WGSD Curriculum – Algebra 1

In Algebra 1, instructional time will focus on three critical areas: (1) deepening and extending understanding of linear and exponential relationships, (2) applying linear models to data that exhibit a linear trend, and (3) analyzing, solving, and using quadratic functions.

While the content learning goals describe the mathematics students should be able to understand and do, the first eight learning goals (The Standards for Mathematical Practice) describe how students should engage with these mathematical concepts and skills as they grow in mathematical maturity and expertise. Teachers should connect the mathematical practices to mathematical content in all mathematics instruction. These learning goals merit the most time, resources, innovation, and focus necessary to qualitatively improve the instruction, assessment, and student achievement in mathematics.

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP1

Learning Goal	**Proficiency Scale**
Students will be able to make sense of problems and persevere in solving them.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Discussing, explaining, and solving a problem with multiple representations and in multiple ways. ● Struggling with various attempts over time. ● Learning from previous solution attempts. ● Checking answers using a different method or strategy. 2: Student demonstrates they are nearing proficiency by: ● Explaining his/her thought processes when solving a problem and representing it in several ways. ● Trying several approaches in find a solution and seeking hints only if stuck. 1: Student demonstrates a limited understanding or skill with the learning goal by: ● Explaining his/her thought processes when solving a problem one way. ● Staying with a challenging problem for more than one attempt.

Learning Targets

- Explain the meaning of a problem and look for efficient ways to solve it
- Use concrete objects or pictures to help conceptualize and solve problems
- Checks their thinking by asking themselves, “Does this make sense?”
- Listens to the strategies of others and tries different approaches
- Uses a different strategies to check answers
- Takes time to thoughtfully consider problems

Learning Design

- Provides time and facilitates discussion in problem solutions
- Facilitates discourse in the classroom so that students UNDERSTAND the approaches of others
- Provides opportunities for students to explain themselves, the meaning of a problem, etc.
- Provides opportunities for students to connect concepts to “their” world
- Provides students TIME to think and become “patient” problem solvers
- Facilitates and encourages students to check their answers using different methods (not calculators)
- Provides problems that focus on relationships and are “generalizable”

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP2

Learning Goal	**Proficiency Scale**
Students will be able to reason abstractly and quantitatively.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by ● Converting situations into symbols to solve problems. ● Converting mathematical equations into meaningful situations. 2: Student demonstrates they are nearing proficiency by translating situations into symbols to solve problems. 1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems.

Learning Targets

- Recognize that a number represents a specific quantity
- Connect the quantity to written symbols and create a logical representation of the problem at hand
- Consider both the appropriate units involved and the meaning of quantities
- Write simple expressions that record calculations with numbers and symbols
- Represent or round numbers using place value concepts

Learning Design

- Provides a range of representations of math problem situations and encourages various solutions
- Provides opportunities for students to make sense of quantities and their relationships in problem situations
- Provides problems that require flexible use of properties of operations and objects
- Emphasizes quantitative reasoning which entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them and/or rules; and knowing and flexibly using different properties of operations and objects

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP3

Learning Goal	**Proficiency Scale**
Students will be able to construct viable arguments and critique the reasoning of others.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Justifying and explaining, with accurate language and vocabulary, why his/her solution is correct. ● Comparing his/her strategy to other students' strategies, asking questions, and making connections with his/her own thinking. ● Explaining the reasoning of others. 2: Student demonstrates they are nearing proficiency by: ● Explaining his/her thinking and the thinking of others with accurate vocabulary. ● Explaining other students' solutions and identifying strengths and weaknesses of the strategy. 1: Student demonstrates a limited understanding or skill with the learning goal by: ● Explaining his/her solution. ● Discussing other ideas, approaches, and strategies.

Learning Targets

- Construct arguments using concrete referents, such as objects, pictures, and drawings
- Refine their mathematical communication skills by answering questions like "How do you know?" and "Can you show me another way?"
- Refine their mathematical communication skills by asking others questions like "How do you know?" and "How did you get that?"
- Explain their thinking to others and respond to others' thinking

Learning Design

- Provides ALL students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments
- Provides ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures
- Provides opportunities for students to construct arguments and critique arguments of peers
- Facilitates and guides students in recognizing and using counterexamples
- Encourages and facilitates students justifying their conclusions, communicating, and responding to the arguments of others
- Asks useful questions to clarify and/or improve students' arguments

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP4

Learning Goal	**Proficiency Scale**
Students will be able to model with mathematics.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Recognizing math in everyday situations. ● Using a variety of models, symbolic representations, and technology tools to represent the solution to a problem and accurately explain the solution representation. 2: Student demonstrates they are nearing proficiency by: ● Recognize math in everyday situations, when prompted. ● Using models and symbols to represent and solve a problem. 1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.

Learning Targets

- Represents problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. and use all of these representations as needed
- Connect different representations and explain the connections
- Evaluate results in the context of the situation and reflect on whether the results make sense
- Evaluate the utility of models to determine which models are most useful and efficient to solve problems

Learning Design

- Provides problem situations that apply to everyday life
- Provides rich tasks that focus on conceptual understanding, relationships, etc.

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP5

Learning Goal	**Proficiency Scale**
Students will be able to use appropriate tools strategically.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by combining various tools to explore and solve a problem as well as justifying his/her tool selection and problem solution. 2: Student demonstrates they are nearing proficiency by selecting from a variety of provided tools the ones that can be used to solve a problem and explaining his/her reasoning for the selection. 1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution.

Learning Targets

- Consider the available tools (including, but not limited to estimation, graph paper, manipulatives, table, list, etc.) when solving a mathematical problem and decide when certain tools might be helpful
- For example, they may use unit cubes to fill a rectangular prism and a ruler to measure the dimensions
- Use graph paper to accurately create graphs and solve problems or make predictions from real world data

Learning Design

- Provides a variety of tools and technology for students to explore to deepen their understanding of math concepts
- Provides problem solving tasks that require students to consider a variety of tools for solving (Tools might include pencil/paper, concrete models, manipulatives, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software, etc.)

WGSD Curriculum – Algebra 1
Mathematical Practices

<table>
<tr><td colspan="2"><u>High Priority Standards</u>
CCSS.Math.Practice.MP6</td></tr>
<tr><td><u>Learning Goal</u>

Students will be able to attend to precision.</td><td><u>Proficiency Scale</u>
4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas.

2: Student demonstrates they are nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications.

1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.</td></tr>
<tr><td colspan="2"><u>Learning Targets</u>
● Use clear and precise language in their discussions with others and in their own reasoning
● Specify units of measure and state the meaning of the symbols used
● Report answers that appropriately address the context of a problem</td></tr>
<tr><td colspan="2"><u>Learning Design</u>
● Facilitates, encourages and expects precision in communication
● Provides opportunities for students to explain and/or write their reasoning to others</td></tr>
</table>

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP7

Learning Goal	**Proficiency Scale**
Students will be able to look for and make use of structure.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Noticing mathematical expressions as component parts. ● Using mathematical generalizations to identify the most efficient solution to mathematical tasks. 2: Student demonstrates they are nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions. 1: Student demonstrates a limited understanding or skill with the learning goal by looking for structure or patterns within mathematics to help him/her solve problems efficiently.

Learning Targets

- Look closely to discover a pattern or structure
  - For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals.
- Examine numerical patterns and relate them to a rule or a graphical representation

Learning Design

- Provides opportunities and time for students to explore patterns and relationships to solve problems
- Provides rich tasks and facilitates pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures

WGSD Curriculum – Algebra 1
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP8

Learning Goal	**Proficiency Scale**
Students will be able to look for and express regularity in repeated reasoning.	4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: ● Connecting prior knowledge to an unfamiliar mathematical situation. ● Creating a model or equation that unifies the various aspects of a problem. ● Noticing patterns, making generalizations, and predicting patterns. 2: Student demonstrates they are nearing proficiency by finding and explaining patterns. 1: Student demonstrates a limited understanding or skill with the learning goal by connecting prior knowledge to new situations and noticing patterns with prompting from a teacher or peer.

Learning Targets

- Notice repetitive actions in computation and look for more shortcut methods
- Use repeated reasoning to understand algorithms and make generalizations about patterns

Learning Design

- Provides problem situations that allow students to explore regularity and repeated reasoning
- Provides rich tasks that encourage students to use repeated reasoning to form generalizations and provides opportunities for students to communicate these generalizations

High Priority Standards

A1.IF.A.1 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. a.Represent a function using function notation. b.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).
A1.IF.A.2 Use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
A1.IF.B.3 Using tables, graphs and verbal descriptions,interpret key characteristics of a function that models the relationship between two quantities.
A1.IF.B.4 Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
A1.IF.B.5 Determine the average rate of change of a function over a specified interval and interpret the meaning.
A1.IF.B.6 Interpret the parameters of a linear or exponential function in terms of the context.
A1.IF.C.7 Graph functions expressed symbolically and identify and interpret key features of the graph.
A1.IF.C.8 Translate between different but equivalent forms of a function to reveal and explain properties of the function and interpret these in terms of a context.
A1.IF.C.9 Compare the properties of two functions given different representations.
A1.BF.A.1 Analyze the effect of translations and scale changes on functions.

Learning Goal

Students will be able to graph and analyze linear, quadratic, and exponential functions including transformations.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Understanding that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.
- Representing a function using function notation.
- Using function notation to evaluate functions for inputs in their domains.
- Interpreting statements that use function notation in terms of a context.
- Determining the average rate of change of a function over a specified interval.
- Interpreting the meaning of the average rate of change over a specified interval in a given context.
- Using tables, graphs and descriptions, interpret key characteristics of a function that models the relationship between two quantities (intercepts, slope, vertex, intervals where the function is increasing or decreasing, symmetries, and end behavior).
- Interpreting the parameters of a linear or exponential function in terms of the context.
- Graphing functions (linear, quadratic, and exponential) from their symbolic representation to show key features of the graph both by hand and by using technology.
- Translating between different forms of a function to reveal and explain different properties of the function and interpreting them in terms of a context (e.g. slope, intercepts, and extreme values).
- Comparing the properties of two functions (linear, exponential, and quadratic) given different representations (e.g. tables, graphs, equations, and in words).
- Analyzing the effect of translations and scale changes on functions.

	2: Student demonstrates they are nearing proficiency by: ● Recognizing and recalling specific vocabulary such as: input, output, domain, range, function, linear, quadratic, exponential, function notation f(x), intercepts, increasing, decreasing, maximum, minimum, zeros ● Performing processes such as: ○ Understanding that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation y=f(x). ○ Relating the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. ○ Determining if a function is linear, quadratic, exponential. ○ Determining if a relation is a function. ○ Recognizing maximum, minimum, and y-intercepts from a graph. 1: Student demonstrates a limited understanding or skill with the learning goal by determining if a graph is a function using the vertical line test.

Learning Targets

- Understand the concept of a function and use function notation
- Understand that f(x) denotes the elements of the range of a function f that correspond to the to the elements of the domain and the graph of f is the graph of the equation y = f(x)
- Understand that the input and output values of a function correspond to (x, y) values on the Cartesian coordinate plane.
- Interpret functions that arise in applications in terms of a context
- Analyze functions using different representations
- Build a function that models a relationship between two quantities
- Interpret the parameters of functions in terms of the situation they model
- Translate between different but equivalent forms of a function to reveal and explain properties of the function and interpret these in terms of a context (e.g. Explain what happens as the values of t increase $A=300(.96)^t$.)
- Analyze the effect of the scale change on the graph f(x) by kf(x) for specific values of k.
- Analyze the effect of the translation on the graph f(x) by f(x) + k for specific values of k.
- Analyze the effect of the translation on the graph f(x) by f(x + k) for specific values of k.
- Find the specific value of k given the graphs of f(x) and the graph after translations and scale changes have been performed.
- Limit quadratics to vertex form.

Learning Design

High Priority Standards

A1.CED.A.1 Create equations and inequalities in one variable and use them to model and/or solve problems.
A1.CED.A.2 Create and graph linear, quadratic and exponential equations in two variables.
A1.CED.A.3 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
A1.REI.A.1 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.
A1.REI.C.6 Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.
A1.REI.C.7 Graph the solution to a linear inequality in two variables.

Learning Goal

Students will be able to solve, write, and graph equations and inequalities.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Creating and manipulating equations in multiple forms.
- Solving multi-step equations.
- Solving and graphing linear inequalities.
- Creating linear, quadratic, and exponential equations in one variable to model and solve problems.
- Creating linear, quadratic, and exponential equations in two variables to model and solve problems.
- Graphing linear, quadratic, and exponential equations in two variables on the Cartesian coordinate plane with labels and scales.
- Creating linear inequalities to model and solve problems.
- Interpreting data points to determine if they are a solution or non-solution within a modeling context.
- Representing constraints with a linear equation or linear inequality within a modeling context.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: linear equation, inequality, equations, slope-intercept form, y-intercepts, x-intercepts, coefficient, constant, variable, coordinate plane, quadrants, distributive property, combining like terms, standard form
- Performing processes such as:
    - Explaining how each step taken when solving a linear equation or linear inequality creates an equivalent equation or inequality that has the same solution(s) as the original.
    - Explaining that the graph of a linear or exponential equation in two variables is the set of all its solutions plotted on the Cartesian coordinate plane.

	○ Explaining that a point not on the graph of a linear or exponential equation in the Cartesian coordinate plane is not a solution. 1: Student demonstrates a limited understanding or skill with the learning goal by finding the slope and y-intercept from an equation in slope-intercept form.

Learning Targets

- Represent and solve equations and inequalities graphically and explain that the graph is the set of all its solutions plotted on the coordinate plane.
- Interpret parts of an expression, such as terms, factors, and coefficients
- Create equations and inequalities in one variable and use them to solve problems.
- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales
- Represent constraints by equations or inequalities and interpret the data points as a solution or non-solution in a modeling context.
- In exponential relationships when solving for the exponent, limit bases to 2, 3, 5, and 10 and limit exponents to 1, 2, 3, and 4.
- Example: Explain why $2x + 6 = 8$ and $2x = 2$ are equivalent and have the same solution.
- When creating and graphing equations, limit exponentials to the form $y = ab^x$, where b is rational and greater than zero.

Learning Design

High Priority Standards

A1.REI.B.3 Solve a system of linear equations algebraically and/or graphically.
A1.REI.B.4 Solve a system consisting of a linear equation and a quadratic equation algebraically and/or graphically.
A1.REI.B.5 Justify that the technique of linear combination produces an equivalent system of equations.
A1.REI.C.8 Solve problems involving a system of linear inequalities.
A1.CED.A.3 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 Goal

Students will be able to solve systems of equations and inequalities.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Solving systems of linear equations by substitution and linear combination (elimination).
- Solving a system of a linear and a quadratic equation algebraically and graphically.
- Writing a system of linear equations to model a situation.
- Solving a system of linear inequalities.
- Interpreting the solution to a systems of linear inequalities in the context provided.
- Representing constraints with a system of equations and/or inequalities within a modeling context.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: system of equations, point of intersection, parallel, infinite solutions, substitution, linear combination, solution set, coefficient
- Performing processes such as solving systems of linear equations by graphing.

1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Solve systems of equations and inequalities
- Justify that the technique of linear combination produces an equivalent system of equations.
- Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables
- Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane
- 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
- Represent constraints by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context

Learning Design

High Priority Standards

A1.APR.A.1 Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.
A1.APR.A.2 Divide polynomials by monomials.
A1.SSE.A.2 Analyze the structure of polynomials to create equivalent expressions or equations.

Learning Goal

Students will be able to simplify exponential and polynomial expressions.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Multiplying polynomials by polynomials.
- Dividing polynomials by monomials.
- Simplifying expressions using multiple rules of exponents.
- Factoring polynomial expressions.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: polynomials, monomials, binomials, trinomials, base, exponent, coefficient, constant, greatest common factor, terms, like terms, expression, degree of term, degree of polynomial, factor
- Performing processes such as:
  - Adding and subtracting polynomials.
  - Multiplying a polynomial by a monomial.
  - Writing a polynomial in standard form and determining the degree of polynomial.
  - Simplifying expressions using a single rule of exponents.

1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Perform arithmetic operations on polynomials
- Multiplying polynomials limited to the product of a binomial and a trinomial (or fewer terms).
- Integer coefficients for all polynomial operations.
- When dividing, the monomial should be a factor of the polynomial.
- When factoring, include polynomials with a GCF that, when factored, results in a factorable quadratic expression.
- Analyze the structure of polynomials to determine an appropriate method for decomposing and composing to create equivalent equations.

High Priority Standards

A1.SSE.A.3 Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties. a) Find the zeros of a quadratic function by rewriting it in factored form. b) Find the maximum or minimum value of a quadratic function by completing the square.
A1.CED.A.2 Create and graph linear, quadratic and exponential equations in two variables.
A1.REI.A.2 Solve problems involving quadratic equations. a) Use the method of completing the square to create an equivalent quadratic equation. c) Analyze different methods of solving quadratic equations.

Learning Goal

Students will be able to model, analyze and solve quadratic relationships.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Solving quadratic equations using factoring, taking square roots, completing the square, and using the quadratic formula.
- Creating and using quadratic equations to model a situation.
- Finding the zeros of a quadratic function by rewriting it in factored form.
- Graphing quadratic equations and identifying intercepts and maximum or minimum.
- Using the method of completing the square to create an equivalent quadratic equation in the form $(x - p)^2 = q$, for the purpose of solving the quadratic equation for certain value(s).
- Finding the maximum or minimum value of a quadratic function by completing the square.
- Representing a quadratic relationship in equivalent forms (graph, table, and equation)
- Analyzing quadratic equations to determine the best method for solving.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: maximum, minimum, zeros, intercepts, quadratic, square root, factor, equivalent, parabola, and vertex form.
- Performing processes such as:
  - Understanding that the vertex of an equation in the form $y = a(x - h)^2 + k$ is (h, k).

1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Use the process of factoring a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context
- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function

- Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions
- 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.
- If a quadratic equation has a complex solution, the result can be stated as “no real solution”.
- When completing the square, given $ax^2 + bx + c$, limited to a = 1 and limit b to even integers.
- When creating equations, limit to simple quadratics ($y = ax^2$, $y = ax^2 + b$)

Learning Design

High Priority Standards

A1.CED.A.4 Solve literal equations and formulas for a specified variable that highlights a quantity of interest.
A1.REI.A.1 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.
A1.SSE.A.1 Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.
A1.NQ.A.1 Explain how the meaning of rational exponents extends from the properties of integer exponents.
A1.NQ.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1.

Learning Goal

Students will be able to manipulate equations.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Solving literal equations and formulas for a specified variable that highlights a quantity of interest.
- Interpreting the contextual meaning of individual terms or factors in a problem.
- Identifying which variable to solve for in a given situation.
- Rewriting equations in other forms (linear: standard and slope-intercept; quadratic: standard, vertex, and factored).
- Rewriting expressions with rational exponents as equivalent radical expressions.
- Rewriting radical expressions as equivalent expressions with rational exponents.
- Applying the properties of exponents to simplify equations with rational exponents.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: formula, variable, solve, function, simplify, equivalent expression, standard, slope-intercept, and vertex
- Performing a process such as
    - Isolating a variable in an equation, without completely simplifying.
    - Explaining how each step when solving an equation or inequality creates an equivalent equation or inequality that has the same solution(s) as the original.

1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R
- Example: Compare how doubling the beginning principal affects the final amount as opposed to doubling the time or the rate. $A = P(1 + r)^t$
- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales
- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression

- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function
- Extend the properties of integer exponents to rational exponents (e.g. (5 1/3)3 = 5 and $\sqrt[n]{x}$ = x 1/n)
- Limit to rational exponents with a numerator of 1.
- For literal equations, limit to formulas and equations with degree three or less and no more than four variables.

High Priority Standards

A1.LQE.A.1 Distinguish between situations that can be modeled with linear or exponential functions. a) Determine that linear functions change by equal differences over equal intervals. b) Recognize exponential situations in which a quantity grows or decays by a constant percent rate per unit interval.
A1.LQE.A.2 Describe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
A1.LQE.A.3 Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
A1.LQE.B.4 Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.
A1.LQE.B.5 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.
A1.LQE.B.6 Find the terms of sequences given an explicit or recursive formula.

Learning Goal

Students will be able to construct and compare linear, quadratic, and exponential models and solve problems.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Distinguishing between situations that can be modeled with linear or exponential functions.
- Describing, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
- Constructing linear, quadratic, and exponential equations given graphs, words, or tables.
- Writing arithmetic and geometric sequences in recursive and explicit forms given graphs, words, or tables.
- Using arithmetic and geometric sequences to model situations
- Translating between the explicit and recursive forms of arithmetic sequences and explicit and recursive forms of geometric sequences.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: exponential growth, exponential decay, arithmetic sequence, geometric sequence, recursive form, explicit form
- Performing processes such as:
  - Recognizing exponential situations in which a quantity grows or decays by a constant percent rate per unit interval.
  - Graphing exponential equations in two variables.
  - Finding the terms of sequences given an explicit or recursive formula.
  - Connecting arithmetic sequences to linear functions and geometric sequences to exponential functions.

1: Student demonstrates a limited understanding or skill with the learning goal by determining that linear functions change by equal differences over equal intervals.

Learning Targets

- Show that linear functions change by equal differences over equal intervals.
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- Show that exponential functions change by equal factors over equal intervals. (*e.g., by algebraic proof, with a table showing differences or by calculating average rates of change over equal intervals)*
- Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.
- Write arithmetic and geometric sequences in recursive and explicit forms given graphs, verbal descriptions, or tables.
- Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.
- Translate between explicit and recursive forms of arithmetic and geometric sequences.
- Model situations with arithmetic geometric sequences.
- Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of the integers.

Learning Design

High Priority Standards

A1.NQ.B.3 Use units of measure as a way to understand and solve problems involving quantities. a)Identify, label and use appropriate units of measure within a problem. b) Convert units and rates.c) Use units within problems. d) Choose and interpret the scale and the origin in graphs and data displays.
A1.NQ.B.4 Define and use appropriate quantities for representing a given context or problem.
A1.NQ.B.5 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Learning Goal

Students will be able to use units to solve problems.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Converting units and rates, including units of area or volume.
- Using unit conversions to perform calculations within a multi-step problem.
- Choosing appropriate scales for the horizontal and vertical axes for graphs and data displays.
- Interpreting the scale for the horizontal and vertical axes and the origin in graphs and data displays.
- Choosing a level of accuracy appropriate to limitations on measurements with any given tool or when reporting quantities.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: significant digits, scientific notation, level of accuracy
- Performing processes such as:
  - Identifying, labeling, and using appropriate units of measure within the contes of problems involving quantities such as rates, time, length, area, and capacity.
  - Identifying situations where information is displayed in a misleading way.
  - Using appropriate units to label a solution based on a given context or problem.

1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Do not provide conversions when converting within systems of measurement.
- Provide conversions when converting between systems of measurement.
- Example: An L-shaped concrete slab is composed of a rectangular piece 30 feet 6 inches by 20 feet 4 inches and a second piece 10 feet 8 inches by 8 feet 3 inches. If the slab is 4 inches thick, how many cubic yards need to be ordered?
- Example: The density of a material is 0.02 kg/cm3. How much would a cubic inch of this material weigh? (use 1 in ≈ 2.54 cm)
- Example: What is 1.6 million divided by 7? How many significant digits should be used? Describe a real-world situations where this might happen.
- When measuring an angle with a protractor, would it be appropriate to say the angle measures 30.123 degrees? Why or why not?

High Priority Standards

A1.DS.A.1 Analyze and interpret graphical displays of data.
A1.DS.A.4 Summarize data in two-way frequency tables. Interpret relative frequencies in the context of the data, and recognize possible associations and trends in the data.
A1.DS.A.5 Construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship. a) Construct a linear function to model bivariate data represented on a scatter plot that minimizes residuals. b) Construct an exponential function to model bivariate data represented on a scatter plot that minimizes residuals.
A1.DS.A.6 Interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.
A1.DS.A.7 Determine and interpret the correlation coefficient for a linear association.
A1.DS.A.8 Distinguish between correlation and causation.

Learning Goal

Students will be able to summarize, represent and interpret data.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Representing data on a scatterplot and determining the type of function that models the relationship.
- Construct a linear function to model the data on a scatterplot (line of best fit) that minimizes residuals.
- Construct an exponential function to model the data represented on a scatterplot that minimizes residuals.
- Interpreting the meaning of the slope and intercept of a linear model in the context of the data.
- Summarize data in two-way frequency tables. Interpret relative frequencies in the context of the data.
- Calculating and comparing the spread (interquartile range and standard deviation) of two or more different data sets.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: positive correlation, negative correlation, no correlation, outlier, scatterplot, slope, intercept, line of best fit, residuals, and range
- Performing processes such as:
    - Recognizing possible associations and trends in the data.
    - Distinguish between correlation and causation.
    - Interpreting the correlation coefficient for a linear association in relation to data.
    - Calculating and comparing the measures of center (median, mean, mode) of two or more different data sets.
    - Interpreting differences in shape, center, and spread in the context of 3 different data sets, accounting for possible effects of outliers.

1: Student demonstrates a limited understanding or skill with the learning goal by analyzing and interpreting data points on a histogram, box plot, dot plot, or scatterplot.

Learning Targets

- Represent data with plots on the real number line (dot plots, histograms, and box plots)
- Use statistics appropriate to the shape of the data distribution to compare center (median, mean, and mode) and spread (interquartile range) of two or more different data sets
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers)
- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related
- Fit a linear function for a scatter plot that suggests a linear association
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data
- Standard deviation should be limited to a small data set (less than or equal to ten data points) with an integral mean.

Learning Design

- Two-way frequency tables: http://mathbitsnotebook.com/Algebra1/StatisticsReg/ST2TwoWayTable.html

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