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Algebra II Modules

Course Description:

Algebra II is a course to building their work with linear, quadratic, and exponential functions, students extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with expressions that define functions, and continue to expand and hone their abilities to model situation and solve equations.

**Students must have a strong foundation in solving equations and systems prior to moving into quadratic functions. Some teachers spend a week or so reinforcing Algebra concepts before moving into Quadratics. Transformations are included in all units pertaining to functions.*

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 1 – QUADRATIC FUNCTIONS

Desired Results

Priority Standards

N.CN.1. Know there is a complex number i such that $i^2 = –1$, and every complex number has the form a + bi with a and b real.

N.CN.2. Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

N.CN.3. Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

N.CN.7. Solve quadratic equations with real coefficients that have complex solutions.

A.SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*

A.SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*

a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example, $x^2 + 4x +3 = (x +3)(x +1)$.*

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. *For example, $x^2 + 4x + 3 = (x + 2)^2 - 1$.*

A.APR.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity $(x^2 + y^2)^2 = (x2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*

Transfer

Students will be able to independently use their learning to…

Make connections among representations of quadratic functions.

Use various methods to solve quadratic equations and apply them to real-life world problems.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Quadratics can be written in multiple equivalent ways.
- Quadratics can have 0, 1, or 2 real solutions, or two complex solutions.
- Quadratic functions can be used to model and solve problems.

ESSENTIAL QUESTIONS

Students will keep considering…

- Why is it advantageous to use and solve quadratics algebraically for real-world problems?
- How do I describe the transformation of a quadratic graph when an arithmetic operation is introduced to the parent function?
- How do I write and graph quadratic equations to model the relationship between two quantities?
- How can I represent the same quadratic in different ways?
- What is the most efficient way to solve any given quadratic?
- What are the key features of any given quadratic?
- What is and how can we express complex numbers?

Acquisition

Students will know…

- Quadratic functions and complex numbers.
- Applications of Quadratic functions.

Students will be skilled at…

- I can transform quadratic functions.
- I can describe the effects of changes in the coefficients of a quadratic function written in vertex form.
- I can define, identify, and graph quadratic functions.

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 1 – QUADRATIC FUNCTIONS

A.CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **A.CED.2.** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A.REI.4.b.** Solve quadratic equations in one variable. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. *Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.* **A.REI.11.** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. *Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.** **F.IF.7.a**. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. *a.* Graph linear and quadratic functions and show intercepts, maxima, and minima.		• I can identify and use maximums and minimums of quadratic functions to solve problems. • I can solve quadratic equations by graphing or factoring. • I can determine a quadratic function from its roots. • I can solve quadratic equations by completing the square. • I can write quadratic functions in vertex form. • I can define and use imaginary and complex numbers. • I can solve quadratic equations with complex roots. • I can solve quadratic equations using the Quadratic Formula. • I can classify roots using the discriminant. • I can solve quadratic inequalities by using tables, graphs, and algebra. • I can use quadratic functions to model data. • I can use quadratic models to analyze and predict. • I can perform operations with complex numbers.

F.IF.8.a. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. *a.* Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **F.IF.9.** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically, in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* **F.BF.3.** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* **G.GPE.2.** Determine or derive the equation of a parabola given a focus and directrix.		

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 1 – QUADRATIC FUNCTIONS

Evidence	
Evaluative Criteria	**Assessment Evidence**
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 2-1
  - Reason abstractly and quantitatively #43,48
  - Model with mathematics #16,31,45
- Section 2-2
  - Reason abstractly and quantitatively #40,49
  - Construct viable arguments and critique the reasoning of others # 40
  - Model with mathematics #11,30-33
  - Use appropriate tools strategically # 35-38
- Section 2-3
  - Reason abstractly and quantitatively # 64, 75
  - Construct viable arguments and critique the reasoning of others #65
  - Model with mathematics #27, 46-47, 66
- Section 2-4
  - Reason abstractly and quantitatively #71
  - Construct viable arguments and critique the reasoning of others # 50, 63, 78
  - Model with mathematics # 38-40, 60-61, 64
  - Use appropriate tools strategically # 65-70
- Section 2-5
  - Reason abstractly and quantitatively # 58-65, 72, 83-84
  - Model with mathematics # 36, 75

- Section 2-6
  - Make sense of problems and persevere in solving them #59
  - Reason abstractly and quantitatively # 54
  - Model with mathematics # 36,37,44,60
- Section 2-7
  - Reason abstractly and quantitatively # 59-60
  - Construct viable arguments and critique the reasoning of others #60, 65
  - Model with mathematics #11,27,34,52,58
  - Use appropriate tools strategically 54-57
- Section 2-8
  - Reason abstractly and quantitatively #42,44,51
  - Model with mathematics #11,19,29,38-40
  - Use appropriate tools strategically 37
  - Look for and make use of structure #12-14,30-35
  - Look for and express regularity in repeated reasoning #24
- Section 2-9
  - Reason abstractly and quantitatively #105 - 108, 110- 111
  - Construction viable arguments and critique the reasoning of others #109
  - Model with mathematics #103-104
  - Look for and make use of structure. #117
  - Look for and express regularity in repeated reasoning. #84

Vocabulary

Absolute value of a complex Number	Imaginary number	Quadratic function
Complex conjugate	Maximum value	Vertex form
Complex number	Minimum value	Zero of a function
	Parabola	

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 2 – POLYNOMIALS

Desired Results

Priority Standards

N.CN.9. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

A.SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*

A.APR.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

A.APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

A.APR.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity $(x^2 + y^2)^2 = (x2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*

A.APR.6. Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For*

Transfer

Students will be able to independently use their learning to…

Solve problems with polynomials.

Identify characteristics of polynomial functions.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Solving higher order polynomials is an extension of solving quadratics.
- Graphing polynomial transformations is an extension of graphing quadratic transformations.

ESSENTIAL QUESTIONS

Students will keep considering…

- How can I tell when/if a polynomial expression can be simplified?
- How can a polynomial be expressed graphically and what does each part of the graph represent?
- What is the best way to solve a polynomial equation?
- What do complex numbers mean as solutions of polynomials?

Acquisition

Students will know…

- Operations with polynomial functions.
- Applications of polynomial functions.

Students will be skilled at…

- I can identify, evaluate, add, and subtract polynomials.
- I can classify and graph polynomials.
- I can multiply polynomials.
- I can use binomial expansion to expand binomial expressions that are raised to positive integer powers.

example, represent inequalities describing cost constraints in various situations. **F.IF.4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. **F.IF.7.c.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. c. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available, and showing end behavior.		• I can apply long division and synthetic division to divide polynomials. • I can identify the multiplicity of roots. • I can use the Rational Root Theorem to solve polynomial equations. • I can apply the Fundamental Theorem of Algebra and its corollary to write a polynomial equation of least degree with given roots. • I can identify all of the roots of a polynomial equation. • I can use properties of end behavior to analyze, describe, and graph polynomial functions. • I can identify and use maxima and minima of polynomial functions to solve problems. • I can transform polynomial functions. • I can use finite differences to determine the degree of a polynomial that will fit a given set of data.

Evidence

Evaluative Criteria	Assessment Evidence
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 2 – POLYNOMIALS

Mathematical practices:

- Section 3.1
  - Construct viable arguments and critique the reasoning of others. #47-49, 52-53
  - Model with mathematics #31,50
  - Use appropriate tools strategically #51
- Section 3.2
  - Construct viable arguments and critique the reasoning of others #54,56-57
  - Model with mathematics #9,39,53
  - Use appropriate tools strategically #35-38
- Section 3.3
  - Construct viable arguments and critique the reasoning of others #49-50
  - Model with mathematics #29,37,63
- Section 3.4
  - Reason abstractly and quantitatively #39
  - Model with mathematics #32,45
  - Look for and make use of structure #55
- Section 3.5
  - Reason abstractly and quantitatively #37-39
  - Model with mathematics #35
  - Use appropriate tools strategically #27
- Section 3.6
  - Reason abstractly and quantitatively #44-47, 56, 66, 70
  - Construct viable arguments and critique the reasoning of others #37,54
  - Model with mathematics #52
  - Use appropriate tools strategically #48-51
- Section 3.7
  - Reason abstractly and quantitatively #43, 46, 54-55
  - Model with mathematics #31,42
  - Look for and make use of structure #53-55
- Section 3.8
  - Construct viable arguments and critique the reasoning of others. #26,28
  - Model with mathematics #27
  - Use appropriate tools strategically #10-12,22-24
- Section 3.9

- Construct viable arguments and critique the reasoning of others #12,15
- Model with mathematics #4-5,9-13
- Look for and make use of structure #1-3,6-8

Vocabulary		
End behavior Leading coefficient Local maximum Local minimum	Monomial Multiplicity Polynomial	Polynomial function Synthetic division Turning point

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 3 – EXPONENTIAL AND LOGARITHMIC FUNCTIONS

Desired Results

Priority Standards

A.SSE.3.c. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15t can be rewritten as (1.151/12) 12t ≈* **1.01212t** *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

A.CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A.CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.*

A.REI.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or

Transfer

Students will be able to independently use their learning to…

Communicate the relationship between exponential and logarithmic functions.

Solve problems using exponential and logarithmic functions.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Exponential and logarithmic functions are inverses of each other.
- When an exponential or a logarithmic function is appropriate to model a problem.
- Transformations of logarithmic and exponential functions are the same as transformations of other types of functions.

ESSENTIAL QUESTIONS

Students will keep considering…

- What do exponential growth and decay graphs look like?
- What is an asymptote?
- What is the number “e” and why do I have it?
- What is a logarithm?
- How do I solve an exponential and logarithmic equations?

Acquisition

Students will know…

- Exponential and logarithmic functions.
- Application of exponential and logarithmic functions.

Students will be skilled at…

- I can write and evaluate exponential expressions to model growth and decay situations.
- I can graph and recognize inverses of relations and functions.
- I can find inverses of functions.
- I can write equivalent forms for exponential and logarithmic functions.
- I can write, evaluate, and graph logarithmic functions.
- I can use properties to simplify logarithmic expressions.
- I can translate between logarithms in any base.

g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. **F.IF.4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. **F.IF.7.e.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F.IF.8.b.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (1.02)t , y = (0.97)t , y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.* **F.IF.9***.* Compare properties of two functions each represented in a different way (algebraically, graphically, numerically, in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*		• I can solve exponential and logarithmic equations and inequalities. • I can solve problems involving exponential and logarithmic equations. • I can use the number e to write and graph exponential functions representing real-world situations. • I can solve equations and problems involving e or natural logarithms. • I can transform exponential and logarithmic functions by changing parameters. • I can describe the effects of changes in the coefficients of exponential and logarithmic functions. • I can model data by using exponential and logarithmic functions. • I can use exponential and logarithmic models to analyze and predict.

F.BF.3. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. **F.BF.4.c.** Find inverse functions. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. **F.BF.5.** Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. **F.LE.1.** Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **F.LE.2.** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values. **F.LE.3.** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly,		

quadratically, or (more generally) as a polynomial function. **F.LE.4.** For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. **F.LE.5.** Interpret the parameters in a linear or exponential function in terms of a context.		

Evidence

Evaluative Criteria	**Assessment Evidence**
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 4.1
  - Make sense of problems and persevere in solving them #5-6,10-11,15-17,20-22,27-28,40
  - Reason abstractly and quantitatively #23,41
  - Construct viable arguments and critique the reasoning of others #29
- Section 4.2
  - Make sense of problems and persevere in solving them #29,31
  - Reason abstractly and quantitatively #36,39,56
  - Construct viable arguments and critique the reasoning of others #34,37
  - Model with mathematics #35,47
- Section 4.3
  - Make sense of problems and persevere in solving them #34,37
  - Reason abstractly and quantitatively #45-46

- Construct viable arguments and critique the reasoning of others #31,35

- Section 4.4
  - Reason abstractly and quantitatively #57-64
  - Construct viable arguments and critique the reasoning of others #56,65
  - Model with mathematics #48
  - Use appropriate tools strategically #51-53
  - Look for and make use of structure #56
- Section 4.5
  - Construct viable arguments and critique the reasoning of others #44
  - Model with mathematics #46-47
  - Use appropriate tools strategically #43,53
- Section 4.6
  - Reason abstractly and quantitatively #38
  - Model with mathematics #25,30,37,40
  - Use appropriate tools strategically #23
- Section 4.7
  - Reason abstractly and quantitatively #32,40-43,49-50,57
  - Model with mathematics #15,31, 44, 51
  - Use appropriate tools strategically #56
- Section 4.8
  - Model with mathematics #6-7, 12-16, 18-20, 22-23, 25, 30
  - Use appropriate tools strategically #20,31
  - Look for and make use of structure #8-11, 21

Vocabulary

Asymptote	Exponential equation	Logarithmic function
Base	Inverse function	Natural logarithm
Common logarithm	Logarithmic equation	

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 4 – RATIONAL AND RADICAL FUNCTIONS

Desired Results

Priority Standards

N.RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define 51/3 to be the cube root of 5 because we want* $(51/3)^3 = 5(1/3)^3$ *to hold, so* $(51/3)^3$ *must equal 5.*

N.RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. *For example, write equivalent representations that utilize both positive and negative exponents.*

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

A.APR.1. Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.

A.APR.7. Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.

A.CED.1. Create equations and inequalities in one variable and use them to solve problems. Include

Transfer

Students will be able to independently use their learning to…

Apply algebraic reasoning to solve problems with rational and radical expressions.

Make connections among multiple representations of rational and radical functions.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Radicals can be written as rational exponents, and the properties of exponents can be used to simplify radical expressions.

ESSENTIAL QUESTIONS

Students will keep considering…

- In what situations is zero or a negative number an inappropriate answer to a problem?
- How is factoring used to simplify a rational expression?
- How are reciprocals used to divide rational expressions?
- How do we add/subtract fractions with variables?
- What makes a number a rational number?
- What are the rules when performing basic operations and simplification of square roots?

Acquisition

Students will know…

- Rational functions and their applications
- The rules of basic operations and simplification of square roots.
- Ways to add, subtract, multiply and divide rational expressions.

Students will be skilled at…

- I can solve problems involving direct, inverse, joint, and combined variation.
- I can simplify rational expressions.
- I can multiply and divide rational expressions.
- I can add and subtract rational expressions.
- I can simplify complex fractions.
- I can graph rational functions.
- I can transform rational functions by changing parameters.
- I can solve rational equations and inequalities.

equations arising from linear and quadratic functions, and simple rational and exponential functions. **A.CED.2**. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A.REI .2.** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **A.REI.11.** Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* **F.IF.5.** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then negative numbers would be an inappropriate domain for the function.* **F.IF.7.b.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.		• I can rewrite radical expressions by using rational exponents. • I can simplify and evaluate radical expressions and expressions containing rational exponents. • I can graph radical functions and inequalities. • I can transform radical functions by changing parameters. • I can solve radical equations and inequalities.

F.IF.7.d. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. d. Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior.		

Evidence

Evaluative Criteria	Assessment Evidence
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 5.1
  - Reason abstractly and quantitatively #32–36, 44
  - Construct viable arguments and critique the reasoning of others #43
  - Model with mathematics #38
  - Use appropriate tools strategically #38
  - Look for and make use of structure #13–15, 28–30, 40–41
- Section 5.2
  - Reason abstractly and quantitatively #46
  - Construct viable arguments and critique the reasoning of others #45
  - Model with mathematics #35
- Section 5.3

- Construct viable arguments and critique the reasoning of others #48
- Section 5.4
  - Reason abstractly and quantitatively #46
  - Construct viable arguments and critique the reasoning of others #45, 48
  - Model with mathematics #47
- Section 5.5
  - Reason abstractly and quantitatively #52
  - Use appropriate tools strategically #47–49
- Section 5.6
  - Reason abstractly and quantitatively #86, 91–92
  - Construct viable arguments and critique the reasoning of others #81
  - Model with mathematics #58, 60–61, 72, 80
  - Use appropriate tools strategically #83
- Section 5.7
  - Reason abstractly and quantitatively #60–63, 71
  - Model with mathematics #19, 47, 55–59, 67, 69
- Section 5.8
  - Reason abstractly and quantitatively #60
  - Construct viable arguments and critique the reasoning of others #54
  - Model with mathematics #50–51, 58
  - Use appropriate tools strategically #55–57

Vocabulary

Complex fraction	Extraneous solutions	Radical function
Constant of variation	Hole (in a graph)	Rational equation
Continuous function	Inverse variation	Rational exponent
Direct variation	Radical equation	Rational function
Discontinuous function		

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 5 – PROPERTIES AND ATTRIBUTES OF FUNCTIONS

Desired Results

Priority Standards

A.APR.7. Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.

A.CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

F.IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then negative numbers would be an inappropriate domain for the function.*

F.IF.7.b. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.BF.1.b. Write a function that describes a relationship between two quantities.

Transfer

Students will be able to independently use their learning to…
Make connections among representations of various function families.
Operate and solve problems with functions and their inverses.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- There are problems that can only be modeled by combining two or more types of functions, called a piecewise function.
- Most math relationships have inverses, and many math relationships will have inverses if the domain is restricted.

ESSENTIAL QUESTIONS

Students will keep considering…

- How are the properties of functions and function operations useful?
- How do I graph piecewise functions?
- How do I find the inverse of a function?
- How are real-world situations modeled when they cannot be described with a single function?

Acquisition

Students will know…

- Functions and their graphs.
- Functional relationships.

Students will be skilled at…

- I can translate between the various representations of functions.
- I can solve problems by using the various representations of functions.
- I can write and graph piecewise functions.
- I can use piecewise functions to describe real-world situations.
- I can transform functions.
- I can recognize transformations of functions.
- I can add, subtract, multiply, and divide functions.
- I can write and evaluate composite functions.

b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* **F.BF.1.c.** Write a function that describes a relationship between two quantities. c. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. **F.BF.3.** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. *Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.* **F.BF.4.** Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) = 2x3 for x > 0 or f(x) = (x + 1)/(x – 1) for x ≠ 1*. b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse.		• I can determine whether the inverse of a function is a function. • I can write rules for the inverses of functions. • I can apply functions to problem situations. • I can use mathematical models to make predictions.

d. Produce an invertible function from a non-invertible function by restricting the domain.		

Evidence

Evaluative Criteria	Assessment Evidence
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 6.1
  - Model with mathematics. #1–15, 19–22, 24–30
  - Look for and make use of structure. #5, 6, 11–15, 19–21
- Section 6. 2
  - Construct viable arguments and critique the reasoning of others. #22
  - Model with mathematics. #2,3, 5, 6, 19, 20, 26
  - Attend to precision. #6
  - Look for and make use of structure. #2, 3, 5, 6, 19, 20, 26
- Section 6.3
  - Model with mathematics. #8, 15, 19, 20, 24, 27, 30–33, 36, 37
  - Look for and make use of structure.#2, 3, 8–10, 27
- Section 6. 4
  - Reason abstractly and quantitatively.#7, 19–23, 27, 28
  - Construct viable arguments and critique the reasoning of others. #30, 31
  - Model with mathematics. #7,19, 20, 22–24, 27, 28

- Section 6.5
  - Reason abstractly and quantitatively. #43, 45
  - Construct viable arguments and critique the reasoning of others. #38, 44
  - Model with mathematics. #14, 33–37, 51
- Section 6.6
  - Reason abstractly and quantitatively. #42
  - Construct viable arguments and critique the reasoning of others. #44, 55
  - Model with mathematics. #22, 23, 36–41, 56

Vocabulary		
Composition of functions One-to-one function	Piecewise function	Step function

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 6 – PROBABILITY

Desired Results

Priority Standards

A.APR.5. Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

S.IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

S.CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

S.CP.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

S.CP.3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S.CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use

Transfer

Students will be able to independently use their learning to…

Apply concepts of probability to solve problems.

Use tables and diagrams to find probability of compound events.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Probability tells us the likelihood that something will happen and allows us to make predictions and informed decisions.
- The chance that an event happens may be represented by use of decimals, fractions, and or percentages.
- How a probability is calculated depends on recognizing which type of probability we are working with.

ESSENTIAL QUESTIONS

Students will keep considering…

- What influences the probability that a given event will occur?
- What is the difference between experimental and theoretical probability?
- What determines whether an event is dependent or independent?
- How can I use probability to form a prediction?
- What is a simulation?

Acquisition

Students will know…

- Experimental probability.
- Probability.

Students will be skilled at…

- I can solve problems involving the Fundamental Counting Principle.
- I can solve problems involving permutations and combinations.
- I can determine the theoretical probability of an event.
- I can calculate the experimental probability of an event.
- I can determine whether events are independent or dependent.
- I can identify the probability of independent and dependent events.

the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in 10th grade. Do the same for other subjects and compare the results.* **S.CP.5.** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* **S.CP.6.** Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. **S.CP.7.** Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. **S.CP.8***.* Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. **S.CP.9.** Use permutations and combinations to compute probabilities of compound events and solve problems.		• I can construct and interpret two-way frequency tables of data associated with each object being classified. • I can determine the probability of mutually exclusive events. • I can find the probability of inclusive events.

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 6 – PROBABILITY

Evidence	
Evaluative Criteria	**Assessment Evidence**
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 7.1
  - Reason abstractly and quantitatively #33,34,38,40
  - Construct viable arguments and critique the reasoning of others #37
  - Model with mathematics #43
  - Look for and express regularity in repeated reasoning #42
- Section 7.2
  - Reason abstractly and quantitatively #21,23,24,30,41,42
  - Construct viable arguments and critique the reasoning of others #25,31,34
  - Attend to precision #35
- Section 7.3
  - Make sense of problems and persevere in solving them. #24
  - Reason abstractly and quantitatively. #33,35
  - Construct viable arguments and critique the reasoning of others. #31
  - Model with mathematics. #6, 7, 15, 16, 30, 38
  - Look for and make use of structure. #24, 34
- Section 7.4
  - Reason abstractly and quantitatively #10, 12, 18, 21, 22
  - Construct viable arguments and critique the reasoning of others #11,22
- Section 7.5
  - Reason abstractly and quantitatively. #20, 23, 31, 34

- Model with mathematics #21, 25, 27
- Look for and make use of structure #36-41

Vocabulary		
Binomial experiment Combination Conditional probability Dependent events	Experimental probability Factorial Independent events	Outcomes Permutation Theoretical probability

KPBSD MATH CURRICULUM
ALGEBRA II
UNIT 7 – SEQUENCES AND SERIES

Desired Results

Priority Standards

A.SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

F.IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥1.*

F.LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

a. Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.BF.1.a. Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F.BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Transfer

Students will be able to independently use their learning to…

Represent sequences and series algebraically to solve problems.

Meaning

ENDURING UNDERSTANDINGS

Students will understand that…

- Sequences and series can model many mathematical ideas and realistic situations.
- Sequences help us to recognize and apply patterns to familiar and unfamiliar situations so we can make predictions.
- Patterns help identify relevant elements of geometric/arithmetic sequences and series.

ESSENTIAL QUESTIONS

Students will keep considering…

- How do I tell the difference between an arithmetic and geometric?
- How can different calculations with an arithmetic or geometric sequence be used in the real world?
- Why do I write a recursive and explicit formulas for sequences?
- Why would I need to find the sum of an infinite series?

Acquisition

Students will know…

- Arithmetic sequences and series.
- Geometric sequences and series.

Students will be skilled at…

- I can identify the ***n***th term of sequence.
- I can write rules of sequences.
- I can evaluate the sum of a series expressed in sigma notation.
- I can find the indicated terms of an arithmetic sequence.
- I can solve the sum of arithmetic series.
- I can determine terms of geometric sequence.
- I can identify the sum of geometric series.
- I can determine the sums of infinite geometric series.

F.LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values.		

Evidence

Evaluative Criteria	Assessment Evidence
Rubrics Course Assignments Performance Tasks Teacher made assessments Observation Journals and Self-Reflection Technology-Based Assessments Other…	PERFORMANCE TASK(S): To be determined

Learning Plan

Mathematical practices:

- Section 9.1
  - Reason abstractly and quantitatively. #43, 46, 48
  - Construct viable arguments and critique the reasoning of others. #33
  - Model with mathematics. #43, 44, 47
  - Attend to precision. #58
  - Look for and make use of structure. #2–13, 15–32, 34–47, 50–58
  - Look for and express regularity in repeated reasoning. #11–13, 22–24, 34–47, 50–58
- Section 9.2
  - Reason abstractly and quantitatively. #43–45, 61
  - Model with mathematics. #12, 23, 34, 35, 42, 46, 48
  - Use appropriate tools strategically. #43–45
  - Look for and make use of structure. #2–11, 13–22, 24–33, 35–49, 54, 55, 57–60
  - Look for and express regularity in repeated reasoning. #47
- Section 9.3
  - Reason abstractly and quantitatively. #50, 51, 59–61

- Construct viable arguments and critique the reasoning of others. #58
- Model with mathematics. #20,36, 37, 46, 48, 49, 53
- Look for and make use of structure. #2–18, 21–35, 38–49, 55, 57

Vocabulary		
Converge	Infinite sequence	Sequence
Diverge	Iteration	Series
Explicit formula	Limit	Term of a sequence
Finite sequence	Recursive formula	