

Kenilworth Public Schools

Curriculum Guide

Content Area: Algebra II
Grade: 10-11
BOE Approved: 8/13/2012

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Submitted by: Michelle Ryan
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ALGEBRA II SCOPE & SEQUENCE

Unit 1- Quadratic Functions & Factoring	Unit 2- Polynomials and Polynomial Functions	Unit 3- Rational Functions	Unit 4- Rational Exponents and Radical Functions	Unit 5- Exponential and Logarithmic Functions	Unit 6- Sequences and Series, Data Analysis, Right Triangle Trig.
Weeks 1-12	Weeks 13-18	Weeks 19-24	Weeks 25-29	Weeks 30-34	Weeks 35-40
<i>Unit Description:</i> Graph, analyze, model, and solve quadratic functions.	<i>Unit Description:</i> Use properties of exponents. Graph, analyze, model, and solve polynomial functions.	<i>Unit Description:</i> Graph, analyze, model and solve rational functions.	<i>Unit Description:</i> Understand and use rational exponents. Analyze and graph radical functions. Solve radical equations.	<i>Unit Description:</i> Graph, analyze, model, and solve exponential and logarithmic functions.	<i>Unit Description:</i> Define, analyze, and find sums of sequences and series. Apply the fundamentals of data analysis and probability distributions. Apply basic Right Triangle Trigonometry.
<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Graph quadratic functions in standard form. 	<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Use Properties of Exponents. 	<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Model Inverse and Joint Variation. ● Graph Simple Rational Functions. 	<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Evaluate nth Roots and use Rational Exponents. 	<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Graph exponential growth functions. ● Graph exponential decay functions. 	<i>Unit Targets:</i> <ul style="list-style-type: none"> ● Define and use Sequences and Series.

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<ul style="list-style-type: none"> ● Graph quadratic functions in vertex or intercept form. ● Solve $x^2+bx+c=0$ by factoring. ● Solve $ax^2+bx+c=0$ by factoring. ● Solve quadratic equations by find square roots. ● Perform Operations with complex numbers. ● Solve Quadratics by completing the square. ● Use the Quad. Formula and the discriminant. ● Graph and Solve Quad. Inequalities. 	<ul style="list-style-type: none"> ● Evaluate and Graph Polynomial Functions. ● Add, Subtract, and Multiply Polynomials. ● Factor and Solve Polynomial Equations. ● Apply the Remainder and Factor Theorems. ● Find Rational Zeros. ● Apply the Fundamental Theorem of Algebra. ● Analyze Graphs of Polynomial Functions. 	<ul style="list-style-type: none"> ● Graph General Rational Functions. ● Multiply and Divide Rational Expressions. ● Add and Subtract Rational Expressions. ● Solve Rational Equations. ● Describe and Compare Function Characteristics. 	<ul style="list-style-type: none"> ● Apply Properties of Rational Exponents. ● Perform Function Operations and Composition. ● Use Inverse Functions. ● Graph Square Root and Cube Root Functions. ● Solve Radical Equations. 	<ul style="list-style-type: none"> ● Use functions involving e. ● Evaluate logarithms and graph logarithmic functions. ● Apply properties of logarithms. ● Solve exponential and logarithmic equations. ● Create and apply exponential and power functions. 	<ul style="list-style-type: none"> ● Analyze arithmetic sequences and series. ● Analyze geometric sequences and series. ● Evaluate Sums of infinite geometric series. ● Analyze variation. ● Construct and interpret Normal Distributions.
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UNIT 1 PLAN ALGEBRA II
 Grades 10-12
 Revised 2023

Unit title: Quadratic Functions and Factoring	
Unit summary: Graph, analyze, model and solve quadratic functions.	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.F.IF.7a, 9-12.A.SSE.3a, 9-12.A.REI.4b, 9-12.N.CN.2, 9-12.A.REI.4a, 9-12.N.CN.7	
Content Statements:	
1	Quadratic functions in standard form
2	Quadratic functions in vertex or intercept form
3	Factoring $x^2+bx+c=0$
4	Factoring $ax^2+bx+c=0$
5	Square roots of Quadratic Equations
6	Complex numbers
7	Completing the square
8	The Quadratic Formula and the discriminant
9	Quadratic Inequalities
Big Idea: Many real-life situations can be modeled using quadratic functions.	
Unit Essential Questions: <ul style="list-style-type: none"> ● What is the shape and characteristics of the graph of a quadratic function? ● What real-world situations can be modeled by quadratics? ● How can quadratic functions be solved and how many solutions can exist? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● Quadratic functions are in the shape of a parabola. ● There are as many as two solutions for a quadratic function and a variety of techniques for finding them.

UNIT 1 PLAN ALGEBRA II

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Unit Learning Targets

Students will...

- Graph quadratic functions in standard form.
- Graph quadratic functions in vertex or intercept form.
- Solve $x^2+bx+c=0$ by factoring.
- Solve $ax^2+bx+c=0$ by factoring.
- Solve quadratic equations by finding square roots.
- Perform Operations with complex numbers.
- Solve Quadratics by completing the square.
- Use the Quadratic Formula and the discriminant.
- Graph and Solve Quadratic Inequalities.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Homework
- Classwork
- Other activities at teacher's discretion

Lesson Plans

<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none">● Graph the parent function for quadratic functions, identify the characteristics of the graph, and explore the effects of changing the coefficients of quadratic functions in standard form.<ol style="list-style-type: none">1. Graph the parent function.2. Identify the vertex and axis of symmetry.3. Explore the effect of changing the coefficient “a” to values greater than and less than one and to positive and negative values.4. Explore the effect of adding a “c” coefficient and changing its value.5. Explore the effect of adding a “b” coefficient and changing its value.	Weeks 1-12

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<p>6. Recognize that “c” is the y-intercept and discuss the formula for the x-coordinate of the vertex.</p> <ul style="list-style-type: none"> ● Model dropped objects with the quadratic function. <ol style="list-style-type: none"> 1. Given the model function, calculate times for objects to fall to earth from various heights. Discuss the relationship between the height and the time to drop to the earth. Demonstrate with actual objects. Discuss that mass does not affect the time to drop (assuming negligible air resistance). 2. Extend the discussion to include the path of all objects in flight, such as that of a batted baseball. Discuss the independence of horizontal and vertical motion. 3. Find maximum heights of objects in flight. 	
<p><i>Teacher Resources</i></p>	<p><i>Teacher Note</i></p>
<ul style="list-style-type: none"> ● Graphing software projected on a large screen ● Actual objects of various weights to drop as demonstrations ● Blackboard or whiteboard 	<p>If all students are provided graphing calculators, add an individual practice exercise to the first activity.</p>

UNIT 2 PLAN ALGEBRA II
 Grades 10-12
 Revised 2023

Unit title: Polynomials and Polynomial Functions	
Unit summary: Use properties of exponents. Graph, analyze, model, and solve polynomial functions.	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.N.RN.1, 9-12.F.IF.7c, 9-12. A.APR.1, 9-12.A.SSE.2, 9-12.A.APR.2, 9-12.N.CN.9	
Content Statements:	
1	Properties of Exponents
2	Evaluate and Graph Polynomial Functions
3	Add, Subtract, and Multiply Polynomials
4	Polynomial Equations
5	Remainder and Factor Theorems
6	Rational Zeros
7	Fundamental Theorem of Algebra
8	Analyze Graphs Polynomial Functions
Big Idea: Perform Operations on Polynomial expressions and graph polynomial functions.	
Unit Essential Questions: <ul style="list-style-type: none"> ● How are addition, subtraction, multiplication, and division applied to polynomials? ● How are polynomials factored? ● What are the shapes and characteristics of the graphs of polynomial functions? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● Operations can be performed on polynomials. ● Polynomials can be factored using a variety of techniques. ● The number of solutions of polynomial functions is at most the degree. ● The domain is the set of all real numbers and the functions are continuous.

UNIT 2 PLAN ALGEBRA II

Grades 10-12

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Unit Learning Targets

Students will...

- Use Properties of Exponents.
- Evaluate and Graph Polynomial Functions.
- Add, Subtract, and Multiply Polynomials.
- Factor and Solve Polynomial Equations.
- Apply the Remainder and Factor Theorems.
- Find Rational Zeros.
- Apply the Fundamental Theorem of Algebra.
- Analyze Graphs of Polynomial Functions.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Homework
- Classwork
- Other activities at teacher's discretion

Lesson Plans

<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none">● Model volumes of geometric shapes with polynomial functions: Given a rectangle, cylinder, and pyramid, each with dimensions that include variables, find the associated volumes. Include binomials as needed (see pages 92 and 108).● Explore the graphs of polynomial functions:<ol style="list-style-type: none">1. Graph a cubic function with a positive leading coefficient and a cubic function with a negative leading coefficient, on the same coordinate plane. Note the characteristics of the graphs. (see page 98 example #5 for possible functions to use)2. Graph a quartic function with a positive leading coefficient and a quartic function with a negative leading coefficient, on the same coordinate plane. Note the characteristics of the graphs (see page 98 example #5 for possible functions to use).	Weeks 13-18

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<p>3. Summarize the observations. Make conclusions about end behavior (see page 97).</p>	
<p><i>Teacher Resources</i></p>	<p><i>Teacher Note</i></p>
<ul style="list-style-type: none"> ● Graphing software projected onto a large screen 	<p>If all students have access to graphing calculators, students may make individual graphs, and make the same observations</p>

UNIT 3 PLAN ALGEBRA II
 Grades 10-12
 Revised 2023

Unit title: Rational Functions	
Unit summary: Graph, analyze, model and solve rational functions	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.A.CED.2, 9-12.F.IF.7d, 9-12.A.APR.7, 9-12.A.REI.2, 9-12.F.IF.9	
Content Statements:	
1	Inverse and Joint Variation
2	Simple Rational Functions
3	General Rational Functions
4	Multiply and Divide Rational Expressions
5	Add and Subtract Rational Expressions
6	Rational Equations
7	Characteristics of Function
Big Idea: Functions with variables in the denominator are defined as rational and can be used to model real-life situations.	
Unit Essential Questions: <ul style="list-style-type: none"> ● What are possible characteristics of the graphs of rational functions? ● What happens when the denominator of a rational expression/function becomes zero? ● How do we solve rational equations? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● The domain of rational functions may not be the set of all real numbers. ● The graphs of rational functions may contain holes and/or asymptotes. ● There are various ways to solve rational equations.

UNIT 3 PLAN ALGEBRA II

Grades 10-12

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Unit Learning Targets

Students will...

- Model Inverse and Joint Variation.
- Graph Simple Rational Functions.
- Graph General Rational Functions.
- Multiply and Divide Rational Expressions.
- Add and Subtract Rational Expressions.
- Solve Rational Equations.
- Describe and Compare Function Characteristics.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Homework
- Classwork
- Other activities at teacher's discretion

Lesson Plans

<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none"> ● Given that two variables vary inversely, and given one pair of values that satisfy the relationship, write an equation for the function. Repeat this for several different inverse variation functions. Notice a pattern in this process. ● Given one inverse variation function, one rational function that has a hole in the graph, one rational function that has a single vertical asymptote (not at $x=0$), and one rational function that has two vertical asymptotes: <ol style="list-style-type: none"> 1. Discuss values that would not be possible for x. Describe the domain for each function. 2. Display the graphs of each function to illustrate that these values for x indeed cannot exist. 	Weeks 19-24
<i>Teacher Resources</i>	<i>Teacher Note</i>

UNIT 3 PLAN ALGEBRA II

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- Graphing software projected onto a large screen.

If all students have access to graphing calculators, students can graph the functions individually in order make the observations

UNIT 4 PLAN ALGEBRA II
Grades 10-12
Revised 2023

Unit title: Rational Exponents and Radical Functions	
Unit summary: Understand and use rational exponents. Analyze and graph radical functions. Solve radical equations.	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.N.RN.1, 9-12.N.RN.2, 9-12.F.BF.1, 9-12.F.BF.4, 9-12.F.IF.7b, 9-12.A.REI.2	
Content Statements:	
1	Roots and Rational Exponents
2	Properties of Rational Exponents
3	Function Operations and Composition
4	Inverse Functions
5	Square Root and Cube Root Functions
6	Radical Equations
Big Idea: Understand and use rational exponents and graph and solve radical functions.	
Unit Essential Questions: <ul style="list-style-type: none"> ● What are the similarities and differences between rational exponents and radical expressions? ● What are inverse functions and composite functions? ● What are the characteristics of the graphs of square and cube root functions? ● How can radical equations be solved? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● All radical expressions have an equivalent rational exponent expression. ● Two functions composed in both directions will equal x if and only if the two functions are inverses of each other. ● The graphs of the square and cube root functions have distinct shapes and characteristics. ● Radical equations can be solved by raising each side of the equations to the power of the index.

UNIT 4 PLAN ALGEBRA II
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Unit Learning Targets

Students will...

- Evaluate n th Roots and use Rational Exponents.
- Apply Properties of Rational Exponents.
- Perform Function Operations and Composition.
- Use Inverse Functions.
- Graph Square Root and Cube Root Functions.
- Solve Radical Equations.

Evidence of Learning

Summative Assessment: Quizzes, Test

Formative Assessments:

- Homework
- Classwork
- Other activities at teacher's discretion

Lesson Plans

<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none"> ● Simplify given nth roots where $n=2, 3, 4$ and 5. List perfect squares, perfect cubes, perfect powers of four, and perfect powers of five. Discuss a general procedure for simplifying roots. ● Graph the parent function for square roots and explore the characteristics of the graph. <ol style="list-style-type: none"> 1. Graph the parent function for square roots 2. Change the leading coefficient to values that are less than and greater than one. Note the effect on the graph. 3. Change the leading coefficient to a negative value. Note the effect on the graph. 4. Add constants that translate the graph. Note the effect on the graph. 	Weeks 25-29
<i>Teacher Resources</i>	<i>Teacher Note</i>

UNIT 4 PLAN ALGEBRA II

Grades 10-12

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- Graphing software projected onto a large screen

If all students have access to graphing calculators, the graphing can be done individually and the same observations can be made.

UNIT 5 PLAN ALGEBRA II
 Grades 10-12
 Revised 2023

Unit title: Exponential and Logarithmic Functions	
Unit summary: Graph, analyze, model, and solve exponential and logarithmic functions.	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.F.IF.7e, 9-12.F.BF.5, 9-12.F.LE.4, 9-12.F.LE.2	
Content Statements:	
1	Exponential growth functions
2	Exponential decay functions
3	Functions involving e
4	Evaluate logarithms and graph logarithmic functions
5	Properties of logarithms
6	Exponential and logarithmic equations
7	Exponential and power functions
Big Idea: Exponential functions can be used to model growth and decay and can be solved using logarithms.	
Unit Essential Questions: <ul style="list-style-type: none"> ● What are the characteristics of the graphs of exponential and logarithmic functions? ● What can be modeled using exponential functions? ● How can operations be performed on exponential and logarithmic functions? ● How can exponential and logarithmic functions be solved? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● The graphs of exponential functions can be used to model growth and decay. ● There are special properties for performing operations on logarithmic and exponential expressions. ● Exponential and logarithmic functions are inverses and can be used to solve each other.

UNIT 5 PLAN ALGEBRA II

Grades 10-12

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Unit Learning Targets

Students will...

- Graph exponential growth functions.
- Graph exponential decay functions.
- Use functions involving e .
- Evaluate logarithms and graph logarithmic functions.
- Apply properties of logarithms.
- Solve exponential and logarithmic equations.
- Create and apply exponential and power functions.

Evidence of Learning

Summative Assessment: Quizzes, Tests

Formative Assessments:

- Homework
- Classwork
- Other activities at teacher's discretion

Lesson Plans

<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none">● Model a family tree with an exponential growth function.<ol style="list-style-type: none">1. Beginning with oneself, draw a family tree for about four generations.2. Make a table of values for the number of generations, and the corresponding numbers of ancestors.3. Explore the pattern. Write a function for the number of ancestors as a function of the generation. Determine the number of ancestors one has going back for a large number of generations.● Explore the graphs of exponential decay functions.<ol style="list-style-type: none">1. Graph the parent function for exponential decay functions.2. Change the value and sign of the leading coefficient. Note the effect on the graph.	Weeks 30-24

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3. Add constants that translate the graph. Note the effect on the graph.	
<i>Teacher Resources</i>	<i>Teacher Note</i>
● Graphing software projected onto large screen	If all students have graphing calculators, the graphs can be made individually and the same changes and observations can be made.

UNIT 6 PLAN ALGEBRA II

Grades 10-12

Revised 2023

Unit title: Sequences and Series, Data Analysis, Right Triangle Trig	
Unit summary: Define, analyze, and find sums of sequences and series. Apply the fundamentals of data analysis and probability distributions. Apply basic Right Triangle Trigonometry.	
Primary interdisciplinary connections: Business, Social Studies, Science	
21st Century Themes: Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy	
Learning Targets	
Standards: NJSLS: 9-12.F.IF.3, 9-12.F.BF.2, 9-12.A.SSE.4, 9-12.A.SSE.3, 9-12.S.ID.4, 9-12.G.SRT.6	
Content Statements:	
1	Sequences and Series
2	Arithmetic sequences and series
3	Geometric sequences and series
4	Infinite geometric series
5	Variation
6	Normal Distributions
Big Idea: Identifying patterns in sequences and series allows us to create models and make predictions. There are many ways to represent and analyze data via normal distributions. Right triangle trigonometry can be used to calculate missing information about triangle measurements.	
Unit Essential Questions: <ul style="list-style-type: none"> ● What is a sequence or a series? ● What is the difference between arithmetic and geometric sequences/series? ● How does a normal curve model real data? ● How can trigonometry be used to solve triangles representing real-life situations? 	Unit Enduring Understandings: <ul style="list-style-type: none"> ● Infinite sequences can be modeled mathematically. ● Understanding the mathematical model of a sequence allows us to find cumulative totals of a series. ● The normal curve can be applied to model numerous real-world scenarios.

UNIT 6 PLAN ALGEBRA II

Grades 10-12

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	<ul style="list-style-type: none"> ● Right triangle trigonometry can be used to solve a triangle given only two measurements.
<p>Unit Learning Targets <i>Students will...</i></p> <ul style="list-style-type: none"> ● Define and use Sequences and Series. ● Analyze arithmetic sequences and series. ● Analyze geometric sequences and series. ● Evaluate Sums of infinite geometric series. ● Analyze variation. ● Construct and interpret Normal Distributions. 	

Evidence of Learning
<p>Summative Assessment: Quizzes, Test</p>
<p>Formative Assessments:</p> <ul style="list-style-type: none"> ● Homework ● Classwork ● Other activities at teacher's discretion

Lesson Plans	
<i>Activities</i>	<i>Timeframe</i>
<ul style="list-style-type: none"> ● Investigate an infinite geometric series with the activity on page 459. ● Calculate the height of tall objects given the angle of inclination to the top of the object from a given distance from the base of the object, using right triangle trigonometry. 	Weeks 35-40
<i>Teacher Resources</i>	<i>Teacher Note</i>
<ul style="list-style-type: none"> ● Colored paper, scissors for each student ● Clinometer, measuring tape or measuring wheel 	<p>The trigonometry activity is best done outdoors to calculate the height of very tall objects. As an alternate, it can be accomplished in the classroom and the angle of inclination should be measured from a sitting position.</p>

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