**Algebra II**

**Prince William County Schools Pacing Guide**

**2021-2022**

Teacher focus groups have assigned a given number of days to each unit based on their experiences and knowledge of the curriculum. Teacher teams will need to include time for assessment as they are planning each unit. It is recommended that teachers stay as close as possible to the pacing guidelines to ensure that all of the Standards of Learning have been taught prior to the SOL Test, and that, as students move within the Division, their math instruction remains consistent. Ongoing review should occur throughout the year.

Teachers may find the full wording of the objectives, along with the essential knowledge and skills to be learned, in the Unit Plans located on the Mathematics Staff Communities webpage. Unit plans created by the Teacher Focus Groups provide suggestions for learning experiences as well as resources to support instruction.

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| **\*\*\* IMPORTANT NOTICE \*\*\*** |
| **Objectives in RED font indicate Algebra I standards that may not have been formally taught or taught to varying levels of mastery during the 2019-2020 school year and may need to be reviewed or to be taught based on the Unfinished Learning spreadsheet completed by prior to the end of 2020-2021.** **Information in BLUE font provides guidance on the priority standards.** |

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| **(5 blocks)****Unit 1 / Modules 1A and 1B: Absolute Value Equations and Inequalities** |
| **Focus Topics** | **Standards of Learning** |
|  **AII.3 a:** Decrease emphasis on absolute value. Choose the level of problem complexity based on time permitting.**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student will** * 1. solve multistep linear inequalities in one variable algebraically and represent the solution graphically;
1. **represent the solution of linear inequalities in two variables graphically;**
2. **solve practical problems involving inequalities; and**
3. **represent the solution to a system of inequalities graphically.**

**The student will** solve1. absolute value linear equations and inequalities;
* Solve absolute value linear equations or inequalities in one variable algebraically. (a)
* Represent solutions to absolute value linear inequalities in one variable graphically. (a)
* Solve equations and verify algebraic solutions using a graphing utility. (a, b, c, d)
 | **A.5 abcd**AII.3 a |

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| **(6 blocks)****Unit 2 / Module 2: Transformations** |
| **Focus Topics** | **Standards of Learning** |
| **Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)**For absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)
* Graph a transformation of a parent function, given the equation. (b)
* Identify the transformation(s) of a function. Transformations of exponential and logarithmic functions, given a graph, should be limited to a single transformation. (b)
* Investigate and verify transformations of functions using a graphing utility. (a, b)

**Between 50 and 75% of schools did not teach – Potentially MISSED****The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including**1. determining whether a relation is a function;
2. **domain and range.**

**f) connections between and among multiple representations using verbal descriptions, tables, equations, and graphs.****The student will** investigate and analyze **absolute value** function families algebraically and graphically. Key concepts include1. domain, range, and continuity;
2. intervals in which a function is increasing or decreasing;
3. connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs;
4. end behavior;
* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* Given the graph of a function, identify intervals on which the function (**absolute value**) is increasing or decreasing. (b)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)
 | **A.8**AII.6 ab**A.7 abf** AII.7 abgh |

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|  **(13 blocks: Part 1 – 7 blocks and Part 2 – 6 blocks)** **Unit 3 / Modules 3A, 3B, 3C, and 3D: Quadratic Functions** |
| **Focus Topics** | **Standards of Learning** |
| **AII.2:** Emphasis on recognize and simplify.Lower priority on operations with complex numbers; do as time permits. (Module 3C)**AII.4:** Lower priority on elimination when solving algebraically. Substitution is used more frequently when solving systems of quadratic and linear equations in Algebra II. (Module 3D)**AII.4:** Emphasis on linear-quadratic systems when solving graphically. Do quadratic-quadratic systems as time permits. (Module 3D)**The student will**1. factor polynomials completely in one or two variables.
* Factor polynomials in one or two variables with no more than four terms completely over the set of integers. Factors of the polynomial should be constant, linear, or quadratic. (c)
* Verify polynomial identities including the difference of squares and perfect square trinomials. (c)

**The student will** perform operations on complex numbers and express the results in simplest form using patterns of the powers of i.* Recognize that the square root of –1 is represented as *i*.
* Simplify radical expressions containing negative rational numbers and express in *a* + *bi* form.
* Simplify powers of *i*.
* Add, subtract, and multiply complex numbers.

**The student will** solve1. quadratic equations over the set of complex numbers;
* Solve a quadratic equation over the set of complex numbers algebraically. (b)
* Calculate the discriminant of a quadratic equation to determine the number and type of solutions. (b)
* Solve equations and verify algebraic solutions using a graphing utility. (a, b, c, d)

**The student will** solve systems of linear-quadratic and quadratic-quadratic equations, algebraically and graphically. * Determine the number of solutions to a linear-quadratic and quadratic-quadratic system of equations in two variables.
* Solve a linear-quadratic system of two equations in two variables algebraically and graphically.
* Solve a quadratic-quadratic system of two equations in two variables algebraically and graphically.
* Solve systems of equations and verify solutions of systems of equations with a graphing utility.

**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)** For quadratic functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)

**Between 50 – 75% of schools did not teach for QUADS only– Potentially Missed****The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including**1. determining whether a relation is a function;
2. **domain and range; and**
3. **zeros**

 **e) values of a function for values in its domain; and** **f) connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.****The student will** investigate and analyze **quadratic** function families algebraically and graphically.* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* Given the graph of a function, identify intervals on which the function (**linear, quadratic**) is increasing or decreasing. (b)
* Identify the location and value of absolute maxima and absolute minima of a function over the domain of the function graphically or by using a graphing utility. (c)
* For any *x* value in the domain of *f*, determine *f(x)*. (f)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)

**The student will** investigate and describe the relationships among solutions of an equation, zeros of a function, x-intercepts of a graph, and factors of a polynomial expression.* Define a polynomial function in factored form, given its zeros.
* Determine a factored form of a polynomial expression from the *x*-intercepts of the graph of its corresponding function.
* For a function, identify zeros of multiplicity greater than 1 and describe the effect of those zeros on the graph of the function.
* Given a polynomial equation, determine the number and type of solutions.

**Close to 50% of schools did not teach – May Need Review****The student will collect and analyze data, determine the equation of the curve of best fin in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.** **The student will** collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of quadratic functions.* Determine an equation of the curve of best fit, using a graphing utility, given a set of no more than 20 data points in a table, graph, or practical situation.
* Make predictions, using data, scatterplots, or the equation of the curve of best fit.
* Solve practical problems involving an equation of the curve of best fit.
* Evaluate the reasonableness of a mathematical model of a practical situation.
 | AII.1 cAII.2AII.3 b AII.4**A.8**AII.6 ab**A.7 abcef**AII.7 abcdefghAII.8  **A.9**AII. 9 |

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| **(6 blocks)****Unit 4 / Module 4: Radical Functions** |
| **Focus Topics** | **Standards of Learning** |
| **Close to 50% of schools did not teach – May Need Review****The student will simplify square roots of whole numbers and monomial algebraic expressions.****The student will**1. add, subtract, multiply, divide, and simplify radical expressions containing rational numbers and variables, and expressions containing rational exponents.
* Simplify radical expressions containing positive rational numbers and variables. (b)
* Convert between radical expressions and expressions containing rational exponents. (b)
* Add and subtract radical expressions. (b)
* Multiply and divide radical expressions. Simplification may include rationalizing denominators. (b)

**The student will** solve1. equations containing radical expressions.
* Solve an equation containing no more than one radical expression algebraically and graphically. (d)
* Solve equations and verify algebraic solutions using a graphing utility. (a, b, c, d)

**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)** For radical functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)

**Close to 50% of schools did not teach – Review May be Needed****The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including**1. determining whether a relation is a function;
2. **domain and range; and**
3. **zeros**

**The student will** investigate and analyze **square root** and **cube root** function families algebraically and graphically.* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* Given the graph of a function, identify intervals on which the function (**square root, cube root**) is increasing or decreasing. (b)
* Identify the location and value of absolute maxima and absolute minima of a function over the domain of the function graphically or by using a graphing utility. (c)
* Identify the location and value of relative maxima or relative minima of a function over some interval of the domain graphically or by using a graphing utility. (c)
* For any *x* value in the domain of *f*, determine *f(x)*. (f)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)
 | **A.3a**AII.1bAII.3 d**A.8**AII.6 ab**A.7abc**A11.7 abcdefgh |

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|  **(4 blocks)****Unit 5 / Module 5: Inverse and Composite Functions** |
| **Focus Topics** | **Standards of Learning** |
| **AII.7 jk:** Both inverse and composition of functions should be taught. Choose the level of problem complexity based on time permitting.**Close to 50% of schools did not teach – Review May be Needed****The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including**1. **domain and range; and**

**The student will** investigate and analyze linear, quadratic, absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic function families algebraically and graphically.* Identify the domain, range, and intercepts of a function presented algebraically or graphically. (a, d, e)
* Determine the inverse of a function (linear, quadratic, cubic, square root, and cube root). (j)
* Graph the inverse of a function as a reflection over the line *y* = *x*. (j)
* Determine the composition of two functions algebraically and graphically. (k)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)
 | **A.7b**AII.7 aejk  |

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| **(7 blocks)****Unit 6 / Module 6: Polynomial Functions** |
| **Focus Topics** | **Standards of Learning** |
| **The student will**1. factor polynomials completely in one or two variables.
* Factor polynomials in one or two variables with no more than four terms completely over the set of integers. Factors of the polynomial should be constant, linear, or quadratic. (c)
* Verify polynomial identities including the difference of squares, sum and difference of cubes, and perfect square trinomials. (c)

**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)**For polynomial functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)

**The student will** investigate and analyze **polynomial** function families algebraically and graphically.* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* Given the graph of a function, identify intervals on which the function (**polynomial**) is increasing or decreasing. (b)
* Identify the location and value of absolute maxima and absolute minima of a function over the domain of the function graphically or by using a graphing utility. (c)
* Identify the location and value of relative maxima or relative minima of a function over some interval of the domain graphically or by using a graphing utility. (c)
* For any *x* value in the domain of *f*, determine *f(x)*. (f)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)

**The student will** investigate and describe the relationships among solutions of an equation, zeros of a function, x-intercepts of a graph, and factors of a polynomial expression.* Define a polynomial function in factored form, given its zeros.
* Determine a factored form of a polynomial expression from the *x*-intercepts of the graph of its corresponding function.
* For a function, identify zeros of multiplicity greater than 1 and describe the effect of those zeros on the graph of the function.
* Given a polynomial equation, determine the number and type of solutions.

**Close to 50% of schools did not teach – May Need Review****The student will collect and analyze data, determine the equation of the curve of best fin in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.** **The student will** collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of quadratic functions.* Determine an equation of the curve of best fit, using a graphing utility, given a set of no more than 20 data points in a table, graph, or practical situation.
* Make predictions, using data, scatterplots, or the equation of the curve of best fit.
* Solve practical problems involving an equation of the curve of best fit.
* Evaluate the reasonableness of a mathematical model of a practical situation.

**Repeat AII.9 as AN EXTENSION FOR CUBIC and QUARTIC**  | AII.1c**A.8**AII.6 abAII.7 abcdefghAII.8**A.9**AII.9 |

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| **(4 blocks)****Unit 7 / Module 7: Exponential and Logarithmic Functions** |
| **Focus Topics** | **Standards of Learning** |
| **AII.7 j:** Inverse of functions should be taught. Choose the level of problem complexity based on time permitting.**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)**For exponential and logarithmic functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)
* Graph a transformation of a parent function, given the equation. (b)
* Identify the transformation(s) of a function. Transformations of exponential and logarithmic functions, given a graph, should be limited to a single transformation. (b)
* Investigate and verify transformations of functions using a graphing utility. (a, b)

**The student will** investigate and analyze **exponential** **and** **logarithmic** function families algebraically and graphically.* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* Given the graph of a function, identify intervals on which the function (**exponential and logarithmic**) is increasing or decreasing. (b)
* For any *x* value in the domain of *f*, determine *f(x)*. (f)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Determine the equations of vertical and horizontal asymptotes of functions (rational, exponential, and logarithmic). (i)
* Graph the inverse of a function as a reflection over the line $y=x.$ (j)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)

**Close to 50% of schools did not teach – May Need Review****The student will collect and analyze data, determine the equation of the curve of best fin in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.** **The student will** collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of quadratic functions.* Determine an equation of the curve of best fit, using a graphing utility, given a set of no more than 20 data points in a table, graph, or practical situation.
* Make predictions, using data, scatterplots, or the equation of the curve of best fit.
* Solve practical problems involving an equation of the curve of best fit.
* Evaluate the reasonableness of a mathematical model of a practical situation.
 | **A.8**AII.6 abAII.7 abdefghij**A.9**AII.9  |

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| **(10 blocks)****Unit 8 / Modules 8A, 8B, and 8C: Rational Functions and Variations** |
| **Focus Topics** | **Standards of Learning** |
| **AII.10:** Inverse variation if time permits**.**  **The student will**1. add, subtract, multiply, and simplify rational algebraic expressions.
* Add, subtract, multiply, and divide rational algebraic expressions. (a)
* Simplify a rational algebraic expression with monomial or binomial factors. Algebraic expressions should be limited to linear and quadratic expressions. (a)
* Recognize a complex algebraic fraction and simplify it as a quotient or product of simple algebraic fractions. (a)

**The student will** solve1. equations containing rational algebraic expressions;
* Solve rational equations with real solutions containing factorable algebraic expressions algebraically and graphically. Algebraic expressions should be limited to linear and quadratic expressions. (c)
* Solve equations and verify algebraic solutions using a graphing utility. (a, b, c, d)

**Between 50 -75% of schools did not teach – Potentially MISSED Standards****The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically. (AII.6 ab)**For rational functions, the student will a) recognize the general shape of function families; and b) use knowledge of transformations to convert between equations and the corresponding graphs of functions. * Recognize the general shape of function families. (a)
* Recognize graphs of parent functions. (a)
* Identify the graph of a function from the equation. (b)
* Write the equation of a function given the graph. (b)
* Graph a transformation of a parent function, given the equation. (b)

**The student will** investigate and analyze **rational** function families algebraically and graphically.* Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities. (a, d, e)
* Describe a function as continuous or discontinuous. (a)
* For any *x* value in the domain of *f*, determine *f(x)*. (f)
* Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
* Describe the end behavior of a function. (h)
* Determine the equations of vertical and horizontal asymptotes of functions (**rational**). (i)
* Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i, j, k)

**The student will** represent and solve problems, including practical problems, involving inverse variation, joint variation, and a combination of direct and inverse variations.* Given a data set or practical situation, write the equation for an inverse variation.
* Given a data set or practical situation, write the equation for a joint variation.
* Solve problems, including practical problems, involving inverse variation, joint variation, and a combination of direct and inverse variations.
 | AII.1 aAII.3 c**A.8**AII.6 abAII.7 adefghiAII.10 |

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| **(4 blocks)****Unit 9 / Module 9: Sequences and Series** |
| **Focus Topics** | **Standards of Learning** |
| **AII.9:** Time permitting. The student will investigate and apply the properties of arithmetic and geometric sequences and series to solve practical problems, including writing the first n terms, determining the nth term, and evaluating summation formulas. Notation will include ∑ and an.* Distinguish between a sequence and a series.
* Generalize patterns in a sequence using explicit and recursive formulas.
* Use and interpret the notations ∑, *n*, *n*th term, and *an*.
* Given the formula, determine *an* (the *n*th term) for an arithmetic or a geometric sequence.
* Given formulas, write the first *n* terms and determine the sum, *Sn*, of the first *n* terms of an arithmetic or geometric series.
* Given the formula, determine the sum of a convergent infinite series.
* Model practical situations using sequences and series.
 | AII.5 |

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| **(5 blocks)****Unit 10 / Module 10: Statistics and Probability** |
| **Focus Topics** | **Standards of Learning** |
| **AII.11 abc:** Primary focus on identify normal distribution and interpret and compare z-scores. Time permitting, apply properties of normal distribution.**AII.12**: Time permitting for permutations and combinations.The student will 1. identify and describe properties of a normal distribution;
2. interpret and compare z-scores for normally distributed data; and
3. apply properties of normal distributions to determine probabilities associated with areas under the standard normal curve.
* Identify the properties of a normal distribution. (a)
* Describe how the standard deviation and the mean affect the graph of the normal distribution. (a)
* Solve problems involving the relationship of the mean, standard deviation, and z-score of a normally distributed data set. (b)
* Compare two sets of normally distributed data using a standard normal distribution and *z*-scores, given the mean and standard deviation. (b)
* Represent probability as area under the curve of a standard normal distribution. (c)
* Use the graphing utility or a table of Standard Normal Probabilities to determine probabilities associated with areas under the standard normal curve. (c)
* Use a graphing utility to investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics. (a, b, c)

The student will compute and distinguish between permutations and combinations.* Compare and contrast permutations and combinations.
* Calculate the number of permutations of *n* objects taken *r* at a time.
* Calculate the number of combinations of *n* objects taken *r* at a time.
* Use permutations and combinations as counting techniques to solve practical problems.
* Calculate and verify permutations and combinations using a graphing utility.
 | AII.11AII.12  |