

WGSD Curriculum – Algebra 2
Mathematical Practices

High Priority Standards
CCSS.Math.Practice.MP1

Learning Goal

Students will be able to make sense of problems and persevere in solving them.

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:
- 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

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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”

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High Priority Standards CCSS.Math.Practice.MP2	
<p><u>Learning Goal</u></p> <p>Students will be able to reason abstractly and quantitatively.</p>	<p><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by</p> <ul style="list-style-type: none"> ● Converting situations into symbols to solve problems. ● Converting mathematical equations into meaningful situations. <p>2: Student demonstrates they are nearing proficiency by translating situations into symbols to solve problems.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● 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 	

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High Priority Standards CCSS.Math.Practice.MP3	
<p><u>Learning Goal</u></p> <p>Students will be able to construct viable arguments and critique the reasoning of others.</p>	<p><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> ● 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. <p>2: Student demonstrates they are nearing proficiency by:</p> <ul style="list-style-type: none"> ● Explaining his/her thinking and the thinking of others with accurate vocabulary. ● Explaining other students’ solutions and identifying strengths and weaknesses of the strategy. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> ● Explaining his/her solution. ● Discussing other ideas, approaches, and strategies.
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● 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 	

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High Priority Standards CCSS.Math.Practice.MP4	
<p><u>Learning Goal</u></p> <p>Students will be able to model with mathematics.</p>	<p><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> ● 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. <p>2: Student demonstrates they are nearing proficiency by:</p> <ul style="list-style-type: none"> ● Recognize math in everyday situations, when prompted. ● Using models and symbols to represent and solve a problem. <p>1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● Provides problem situations that apply to everyday life ● Provides rich tasks that focus on conceptual understanding, relationships, etc. 	

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High Priority Standards CCSS.Math.Practice.MP5	
<p><u>Learning Goal</u></p> <p>Students will be able to use appropriate tools strategically.</p>	<p style="text-align: center;"><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>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.</p> <p>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.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● 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.) 	

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High Priority Standards CCSS.Math.Practice.MP6	
<p><u>Learning Goal</u></p> <p>Students will be able to attend to precision.</p>	<p style="text-align: center;"><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas.</p> <p>2: Student demonstrates they are nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● Facilitates, encourages and expects precision in communication ● Provides opportunities for students to explain and/or write their reasoning to others 	

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High Priority Standards CCSS.Math.Practice.MP7	
<p><u>Learning Goal</u></p> <p>Students will be able to look for and make use of structure.</p>	<p><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> ● Noticing mathematical expressions as component parts. ● Using mathematical generalizations to identify the most efficient solution to mathematical tasks. <p>2: Student demonstrates they are nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions.</p> <p>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.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● Look closely to discover a pattern or structure <ul style="list-style-type: none"> ○ 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 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● 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 	

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High Priority Standards CCSS.Math.Practice.MP8	
<p><u>Learning Goal</u></p> <p>Students will be able to look for and express regularity in repeated reasoning.</p>	<p><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> ● 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. <p>2: Student demonstrates they are nearing proficiency by finding and explaining patterns.</p> <p>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.</p>
<p><u>Learning Targets</u></p> <ul style="list-style-type: none"> ● Notice repetitive actions in computation and look for more shortcut methods ● Use repeated reasoning to understand algorithms and make generalizations about patterns 	
<p><u>Learning Design</u></p> <ul style="list-style-type: none"> ● 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 	

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High Priority Standards

A2.NQ.A.1 Extend the system of powers and roots to include rational exponents.

A2.NQ.A.2 Create and recognize equivalent expressions involving radical and exponential forms of expressions.

A2.NQ.A.3 Add, subtract, multiply and divide radical expressions.

A2.NQ.A.4 Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.

Learning Goal

Students will be able to extend and use the relationship between rational exponents and radicals.

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:
- extending the system of powers and roots to include rational exponents with integer numerators other than 1.
 - creating and recognizing equivalent expressions involving radical and exponential forms of expressions.
 - adding, subtracting, multiplying and dividing radical expressions.
 - using conjugates to simplify rational expressions containing radicals in the denominator.
 - solving equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.
- 2: Student demonstrates they are nearing proficiency by:
- recognizing and recalling specific vocabulary, such as: powers, roots, rational exponents, radical, conjugate, extraneous solutions.
 - performing specific processes, such as:
 - Simplifying radical expressions.
 - Simplifying expressions with rational exponents.
- 1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Simplify expressions including constants and variables as bases and using rational exponents including those with integer numerators other than one.
- Convert from radical form to rational exponent form and from rational exponent form to radical form.
- Recognize that radical form and rational exponent forms are equivalent.
- Exponent denominators should be natural numbers of ten or less; coefficients should be negative one thousand to one thousand, and no more than three distinct variables.
- When simplifying and performing operations on radical expressions, indices should not exceed five.
- When solving equations, polynomials should not exceed degree two, equations can contain one or two radicals, and expressions with rational exponents should be set equal to a constant.

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High Priority Standards

A2.NQ.B.5 Represent complex numbers.

A2.NQ.B.6 Add, subtract, multiply and divide complex numbers.

A2.NQ.B.7 Know and apply the Fundamental Theorem of Algebra.

Learning Goal

Students will be able to use complex numbers.

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:

- adding and subtracting complex numbers with answers given in $a + bi$ form.
- multiplying complex numbers with answers given in $a + bi$ form.
- dividing complex numbers with answers given in $a + bi$ form, using conjugates to rationalize the denominator.
- knowing and applying the Fundamental Theorem of Algebra.
- understanding that complex solutions always occur in pairs.
- understanding that factors repeated n times have a multiplicity of n .

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary, such as: complex numbers, rationalize, multiplicity
- performing processes such as:
 - representing complex numbers in the form $a + bi$, where a and b are real numbers.

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

Learning Targets

- Items requiring $a + bi$ would include items like $(2 + 2i)/4$ which should be written as $1/2 + 1/2i$.
- While simplified answers may have fractional a and/or b values, given problems should use integer values for a and b . When multiplying and dividing, limit a and b to values between negative twelve and twelve.
- Recognize that the degree of a polynomial determines the number of solutions. (real + imaginary).

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High Priority Standards

A2.SSE.A.1 Develop the definition of logarithms based on properties of exponents.

A2.SSE.A.2 Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.

A2.SSE.A.3 Use properties of logarithms to solve equations or find equivalent expressions.

A2.SSE.A.4 Understand why logarithmic scales are used, and use them to solve problems.

Learning Goal

Students will be able to define and use logarithms.

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:

- developing the definition of logarithms $\log_b y = x$ if and only if $b^x = y$, based on properties of exponents.
- using the inverse relationship between exponents and logarithms to solve simple exponential and logarithmic equations.
- using properties of logarithms to solve equations or find equivalent expressions.
- understanding why logarithmic scales are used, and using them to solve problems.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: exponential, logarithmic
- performing processes such as:
 - converting equations from exponential to logarithmic form.
 - converting equations from logarithmic to exponential form.

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

Learning Targets

- Bases should be greater than zero.
- The expressions used as exponents should not exceed linear.
- The expression used in logarithms should not exceed linear $c \log_n(ax + b) = m$, where n or m are integers and c is a constant.
- No more than three distinct variables in expanding and condensing problems.
- Equations should have no more than two terms on one side of the equation and one term on the other side.
- Equations should have the same base throughout.
- Demonstrate an understanding of applications of the logarithmic scale and apply it in problem solving. For example: pH scale, Richter scale, sound intensity, light intensity and the musical scale.
- Demonstrate an understanding of how logarithmic scales are used to compare quantities.

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High Priority Standards

A2.REI.A.1 Create and solve equations and inequalities, including those that involve absolute value.

A2.REI.A.2 Solve rational equations where numerators and denominators are polynomials and where extraneous solutions may result.

A2.REI.B.3 Create and solve systems of equations that may include non-linear equations and inequalities.

Learning Goal

Students will be able to solve equations and inequalities and 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 exponential equations that do not require logarithms.
- writing an equation or inequality to model a context.
- creating and solving quadratic, cubic, exponential, and absolute value equations.
- solving quadratic, exponential, and absolute value inequalities.
- creating step equations.
- solving rational equations by various methods, including instances when the numerator and denominator are polynomials.
- checking solutions and identifying those that are extraneous.
- writing a system of equations to model a context or setting that may include non-linear equations and inequalities.
- solving systems of equations that may include non-linear equations and inequalities.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: linear, quadratic, cubic, exponential, absolute value, non-linear, system of equations, extraneous
- performing processes such as:
 - creating and solving linear equations and inequalities.

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

Learning Targets

- Absolute value equations and inequalities should be limited to variables to the first power. (e.g., $-5|x - 4| + 2 = -20$).
- Systems of equations should be limited to: linear – linear (writing the system is required), linear – linear – linear, linear –quadratic, quadratic – quadratic and non-linear – non-linear.
- Systems of equations should only have three or fewer unknowns.
- If circles are used, the equations should be given in $(x - h)^2 + (y - k)^2 = r^2$ form.
- The student may use algebraic and/or graphical methods to solve these problems.

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High Priority Standards

A2.APR.A.1 Extend the knowledge of factoring to include factors with complex coefficients.

A2.APR.A.2 Understand the Remainder Theorem and use it to solve problems.

A2.APR.A.3 Find the least common multiple of two or more polynomials.

A2.APR.A.4 Add, subtract, multiply and divide rational expressions.

A2.APR.A.5 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.

Learning Goal

Students will be able to perform operations on polynomials and rational 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:

- extending the knowledge of factoring to include factors with complex coefficients.
- understanding the Remainder Theorem and using it to solve problems.
- dividing polynomials, using long division and synthetic division.
- finding the least common multiple of two or more polynomials.
- adding and subtracting rational expressions, including those with polynomial numerators and denominators, including those unlike denominators.
- multiplying and dividing rational expressions, including those with polynomial numerators and denominators.
- identifying zeros of polynomials when suitable factorizations are available, and using the zeros to sketch the function defined by the polynomial.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: remainder theorem, synthetic division
- performing processes such as:
 - completely factoring polynomials with rational coefficients.

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

Learning Targets

- Extend the knowledge of factoring to completely factor general polynomial expressions.
- Factor simple expressions that require complex coefficients, such as $x^2 + 16 = (x + 4i)(x - 4i)$.
- Any of the following factoring problems can be assessed: difference of squares, trinomials, sum of cubes, difference of cubes, GCF, factor by grouping and quartic with no more than four terms.
- Understand that a remainder of zero indicates the divisor is a factor of the dividend.
- Understand that a remainder other than zero indicates the divisor is not a factor of the dividend.

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- Express the result as a quotient with a remainder.
- Understand the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division of $p(x)$ by $(x-a)$ is $p(a)$, so $p(a) = 0$ if and only if $(x-a)$ is a factor of $p(x)$.
- Divisors should not be greater than degree two.
- Dividends should not be greater than degree four.
- When finding the least common multiple, polynomials should be factorable and of degree four or less.
- When adding, subtracting, multiplying and dividing rational expressions: Final answers should not have common factors in the numerators and denominators. Polynomials should not exceed degree four. The number of expressions should not exceed three for an addition, subtraction or multiplication problem.
- Factor polynomials and use the zero-product property to identify the zeros.
- Use the zeros and other key characteristics to sketch the function defined by the polynomial. Polynomials should be no greater than degree four. Intercepts should be written as ordered pairs in items and in responses.

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High Priority Standards

A2.IF.A.1 Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.

A2.IF.A.2 Translate between equivalent forms of functions.

Learning Goal

Students will be able to use and interpret functions.

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:
- identifying and interpreting key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.
 - representing a given function as a table, equation or graph.
 - translating between equivalent forms of functions.
- 2: Student demonstrates they are nearing proficiency by:
- recognizing and recalling specific vocabulary such as: function, domain, range, piece-wise, step function, end behavior, x- and y-intercept, local maxima and minima value, symmetry, points of discontinuity, interval of increasing and decreasing, and horizontal and vertical asymptote.
 - performing processes such as:
 - identifying the vertex and intercepts of a quadratic function.
- 1: Student demonstrates a limited understanding or skill with the learning goal.

Learning Targets

- Identify the following key characteristics of functions from graphs, tables and equations: domain, range, end behavior, x- and y-intercepts, local maxima and minima values, symmetries, points of discontinuity, intervals of increasing and decreasing, and horizontal and vertical asymptotes.
- Identify these key characteristics for general polynomials, square roots, cube roots, absolute value of linear functions, simple piece-wise defined, step functions, exponential, logarithmic, and rational functions.
- Represent a given function as a table, equation or graph.
- Determine specific values of a function from a table, graph, or equation. Polynomials should be of no greater degree than four, intercepts are ordered pairs, and limit rational functions to those without oblique asymptotes.
- Translate between equivalent forms of functions.
- Find equivalent forms of functions to highlight key characteristics.
- For example, Write a quadratic function in vertex form ($y = a(x - h)^2 + k$ where (h, k) is the vertex), standard form ($y = ax^2 + bx + c$), and/or intercept form ($y = a(x - p)(x - q)$ where p and q are the x intercepts) by factorization, completing the square and multiplication.

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High Priority Standards

A2.BF.A.1 Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).

A2.BF.A.2 Derive inverses of functions, and compose the inverse with the original function to show that the functions are inverses.

A2.BF.A.3 Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

Learning Goal

Students will be able to create new functions from existing functions.

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 new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).
- deriving inverses of functions, and composing the inverse with the original function to show that the functions are inverses.
- describing the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: function, domain, range, inverse, transformation, dilation, stretch, shrink
- performing processes such as:
 - deriving the inverse of a linear function.

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

Learning Targets

- Add functions to create new functions, and determine the domain and range of the new function, (modifying the domain and range as necessary).
- Subtract functions to create new functions, and determine the domain and range of the new function (modifying the domain and range as necessary).
- Multiply functions to create new functions, and determine the domain and range of the new function (modifying the domain and range as necessary).
- Divide functions to create new functions, and determine the domain and range of the new function, (modifying the domain and range as necessary).
- Compose functions, and determine the domain and range of the new function.
- The number of functions to compose should be restricted to two.
 - Domains and ranges will be given in word form (i.e., all reals) or as inequalities.
 - The degree of the polynomials to be composed should be no greater than a linear function with a quadratic function.
 - Items may contain $f(g(x))$ and $f \circ g(x)$ notation.

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- Derive inverses of given functions.
- Compose functions to determine if they are inverses.
- Compose the inverse with the original function to prove that the functions are inverses.
- When finding inverses, limit functions to linear, quadratic, exponential, logarithmic and cubic (cubic functions will be limited to $f(x) = ax^3 + b$).
- Describe the effects of transformations algebraically using a, h, and k, given an equation in the form $f(x)=a(x - h) + k$, or given other general forms of the functions listed.
- Describe the effects of transformations graphically using terms such as horizontal or vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation.
- Create equations from the linear, quadratic, cubic, square and cube root, and absolute value, exponential and logarithmic parent functions that produce the above listed transformations.
- Create graphs from the linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic parent graphs that demonstrate vertical stretch (expansion) or shrink (compression), reflection, horizontal and vertical translation, and dilation.
 - Use a values of $-3 \leq a \leq 3$.
 - Use h and k values of $-10 \leq h \leq 10$ and $-10 \leq k \leq 10$.
 - Referencing a reflection should be “across” a line not “over” a line.

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High Priority Standards

A2.FM.A.1 Create functions and use them to solve applications of quadratic and exponential function model problems.

Learning Goal

Students will be able to use functions to model real-world 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:

- creating functions and using them to solve applications of quadratic and exponential function model problems.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: compound interest, exponential growth, exponential decay.
- performing processes such as:
 - writing a function to model a problem or situation.

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

Learning Targets

- Create quadratic or exponential equations to model problems.
- Solve quadratic or exponential equations to determine solutions to problems algebraically or graphically.
- e.g. Price-demand-cost-revenue—profit situations, compound interest problems, and exponential growth or decay problems.

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High Priority Standards

A2.DS.A.1 Analyze how random sampling could be used to make inferences about population parameters.

A2.DS.A.2 Determine whether a specified model is consistent with a given data set.

A2.DS.A.3 Describe and explain the purposes, relationship to randomization and differences among sample surveys, experiments and observational studies.

A2.DS.A.4 Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates.

A2.DS.A.5 Describe and explain how the relative sizes of a sample and the population affect the margin of error of predictions.

A2.DS.A.6 Analyze decisions and strategies using probability concepts.

A2.DS.A.7 Evaluate reports based on data.

Learning Goal

Students will be able to make inferences and justify conclusions.

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 random sampling.
- explaining how a random sample can be used to make an inference about a population.
- analyzing situations to determine if random sampling was used.
- determining whether a specified model is consistent with a given data set.
- describing and explaining the purposes, relationship to randomization and differences among sample surveys, experiments and observational studies.
- describing and explaining how the relative sizes of a sample and the population affect the margin of error of predictions.
- analyzing decisions and strategies using probability concepts.
- evaluating reports based on data.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: random sampling, margin of error, population, sample size, observational study, bias, validity
- performing processes such as:
 - using data from a sample to estimate characteristics of the population and recognizing the meaning of the margin of error in these estimates.

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

Learning Targets

- Specified models might include dot plots, histograms, frequency tables, lists or simulation result statements.
- Explain the purposes and relationship to random sampling in sample surveys.
- Describe and explain the purposes and relationship to randomization of applying treatment in experiments.
- Describe and explain the purposes and relationship to randomization in sampling for observational studies.

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- Describe and explain the differences between random samples in surveys, experiments, and observational study.
- Ex: Marvin’s Chip Company claims their chip bags contain a mean of 9 oz of chips with a margin of error of $\pm .04$ oz. A randomly selected box containing 10 bags of chips is selected and the individual bags are weighed with the following results (in oz): 9.0 9.3 8.5 8.8 9.1 9.5 8.9 8.8 9.2 8.9 Does the data support Marvin’s claim?
- Explain that larger sample sizes lead to smaller margin of error.
- Explain that larger populations require larger sample size to decrease the margin of error.
- Describe how the validity of an inference is affected by the margin of error.
- Ex: Given a statistic and margin of error give the range of values the population is likely to be within. Explain some reasons why a sample statistic may be different from a population statistic. Given a known population, pull various random samples to compare common measures of center and spread between the sample and population. How does varying the size of the sample affect the difference between the sample and population statistics?
- Ex: Given a bag with 5 red marbles and 5 white marble, you choose a marble from the bag without looking, put it aside and then choose another marble, again without looking. From the list below, select all methods that would result in determining the probability you would select one red and one white marble.
- Evaluate statistical reports to determine statistical issues such as bias, validity of resource, reasonable reporting of statistical analysis and accurate graphical representations.

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High Priority Standards

A2.DS.B.8 Know and use the characteristics of normally distributed data sets; predict what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean.

A2.DS.B.9 Fit a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.

Learning Goal

Students will be able to fit a data set to a normal distribution.

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:

- knowing and using the characteristics of normally distributed data sets.
- predicting what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean.
- fitting a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.

2: Student demonstrates they are nearing proficiency by:

- recognizing and recalling specific vocabulary such as: normal distribution, standard deviation, empirical rule
- performing processes such as:
 - Draw and label the normal curve with values on the horizontal axis when given the mean and standard deviation.

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

Learning Targets

- Know and be able to use the 68-95-99.7 rule to determine the percentages of data above or below the mean for given standard deviations.
- Draw and label the standard normal curve with percentages using the empirical rule (68-95-99.7 rule).
- Standard deviations should be restricted to integer values from negative three to three.
- EX: Suppose the test scores in a school are normally distributed with a mean of 72 and a standard deviation of 8. Find what percentage of the students scored above 64. A student takes a simple random sample of students from his high school of 2580 students asking how much they usually spend on fast food each week. The data was normally distributed with a mean of \$6.50 and a standard deviation of \$1.75. Approximately how many students at the school spend between \$8.25 and \$10 each week?
- Determine from a data set if approximately 68% of the data is within one standard deviation of the mean, if approximately 95% of the data is within two standard deviations of the mean, and if approximately 99.7% (all) of the data is within three standard deviations of the mean.
- Data sets should be no more than fifty numbers.

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Sources:

<https://dese.mo.gov/sites/default/files/curr-math-mls%20expanded-expectations-algebra-1.pdf>

<http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/11/Smarter-Balanced-Math-ALDs.pdf>

[Mathematics Standards | Common Core State Standards Initiative](#)

<http://katm.org/wp/wp-content/uploads/flipbooks/>

http://itembank.marzanoresearch.com/search_details.aspx

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