.CED.A.2** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC1(9-12):** I can ask purposeful, insightful questions to find a variety of innovative solutions.
- **AA1(9-12)**: I can evaluate different approaches and justify the best pathway to success.

Understandings: Students will understand that...

- A function maps each input (domain) to exactly one output (range), and is often expressed as f(x).
- Function notation helps evaluate and interpret functions in different contexts, connecting mathematical expressions to real-world situations.
- Understanding the different representations of functions - verbal, graphical, using tables, and algebraic - allows us to model real-world situations, identify relationships, make predictions, and solve problems effectively. Different representations provide unique insight into the behavior and characteristics of functions.

Essential Questions:

- How do you distinguish between relations and functions?
- What is a function, and how can we represent it using equations, graphs, and tables?
- How do we use function notation to evaluate and interpret functions?
- In what ways do different representations of a function (graph, table, equation) provide unique insights into its behavior?
- How can mathematical functions be used to represent, analyze, and solve real-world problems, and what insights do different forms of representation provide?

Students will know...

- Functions are relations with each element domain paired with exactly one element of the range.
- Methods for determining if a relation represents a function.
- Function notation is another way to represent your dependent variable.
- Functions can be represented by tables, equations, graphs and mapping diagrams.
- Through graphical representations, students can visually analyze key features such as intercepts, domain and range and maximums/minimums in the context of a problem.
- Domain is the set of all x-values and range is the set of all y-values in a relation.

Students will be able to...

- Understand that a function is a relationship where each input (domain) has exactly one output (range).
- Represent relations in tables, graphs, equations and mapping diagrams.
- Identify the domain (set of possible inputs) and range (set of possible outputs) from a graph, mapping diagram, or table.
- Use function notation to represent functions and evaluate them for given inputs.
- Solve for the input given an output of a function from an equation.
- Interpret and plot functions on a coordinate plane, recognizing how graphs represent the function's behavior.
- Interpret graphs to find key features in a scenario.
- Use functions and function notation to describe contextual situations.

Key Vocabulary: Function, domain, range, function notation, independent variable, dependent variable, element, input, output, graph of a function, evaluate, maximum, minimum, y-intercept, x-intercept, table of values, equation of a function, mapping diagram, Vertical Line Test, discrete, continuous

Assessment Evidence

Performance Tasks:	**Other Evidence:**
Merry Go Round Performance Task **AA1(9-12)** Data collection and graphical analysis Summative Assessment ● Evaluating functions ● Representing relations ● Identifying the domain & range ● Is it a function? ● Represent situations using Function notation ● Analyzing a graph using function notation	Common Formative/Interim Assessment:**TCC1(9-12)** ● Representing relations & identifying whether a relation is a function Quiz ● Function notation (evaluating) quiz

Learning Plan

In this unit on Functions, students will develop an understanding that a function is a relation in which each element of the domain is paired with exactly one element of the range. Understanding functions is foundational to preparing students for studying the functions studied in Algebra 1 and Algebra 2. Essential questions such as *"How do we represent and interpret functions?"* and *"In what ways do different representations of a function provide unique insights?"* will guide their exploration and deepen their conceptual understanding. Students will

- Explore various ways to represent functions, including equations, graphs, tables, and mapping diagrams, gaining insights into how each form highlights different features of the function. These multiple representations of functions will extend to the functions studied in Algebra 1, Algebra 2, Pre-Calculus, and Calculus.
- Through the use of function notation, students will learn to evaluate and interpret functions in diverse contexts, connecting mathematical expressions to real-world scenarios. By analyzing graphs, they will identify key features such as intercepts, domain, range, and maximums/minimums, and understand how these features describe the function's behavior. **TCC1(9-12)**
- Students will be able to determine whether a relation is a function and explain why, using evidence from different representations. The learning will extend to modeling real-world situations with functions, allowing students to visualize and solve practical problems. This includes a Merry Go Round performance task where students will collect data and create and analyze its graphical representation. **AA1(9-12)**

By the end of the unit, students will be equipped to begin to represent, evaluate, and analyze functions, both in mathematical and real-world contexts.

Teacher Resources: Algebra 1 Textbooks; IM Algebra 1 Unit 4: Functions; State of CT Algebra 1 Model Curriculum Unit 3; Desmos; IXL; TI Smartview Software; Teacher created in-class notes, activities, and problem sets

Unit 3 - Linear Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **A.CED.A.2** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.REI.D.10** 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 (which could be a line).
- **F.IF.B.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - **F.IF.C.7.A Graph linear** and quadratic **functions and show intercepts**, maxima, and minima.
- **F.IF.C.8** Write a function defined by an expression in different by equivalent forms to reveal and explain different properties of the function.
- **F.LE.A.2 Construct linear** and exponential functions, **given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).**
- **G.GPE.B.5** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (**e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point)**. *The example in the standard is the focus of instruction in Algebra 1, not the formal proof. We want students to be able to write the equation parallel and perpendicular and identify parallel/perpendicular pairs from equations.*

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **CCE4(9-12):** I can communicate and express my understanding in an authentic, respectful, and relevant way, using the most effective mode of expression.
- **AA1(9-12):** I can evaluate different approaches and justify the best pathway to success.

Understandings: Students will understand that...

- Linear functions describe relationships and quantities with a constant additive rate of change, known as the slope.
- Equations represent relationships between quantities and can be graphed on a coordinate plane.
- The graph of a linear function (a line) represents a set of infinite solutions to a two variable equation.
- The average rate of change describes how a function's output changes over an interval.
- Graphs of functions reveal key features like intercepts and its slope.

Essential Questions:

- How can understanding linear functions and their multiple representations help us model real-world situations, interpret relationships, and problem solve effectively?
- What is a linear function, and how can it be represented using equations, graphs, and tables?
- What is the significance of a linear function's slope and y-intercept in the context of modeling linear applications?
- How do changes in the form of a linear equation affect its graph and the relationship between variables?
- What is the significance of parallel and perpendicular lines in solving geometric and algebraic problems?

Students will know…

- Linear functions do not include exponents, variables in the denominator, or variables under radicals.
- Linear functions have three accepted forms: slope intercept, standard, and point-slope.
- Linear functions can be identified from equations, graphs, and tables.
- Slope is a constant rate of change that can be calculated from a graph, table, equation, or two points.
- The y-intercept is often referred to as the initial value. It can be identified from an equation or from a graph.
- The x-intercept is often referred to as the zero of the function - when the value of the function is zero.
- Linear functions can be built from graphs, descriptions, or input-output pairs.
- To write the equation of a line, at least one point and the slope are needed.
- Parallel and perpendicular lines can be identified and written using slope criteria. Parallel lines have the same slope while perpendicular lines have opposite reciprocal slopes.

Students will be able to...

- Identify and classify linear functions from graphs, tables, and equations.
- Calculate the slope of a line from a graph, table, equation, and/or two points.
- Interpret the meaning of intercepts given a situation, equation, or graph.
- Graph linear functions using slope-intercept form.
- Graph linear functions in standard form by rewriting into slope-intercept form or by finding the intercepts.
- Graph linear equations in point-slope form.
- Write equations of linear functions given a graph, a context, a point and slope, or two points.
- Write equations of parallel and perpendicular lines given a line and a point not on the line.
- Solve problems involving parallel and perpendicular lines.
- Translate between different representations of linear functions (graph, table, equation).
- Create equations to model situations using linear functions.
- Analyze and interpret the slope and intercepts of a linear

	function in real-world situations.
Key Vocabulary: Linear Function, Linear Equation, Graph, Table, Slope, Constant Rate of Change, Y-intercept, X-intercept, Slope-Intercept Form, Standard Form, Point-Slope Form, Parallel Lines, Perpendicular Lines, Domain, Range, Function Notation, Coordinate Plane, Origin, Solution, Intercept	
Assessment Evidence	
Performance Tasks: Summative Assessment: **AA1(9-12)** ● Matching equations to graphs ● Identifying slope and y-intercept ● Completing coordinate tables for linear equations ● Horizontal and vertical lines ● Writing equations ● Graphing linear equations ● Identifying linear vs. nonlinear relationships ● Interpreting real-world situations with linear equations ● Finding break-even points and calculating profit	**Other Evidence:** Common Formative/Interim Assessment: **CCE4(9-12)** ● Calculating slope and identifying if a relation is linear ● Graphing and applying slope intercept form
Learning Plan	
Linear functions are the first function family studied in high school. Students will explore linear relationships, learning to represent them using equations, graphs, and tables. The purpose of this unit is to introduce the connection between graphs and linear equations in two variables. Students will discern the best approach for graphing based on the form of the equation and equation writing based on the information given. ● Students will identify linear versus non-linear relations and understand that a linear function pairs each input (domain) with exactly one output (range). ● They will calculate and interpret slope as the rate of change. Additionally, students will recognize the y-intercept's significance, beginning in the context of application problems and then making the connection to the equation. ● Students will graph linear functions in various forms, which include slope-intercept, standard, and point-slope forms. Students will identify key features of the function, including slope, the y-intercept, and x-intercept. Using these features they will graph lines and translate between forms of the equation. **CCE4(9-12)** ● Real-world problems will help students apply their skills, modeling situations with constant rates of change and solving linear equations. ● Students will be able to graph linear equations, solve real-world problems, and write equations that represent linear relationships. **AA1(9-12)**	
Teacher Resources: Algebra 1 Textbooks; IM Algebra 1 Unit 2: Linear Equations; State of CT Algebra 1 Model Curriculum Unit 4; Desmos; IXL, TI Smartview Software; Teacher created in-class notes, activities, and problem sets	

Unit 4 - Systems of Linear Equations and Inequalities

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **A.CED.A.2** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.CED.A.3** Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
- **A.REI.C.5** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- **A.REI.C.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- **A.REI.D.10** 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 (which could be a line).
- **A.REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear**, polynomial, rational, absolute value, exponential, and logarithmic functions.*
- **A.REI.D.12** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.

- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC3(9-12):** I can integrate relevant information to produce multiple valid solutions.
- **TCC4(9-12)**: I can integrate my learning to adapt to experiences in the classroom, career and life.
- **AA1(9-12)**: I can evaluate different approaches and justify the best pathway to success

Understandings: Students will understand that...

- Systems of equations and inequalities can model real-world scenarios involving more than one variable.
- A solution to a system of equations is the point where all equations intersect.
- A solution to a system of inequalities is the region of the coordinate plane that contains the ordered pairs that satisfy all of the inequalities.
- Multiple methods can be used to solve systems, each with its own advantages.

Essential Questions:

- What does it mean for an ordered pair to be a solution to a system?
- How do you determine the most efficient method to solve a system?
- How does the number of solutions of a system connect to its graph?
- How do systems help us solve real-world problems with multiple constraints?

Students will know…

- Expressions can be substituted in for variables.
- The solution to a system of linear equations is the ordered pair which is a solution to each linear equation in the system.
- There are multiple methods to solve systems of equations. All methods result in the same solution, but one method may be more efficient.
- Some systems have infinitely many solutions (graphically they are the same line) or no solution (graphically it results in parallel lines).
- Systems can be used to determine break-even points and to analyze data relative to the break-even point.
- An inequality divides the coordinate plane into two half-planes. One side of the boundary line will represent solutions and is shaded to show this.
- The solution to a system of inequalities is the overlapping region of these shaded half-planes, known as the feasible region.

Students will be able to…

- Solve a system of linear equations using graphing, substitution, and elimination methods.
- Determine the most efficient method to solve a system of linear equations.
- Solve a system of linear inequalities by graphing.
- Algebraically check solutions to a system of linear equations and to a system of linear inequalities.
- Determine the number of solutions to a system of linear equations.
- Write and solve systems of linear equations and of linear inequalities to model real world problems.

Key Vocabulary: linear equation, linear inequality, system of linear equations, system of linear inequalities, equivalent equation, solution, graphing method, substitution method, elimination (linear combination) method, inconsistent, consistent, independent, dependent, infinitely many solutions, no solution, revenue, profit, break even point

Assessment Evidence	
Performance Tasks: ● Amusement park problem - introduction to systems of linear equations **AA1(9-12)** ● Donut problem - introduction to systems of linear inequalities **TCC3(9-12)** ● Summative test on systems of linear equations and linear inequalities **TCC4(9-12)**	**Other Evidence:** Common Formative/Interim Assessments: ● Solving systems of equations by graphing ● Solving systems of equations by substitution and elimination ● Number of solutions and systems of linear inequalities

Learning Plan

The purpose of this unit is to introduce the connection between graphs and linear equations in two variables given multiple equations. Students will discern the best approach for writing systems of equations and solving based on the information given. Systems of equations then extends to systems of inequalities, where there is a feasible region for the solution set.

- This unit starts with an informal introduction to systems of equations through the amusement park problem **AA1(9-12)**. Students create tables, graphs, and equations to model three different membership plans at an amusement park. Students compare these plans and look for break even points.
- Students will solve systems by the graphing method, both by hand and using technology (TI graphing calculator, desmos calculator). Students also solve application problems by graphing.
- Students learn algebraic methods for solving systems of equations. Students solve problems that are stand alone and real world problems by substitution and by elimination.
- Students will learn about special cases - inconsistent and dependent systems of equations.
- Students are introduced to systems of linear inequalities using the donut problem **TTC3(9-12)**.

The unit will conclude with a summative test on all topics **TCC4(9-12).**

Teacher Resources: IM Algebra 1 Unit 2: Linear Equations, Inequalities, and Systems; State of CT Algebra 1 Model Curriculum Unit 6; Teacher created worksheets and assessments; Desmos; Khan academy; IXL; Socrative; Blooket; Quizizz; Kahoot

Unit 5 - Introduction to Statistics

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **S.ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots).
- **S.ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- **S.ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
- **S.ID.B.5** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- **S.ID.B.6** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    - **S.ID.B.6.A Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear,** quadratic, and exponential models.
    - **S.ID.B.6.C** Fit a linear function for a scatter plot that suggests a linear association.
- **S.ID.C.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **S.ID.C.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- TCC3(9-12): I can integrate relevant information to produce multiple valid solutions.

Understandings: Students will understand that...	**Essential Questions:**
● Data can be represented in multiple graphical ways to reveal	● How can data be represented and interpreted to make real-wold

trends and insights. • Measures of center and spread can be used to summarize quantitative data. • The context of data matters when interpreting statistical findings. • Bivariate data can be analyzed using scatterplots and equations of the line of best fit.	decisions? • What can measures of center and spread tell us about a data set? • How do outliers and distribution shape influence interpretation of data? • How can the equation of a trend line be used to make predictions about bivariate data?
Students will know... • Data involving one quantitative variable can be displayed and analyzed using dot plots, histograms, and box plots. • Mean and median are used to describe and compare the center of a distribution; interquartile range (IQR) and standard deviation are used to describe and compare the spread of a distribution. • Data involving two categorical variables can be displayed and analyzed using two way tables. • Data involving two quantitative variables can be displayed and analyzed using scatterplots.	**Students will be able to...** • Create and analyze dot plots. • Create and analyze histograms. • Calculate the mean, median, mode, range, and IQR. • Use technology to calculate the five-number summary and the standard deviation. • Interpret the standard deviation and compare the standard deviation between two data sets. • Create and analyze box plots. • Interpret the skewness of data. • Use a two-way table to describe categorical data • Create a scatterplot to display quantitative data • Describe a scatterplot in terms of direction and strength • Sketch a line of best fit for a scatterplot • Use technology to calculate the equation of the line of best fit and to calculate the correlation coefficient • Use the equation of the line of best fit to make predictions about the data set
Key Vocabulary: Box Plot, Dot Plot, Histogram, Interquartile Range, Mean, Median, Mode, Outlier, Range, Skewed Left, Skewed Right, Skewness, Standard Deviation, Two way table, Scatterplot, Direction, Strength, Correlation, Extrapolation, Interpolation	
Assessment Evidence	
Performance Tasks: Summative Project - Students create a set of data relating their height versus the number of steps taken; they use the graphing calculator to determine the equation of the line of best fit and then answer questions related to this line. Students also calculate measures of center and spread and create a histogram of the class data. **TCC3(9-12)**	**Other Evidence:** Common Formative/Interim Assessments: • Creating and analyzing graphs • Calculating and comparing measures of center and spread • Two way tables

Learning Plan
This unit is designed to have students learn how to summarize data, both graphically and through statistics. ● Students study one variable quantitative data. Students create and analyze dot plots, histograms, and boxplots. They discuss the shape of these graphs, focusing on symmetry and skewness. ● Students use one variable statistics to summarize data. They calculate mean, median, mode, range, the 5 number summary, and the interquartile range (IQR) by hand, before learning how to calculate these using technology (graphing calculator and desmos calculator). Students use technology to calculate the standard deviation. ● Students look at two variable categorical data, which is summarized in two way tables. They create tables based on data, and they describe the data by calculating relative frequencies. ● Students study two variable quantitative data by creating and describing scatterplots. They use technology (graphing calculator and desmos calculator) to determine the equation of the line of best fit and to calculate the correlation coefficient. They interpret the slope and y-intercept of the trend line and use the trend line to make predictions about the data. The unit concludes with a final project where students collect data to analyze the relationship between their height and the number of steps taken. **TCC3(9-12)**
Teacher Resources: Algebra 1 Textbooks; IM Algebra 1 Unit 1: One-Variable Statistics; IM Algebra 1 Unit 3: Two-Variable Statistics; State of CT Algebra 1 Model Curriculum Unit 5; Desmos; TI Smartview Software; Teacher created in-class notes, activities, and problem sets; Desmos; Khan academy; IXL; Socrative; Blooket; Quizizz; Kahoot

Unit 6 - Exponential Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **8.EE.A.1** Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, 3^2 times 3^(-5) = 3^(-3) = 1/3^3 = 1/27.*
- **N.RN.A.1** Explain how the definition of the meaning of a rational exponent follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define 5^(1/3) to be the cube root of 5 because we want [5^(1/3)]^3 = 5^[(1/3) x 3] to hold, so [5^(1/3)]^3 must equal 5.*
- **N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.
- **F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities,** and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* (For this unit, we will be discussing finding the asymptote and y-intercept).*
- **F.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand and in simple cases using technology for more complicated cases.*
    - **F.IF.C.7.E Graph exponential** and logarithmic **functions, showing intercepts** and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- **F.IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
    - **F.I.C.8.B** Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (1.02)^t, y = (0.97)^t, y = (1.01)^(12t), y = (1.2)^(t/10), and classify them as representing exponential growth and decay.*
- **F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- **F.BF.A.1** Write a function that describes a relationship between two quantities.*
- **F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions.
    - **F.LE.A.1.A** Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
    - **F.LE.A.1.B** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

- **F.LE.A.1.C** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- **F.LE.A.2 Construct** linear and **exponential functions,** including arithmetic and **given graph, a description of a relationship, or two input-output pairs (including reading these from a table).**
- **F.LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantitative increase linearly, quadratically, or (more generally) as a polynomial function.
- **F.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.
- **A.REI.D.10** 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 (which could be a line).
- **A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **S.ID.B.6.A** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC3(9-12)**: I can integrate relevant information to produce multiple valid solutions.
- **TI3(9-12)**: I can formulate and investigate probing questions to further my learning.
- **CCE4(9-12)**: I can communicate and express my understanding in authentic, respectful, and relevant ways, using the most efficient mode of expression.

Understandings: Students will understand that...

- Exponential functions represent relationships involving a constant multiplicative rate of change.
- Exponential functions represent relationships involving rapid growth or decay and can model real-world situations involving finance, medicine, and populations.
- Exponential and linear models both involve a constant rate of change. Exponential models are a multiplicative rate of change while linear models are an additive rate of change.

Essential Questions:

- How are exponential properties related to observed patterns?
- What are the characteristics of exponential growth and decay and how is this reflected in real-world phenomena?
- How can you differentiate between an exponential model and a linear model?

Students will know...	Students will be able to...
• The properties of exponents are specific rules derived from observed patterns in mathematics. These include the product, quotient, and power rules, as well as the zero exponent and negative exponent rules. • Rational exponents allow you to convert expressions to simplify. • Radical expressions can be simplified by removing any perfect-square factors. • Exponential functions change by a constant factor. • Simple and compound interest is an exponential growth model. • Depreciation and half-life are exponential decay models. • Interest can compound in different time intervals. • The graphs of exponential functions include a horizontal asymptote.	• Simplify expressions using properties of exponents, including integer and rational exponents. • Convert between radicals and rational exponents to simplify expressions. • Simplify radical expressions. • Distinguish between exponential and linear models given graphs, tables, and equations. • Determine the growth/decay rate of an exponential model from tables, graphs, equations, or application problems. • Represent exponential functions graphically or as equations, including situations involving growth, decay, and compound interest. • Model exponential equations from situations involving growth and decay, such as student loan interest or half-life. • Use technology to model and evaluate exponential relations to solve problems. • Graph exponential functions; identify the y-intercept and asymptote.

Key Vocabulary: Appreciation, Base, Compound Interest, Cube Root, Decay, Decay Factor, Depreciation, Expont, Exponential Function, Growth, Growth Factor, Initial Value, Integer Exponents, Negative Exponent, Power, Power Rule, Product Rule, Quotient Rule, Radical, Rational Exponent, Square Root

Assessment Evidence

Performance Tasks:	Other Evidence:
Summative Assessment: Test Unit 6 TCC3(9-12); CCE4(9-12). Topics will include: • Simplifying expressions using the properties of exponents • Converting between rational and radical form • Identifying linear and exponential relations • Graphing exponential functions • Applications problems to model exponential growth and decay using the simple and compound interest formulas	In-class activity: • Exploration of the properties of exponents to derive the rules for the product, quotient, and power rules. **TI3(9-12)** • Properties of exponents maze activity Common Formative Assessment/Interim: • Properties of exponents • Modeling with the simple and compound interest formulas.

Learning Plan

In this unit, students will explore the properties of exponents and exponential functions, including their applications to everyday life. Students will distinguish between linear functions and exponential functions. This is also the first function in which students are exposed to the idea of an asymptote, a line that the graph approaches, and functions with range restrictions.

- Students will investigate the properties of exponents and simplify expressions using the properties of exponents. **TI3(9-12)**
- Students will extend the properties of exponents to rational exponents and convert between rational exponents and radical expressions. **TCC3(9-12)**
- Students will compare linear and exponential models.
- Students will construct exponential functions to model growth and decay using simple and compound interest. This will include examples of tax, loans, car value, and population modeling.
- Students will graph exponential functions including their key features of the horizontal asymptote, y-intercept, and 1-2 other points.

Teacher Resources: Algebra 1 Textbooks; IM Algebra 1 Unit 5: Introduction to Exponential Functions; State of CT Algebra 1 Model Curriculum Unit 7; Desmos; TI Smartview Software; Teacher created in-class notes, activities, and problem sets

Unit 7 - Operations with Polynomial Expressions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.*
  - **A.SSE.A.1.A** Interpret parts of an expression, such as terms, factors, and coefficients.
- **A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it. For example, see x^4 – y^4 as (x^2)^2 – (y^2)^2, thus recognizing it as a difference of squares that can be factored as (x^2 – y^2)(x^2 + y^2).
- **A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
  - **A.SSE.B.3.A** Factor a quadratic expression to reveal the zeros of the function it defines.
  - **A.SSE.B.3.B** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- **A.APR.A.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- **A.APR.B.3** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- **F.IF.C.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
  - **F.IF.C.8.A** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... (“I can” statements to be demonstrated)

- **TCC2(9-12):** I can evaluate evidence from multiple perspectives, and recognize their limitations and implications, in order to justify new conclusions.

- **CCE4(9-12):** I can communicate and express my understanding in an authentic, respectful and relevant way, using the most effective mode of expression.

Understandings: Students will understand that... • Polynomial expressions can be simplified and factored using different strategies. • Operations on polynomials follow similar rules to operations on integers. • Factoring allows us to identify important features such as zeros of a function.	**Essential Questions:** • How can polynomials be classified and simplified? • What is the difference between a constant, linear, quadratic, and cubic polynomial? • How do operations on polynomials reflect operations on numbers? • How can you verify two algebraic expressions that appear to be different are equivalent? • How do you determine which strategy to use when factoring polynomial expressions?
Students will know... • Polynomials are classified by the degree and number of terms (Monomial, Binomial, Trinomial, Polynomial, Constant, Linear, Quadratic, Cubic, Quartic, Quintic). • Distribution is an extension of the properties of exponents and multiplication. • Like terms mean the same variable and the same degree. • Standard form is the highest degree term to the lowest degree. • Factoring is the inverse of a product. • The mathematical rules for adding, subtracting, and multiplying polynomials. • Various methods of factoring including GCF, grouping, difference of squares, and trinomials.	**Students will be able to…** • Classify a polynomial by its degree and number of terms. • Simplify/Perform the operations of adding, subtracting, and multiplying on polynomial expressions. • Write a polynomial expression in standard form. • Factor the GCF from a polynomial expression. • Factor trinomials, binomials (difference of squares), and polynomials with 4 terms (grouping). • Recognize that the sum of two squares cannot be factored under the real numbers.

Key Vocabulary: polynomial, degree, term, monomial, binomial, trinomial, constant, linear, quadratic, cubic, quartic, quintic, factor, GCF (greatest common factor), difference of two squares, grouping, distributive property, like terms, factor completely, perfect square trinomials, standard form

Assessment Evidence

Performance Tasks: **Summative Assessment: Test Unit 7 TCC2(9-12); CCE4(9-12)** Topics will include: • Classifying polynomial expressions • Simplify polynomial expressions and rewrite in standard form	**Other Evidence:** Common Formative/Interim Assessments: • Vocabulary, adding and subtracting polynomials • Multiplying polynomials • Factoring the GCF

• Multiply polynomial expressions • Factor polynomial expressions including GCF, difference of two squares, a=1, and a>1 (if time permits).	• Factoring trinomials when a=1, • Factoring a difference of squares • Factoring polynomial expressions by grouping
Learning Plan	
This unit begins with students developing an understanding of what it means to be a polynomial. Examples and non-examples are compared to arrive at a definition. Students will classify polynomials by their degree and number of terms. Students learn to add, subtract, and multiply polynomials. Students learn how to factor the greatest common factor from a polynomial, and how to factor a trinomial into two binomials.Students learn to factor binomials when they are a difference of squares. Finally, students will use factoring by grouping to factor polynomials with 4 terms.	
Teacher Resources: Algebra 1 Textbooks; IM Algebra 2 Unit 2: Polynomials and Rational Functions (lessons 1-4); State of CT Algebra 1 Model Curriculum Unit 8; Teacher created worksheets and assessments; Desmos; Khan academy; IXL; Socrative; Blooket; Quizizz; Kahoot	

Unit 8 - Introduction to Quadratic Functions

Desired Results - Goals, Transfer, Meaning, Acquisition

Established Goals:

Common Core State Standards (* indicates a modeling standard. For standards that encompass several different topics/concepts, the bolded part is the focus for this unit. If no bolding, the entire standard pertains to this unit.)

- **A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems.** *Include equations arising from linear and **quadratic functions**, and simple rational and exponential functions.*
- **A.CED.A.2** Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.REI.A.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- **A.REI.B.4** Solve quadratic equations in one variable.
    - **A.REI.B.4.B** Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
- **F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts;** intervals where the function is increasing, decreasing, positive, or negative; **relative maximums and minimums; symmetries; end behavior**; and periodicity.**
- **F.IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
- **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
    - **F.IF.C.7.A** Graph linear and quadratic functions and show intercepts, maxima, and minima.*
- **F.IF.C.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- **F.BF.A.1** Write a function that describes a relationship between two quantities.*
- **F.BF.B.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. *An exploratory introduction if time permits. This is not assessed in Algebra 1, it will be taught and assessed in Algebra 2.*
- **S.ID.B.6.A** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or

choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

- **N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.*
- **N.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.*
- **N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*

Standards for Mathematical Practice

- MP1: Make sense of problems and persevere in solving them.
- MP2: Reason abstractly and quantitatively.
- MP3: Construct viable arguments and critique the reasoning of others.
- MP4: Model with mathematics.
- MP5: Use appropriate tools strategically.
- MP6: Attend to precision.
- MP7: Look for and make use of structure.
- MP8: Look for and express regularity in repeated reasoning.

Vision of A Learner Attributes: Students will be able to independently use their learning to... ("I can" statements to be demonstrated)

- **TCC3(9-12):** I can integrate relevant information to produce multiple valid solutions.
- **AA1(9-12)**: I can evaluate different approaches and justify the best pathway to success.

Understandings: Students will understand that...

- Quadratic functions model situations involving parabolic patterns.
- The features of a parabola can be interpreted to make predictions and draw conclusions.
- If the product of two quantities equals zero, at least one of the quantities equals zero.
- There are a variety of methods to solve a quadratic equation and often one method will be more efficient than the others.

Essential Questions:

- Why is it useful to write a polynomial in factored form?
- How do you determine the most efficient method to solve a quadratic?
- How do quadratic functions model real world phenomena?
- What do the vertex and intercepts tell us about the function?

Students will know...

- Quadratic functions can be represented graphically, algebraically, or numerically.
- The best method for solving a quadratic equation depends on the original format of the equation.
- Quadratic functions have an axis of symmetry through the vertex.
- The y-value of the vertex is the maximum or minimum of the

Students will be able to...

- Solve quadratic equations using square roots, factoring, and the quadratic formula.
- Defend/justify the most efficient approach to solving a quadratic equation.
- Graph quadratic functions in standard form.
- Connect the solutions of the equations with the x-intercepts of the function and connect the vertex with the maximum or

quadratic function. ● The x-intercepts of the graph are the solutions of the equation. ● Previous knowledge (for example, area is length x width, revenue is product x price, etc.) can be represented by/applied to quadratic equations/functions.	minimum value. ● Use quadratic reasoning (for example, area is length x width, revenue is product x price, maximum = vertex, etc.) to solve problems.
Key Vocabulary: Quadratic function, axis of symmetry, maximum, minimum, x-intercept, y-intercept, roots, solutions, zeros, standard form, intercept form, quadratic formula, vertical motion model, zero product property	
Assessment Evidence	
Performance Tasks: **Summative Assessment: Test Unit 8 TCC3(9-12); AA1(9-12)** ● Solve quadratic equations using most efficient method ● Graph parabolas and identify key features ● Write a quadratic function to model projectile motion and other real world phenomena	**Other Evidence:** Common Formative/Interim Assessments: ● Solving by square roots ● Solving by factoring ● Solving by quadratic formula ● Graphing parabolas and identifying key features
Learning Plan	
This unit continues the introduction to quadratics that students had in the polynomial unit. ● Students learn how to calculate the vertex of a parabola and use that to create a complete graph of a quadratic. ● Students identify the vertex, axis of symmetry, x-intercepts, y-intercept, domain, and range of a parabola. ● Students learn to calculate the values of the x-intercepts by solving the quadratic equation using square roots, factoring, and the quadratic formula. ● Students investigate the most efficient method for solving a quadratic equation. ● Students write quadratic equations to model real world situations, such as projectile motion or area. The unit concludes with a summative test. **TCC3(9-12); AA1(9-12)**	
Teacher Resources: State of CT Algebra 1 Model Curriculum Unit 8; Algebra 1 Textbooks; Teacher created worksheets and assessments; Desmos; Khan academy; IXL; Socrative; Blooket; Quizizz; Kahoot	