Curriculum Units and Learning Outcomes

Content Area: Accelerated Algebra I	Grade Level: 9
Unit 1 : Evaluate Expressions, Solve Equations, Graph Linear Equations	

Unit Summary: This unit reviews and extends students' understanding of key topics from Algebra I like simplifying expressions, solving all types of one variable equations, graphing lines, and identifying/ writing functions and relations in various forms. Students will then build on that knowledge to graph piecewise / absolute value functions and explore linear regressions and arithmetic sequences.

Massachusetts Standards:

- **A.SSE.1, 2**
  1.Interpret expressions that represent a quantity in terms of its context.
  a. Interpret parts of an expression, such as terms, factors, and coefficients
  b. Interpret complicated expressions by viewing one or more of their parts as a single entity.
  2. Use the structure of an expression to identify ways to rewrite it.

- **A.REI.1, 3a, 10**
  Understand solving equations as a process of reasoning and explain the reasoning.
  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 or refute a solution method.
  3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  a. Solve linear equations and inequalities in one variable involving absolute value.
  10.Represent and solve equations and inequalities graphically. 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). Show that any point on the graph of an equation in two variables is a solution to the equation.

- **A.CED.1, 2, 4**
  Create equations that describe numbers or relationships.
  1. Create equations and inequalities in one variable and use them to solve problems. (Include equations arising from linear, quadratic, and exponential functions with integer exponents.)

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
4. Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations (Properties of equality).

- **F.IF.1, 2, 4, 5, 7, 9**
Understand the concept of a function and use function notation.
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 (range) of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
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; and end behavior.
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph piecewise-defined functions, including step functions and absolute value functions.
9. Translate among different representations of functions (algebraically, graphically, numerically in tables, or by verbal descriptions). Compare properties of two functions each represented in a different way.

- **F.BF.4a**
Build new functions from existing functions.
4. Find inverse functions algebraically and graphically.
a. Solve an equation of the form $f(x) = c$ for a linear function f that has an inverse and write an expression for the inverse.

- **N.RN.3**
Use properties of rational and irrational numbers.
3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

- **N.Q.1, 2, 3**
Reason quantitatively and use units to solve problems.
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.
2. Define appropriate quantities for the purpose of descriptive modeling.
3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

- **F.LE.1a**
Construct and compare linear, quadratic, and exponential models and solve problems.
1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

Enduring Understandings:

- Equations and expressions to be solved or simplified by applying the correct order of operations and algebraic properties.
- Piecewise functions are comprised of two or more functions. Each function is applied on a different interval along the domain. Piecewise functions are necessary to model real-life situations where functions change over a given interval (cost of shipping an item by its weight or size) Absolute value and step functions are a specific type of piecewise function.
- Algebraic properties are the mathematical laws that govern a legal set of moves one can make when performing a mathematical task.
- Functions are a mathematical way to express the relationship between two variables where every input value has a unique output. There are multiple ways functions can be represented.
- Translations and dilations can be applied to parent functions, such as linear, quadratic, and exponential, in order to graph them and write new functions based on the parent.
- Lines can be represented in three forms: standard, slope intercept, and point slope form. Lines can be graphed or written in each form. Lines can be converted from one form or another, particularly to simplify a problem.
- Arithmetic sequences are generated by analyzing the common difference between terms, then generalizing that information to find additional terms

Essential Questions:

- How do we solve all types of one variable equations?
- Why might there be zero, one, two solutions or an infinite amount of solutions to an equation?
- How do we justify mathematical operations based on algebraic properties?
- How can functions be modeled using tables, maps, equations, and graphs?
- How are a series of transformations used to graph a new function from a parent function?
- How do we determine the domain and range given a graph?
- How do we graph a line?
- What is the difference and relationship between arithmetic sequences and linear equations?

Students will demonstrate KNOWLEDGE of:

- One variable equations, absolute value equations, proportional equations, literal equations and arithmetic sequences.
- functions and relations
- linear functions
- Transformations of parent functions

Students will be SKILLED at:

- Simplify and evaluate expressions
- Use algebraic properties to justify math steps
- Identify functions and relations in many forms
- Transform graphs of functions
- Identify the domain and range of functions and relations

● Algebraic properties ● Algebraic expressions	● Write and solve one variable equations ● Solve absolute value equations ● Identify the number of solutions of an equation ● Solve proportional equations ● Use dimensional analysis to convert units ● Rearrange literal equations for an indicated variable ● Graph Linear Equations (all forms) ● Find terms in an arithmetic sequence ● Write explicit functions from an arithmetic pattern ● Write and graph piecewise and absolute value functions

Estimated Duration: 6 weeks