

Original Adoption:	August 2018
Created by:	Algebra 2 PLC
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Ocean County Algebra 2 Curriculum	
Content Area: Mathematics	
Course Title: Algebra 2	Grade Level: High School
Linear and Quadratic Functions Including Complex Solutions	43 Days
Polynomials, Analysis of Nonlinear Functions and Modeling with Rational Exponents	44 Days
Logarithms, Periodic Models and the Unit Circle	38 Days
Rational Expressions and Conditional Probability	42 Days

Introduction

Effective mathematics education provides students with a balanced instructional program. In such a program, students become proficient in basic computational skills and procedures, develop conceptual understandings, and become skilled at problem solving. Standards-based mathematics instruction starts with basic material and increases in scope and content as the years progress.

The curriculum is aligned to the NJSL for Mathematics. Activities outlined in this curriculum infuse the Standards for Mathematical Practice. In alignment to the content and practice standards, algebra 2 students will extend their knowledge of mathematics as they learn to represent and compare complex numbers, polynomials, periodic models and inference making.

Students use functions to model real world applications and their knowledge of their properties to explain the world around them. They will summarize, represent and interpret data to make inferences and justify conclusions. Students will use numerical, graphical, and algebraic models to solve problems.

Unit 1: Linear and Quadratic Functions Including Complex Solutions

Duration: 43 Days

Standards/Learning Targets

Focus Standards (Major Standards)

A.SSE 1A. Interpret parts of an expression such as terms factors and coefficients.

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 nutritional and cost constraints on combinations of different foods.

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. 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 the positive integers would be an appropriate domain for the function

Supporting and Additional Standards

F.IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function

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

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

A.REI.B.4. Solve quadratic equations in one variable.

A.REI.B.4b. 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 $a \pm bi$ for real numbers a and b .

A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

F.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

MP.1 Make sense of problems and persevere in solving them

- Find meaning in problems
- Look for entry points
- Analyze, conjecture and plan solution pathways
- Monitor and adjust
- Verify answers
- Ask themselves the question: “Does this make sense?”

MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none"> ● Make sense of quantities and their relationships in problems ● Learn to contextualize and de-contextualize ● Create coherent representations of problems
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none"> ● Understand and use information to construct arguments ● Make and explore the truth of conjectures ● Recognize and use counterexamples ● Justify conclusions and respond to arguments of others
MP.4	Model with Mathematics.	<ul style="list-style-type: none"> ● Apply mathematics to problems in everyday life ● Make assumptions and approximations ● Identify quantities in a practical situation ● Interpret results in the context of the situation and reflect on whether the results make sense
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> ● Consider the available tools when solving problems ● Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) ● Make sound decisions of which of these tools might be helpful
MP.6	Attend to precision.	<ul style="list-style-type: none"> ● Communicate precisely to others ● Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes ● Calculate accurately and efficiently
MP.7	Look for and make use of structure.	<ul style="list-style-type: none"> ● Discern patterns and structures ● Can step back for an overview and shift perspective ● See complicated things as single objects or as being

MP.8 Look for and express regularity in repeated reasoning.

composed of several objects

- Notice if calculations are repeated and look both for general methods and shortcuts
- In solving problems, maintain oversight of the process while attending to detail
- Evaluate the reasonableness of their immediate results is certain patterns and structures

Primary Interdisciplinary Connections: Infused within the unit are connections to the NJSL for Mathematics, Language Arts Literacy

RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

- **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**
- **8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
- **A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations**
- **E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.**
- **F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**

21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at www.NJ.gov/education/aps/cccs/career/

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.3 Career and Technical Education- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.math1forschool.com
- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

Other Assessments

Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

Summative

- Chapter/Unit Test
- Quizzes
- Presentations

	<ul style="list-style-type: none"> • Unit Projects <p>Benchmark</p> <ul style="list-style-type: none"> • State Standardized Assessments • Quarterly Benchmark Assessment <p>Alternative</p> <ul style="list-style-type: none"> • Portfolio Project • Modified assignments
Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> • Complex number i is defined such that $i^2 = -1$. • Every complex number has the form $a + bi$ with a and b real. • As with real solutions, complex solutions to quadratic equations may be determined by taking square roots, factoring, and completing the square. • Solutions of linear systems contain different function types. • Solving a system of linear equations containing n variables requires n equations. • Properties of integer exponents extends to rational exponents (for example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5(1/3)^3$ to hold, so $(5^{1/3})^3$ must equal 5) • Radical notation is a representation of rational exponents. • Alternate, equivalent forms of an exponential expression containing rational exponents may reveal specific 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> • Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties. Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties. • Solve quadratic equations with real coefficients that have complex solutions by taking square roots, completing the square and factoring. • Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically. • Solve algebraically a system of three linear equations. • Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

<p>attributes of the function that it defines</p> <ul style="list-style-type: none"> ● Exponents and logarithms have an inverse relationship. ● Solutions to an exponential equation in one variable can be written as a logarithm. 	<ul style="list-style-type: none"> ● Use the formula for the sum of a finite geometric series to solve problems [for example, calculate mortgage payments; derive the formula for the sum of a finite geometric series (when the common ratio is not 1)]. ● Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents. ● Use the properties of exponents to transform expressions for exponential functions, explain properties of the quantity revealed in the transformed expression or different properties of the function. ● Express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
Instructional Plan	
Suggested Activities	Resources
<ul style="list-style-type: none"> ● N.CN.A.1 Complex number pattern ● N.CN.A.2 Powers of a complex number ● N.CN.C.7, A.REI.B.4b Completing the square ● A.REI.C.7 Linear and Quadratic System ● A.REI.C.6 Pairs of Whole Numbers ● F.BF.A.2 Snake on a Plane ● F.LE.A.2 Rumors ● F.LE.B.5, F.LE.A.2 Exponential Parameters ● A.SSE.B.4 Course of Antibiotics 	<ul style="list-style-type: none"> ● Graphing Calculator ● Microsoft Excel/PowerPoint ● Teacher-made tests, worksheets, warm-ups, and quizzes ● Computer software to support unit ● Smart board ● Document camera ● www.ixl.com ● www.purplemath.com

- [N.RN.A.1 Evaluating Exponential Expressions](#)
- [N.RN.A.2 Rational or Irrational?](#)
- [A.SSE.B.3c Forms of exponential expressions](#)
- [F.IF.C.8b Carbon 14 dating in practice I](#)
- [F.LE.A.4 Carbon 14 dating](#)

- www.brightstorm.com
- www.coolmath.com

Suggested Options for Differentiation

English Language Learners

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

Special Education/504 Plans

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible

- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

Students at Risk of School Failure

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank

- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

- Algebra 2 Text
- www.kutasoftware.com
- Text Support Materials

Teacher Notes:

Unit 2: Polynomials, Analysis of Nonlinear Functions and Modeling with Rational Exponents

Duration: 42 Days

Standards/Learning Targets

Focus Standards (Major Standards)

N.RN.A.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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*

N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

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

A.SSE.B.3c: Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

A.APR.B.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.SSE.A.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.B.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.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A.REI.A.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

F.IF.B.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.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

A.REI.D.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.*

Supporting and Additional Standards

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

F.IF.C.7c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

A.APR.C.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the difference of two squares; the sum and difference of two cubes; the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*

A.APR.D.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.A.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.

G.GPE.A.2. Derive the equation of a parabola given a focus and directrix

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

F.IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

- | | | |
|------|--|---|
| MP.1 | Make sense of problems and persevere in solving them | <ul style="list-style-type: none">● Find meaning in problems● Look for entry points● Analyze, conjecture and plan solution pathways● Monitor and adjust● Verify answers● Ask themselves the question: “Does this make sense?” |
| MP.2 | Reason abstractly and quantitatively. | <ul style="list-style-type: none">● Make sense of quantities and their relationships in problems● Learn to contextualize and de-contextualize● Create coherent representations of problems |
| MP.3 | Construct viable arguments and critique the reasoning of others. | <ul style="list-style-type: none">● Understand and use information to construct arguments● Make and explore the truth of conjectures● Recognize and use counterexamples● Justify conclusions and respond to arguments of others |
| MP.4 | Model with Mathematics. | <ul style="list-style-type: none">● Apply mathematics to problems in everyday life● Make assumptions and approximations● Identify quantities in a practical situation● Interpret results in the context of the situation and reflect on whether the results make sense |
| MP.5 | Use appropriate tools strategically. | <ul style="list-style-type: none">● Consider the available tools when solving problems● Are familiar with tools appropriate for their grade or course |

(pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools)

- Make sound decisions of which of these tools might be helpful

MP.6 Attend to precision.

- Communicate precisely to others
- Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes
- Calculate accurately and efficiently

MP.7 Look for and make use of structure.

- Discern patterns and structures
- Can step back for an overview and shift perspective
- See complicated things as single objects or as being composed of several objects

MP.8 Look for and express regularity in repeated reasoning.

- Notice if calculations are repeated and look both for general methods and shortcuts
- In solving problems, maintain oversight of the process while attending to detail
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CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.3 Career and Technical Education- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.mathx1forschool.com

Other Assessments

Formative

- Observation

- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

Benchmark

- State Standardized Assessments
- Quarterly Benchmark Assessment

Alternative

- Portfolio Project
- Modified assignments

Knowledge and Skills

Content

Students will know...

- Polynomial division: For a polynomial $p(x)$ and a number a :

Skills

Students will be able to..

- Apply the Remainder Theorem in order to determine the

- $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$
- $(x - a)$ is a factor of $p(x)$ if and only if $p(a) = 0$
- Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function.
- Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function.
- Polynomial identities can be used to describe numerical relationships.
- Rational expressions can be written in different forms.
- Inverse relationships exist between roots and powers.
- Extraneous solutions do not result in true statements.
- A radical function is any function that contains a variable inside a root.
- Any point on a parabola is equidistant between the focus and the directrix.
- Logarithmic functions
- Solutions to complex systems of nonlinear functions can be approximated graphically

factors of a polynomial.

- Use an appropriate factoring technique to factor polynomials. Explain the relationship between zeros and factors of polynomials, and use the zeros to construct a rough graph of the function defined by the polynomial.
- Graph polynomial functions from equations; identify zeros when suitable factorizations are available; show key features and end behavior.
- Use polynomial identities to describe numerical relationships and prove polynomial identities.
- Solve simple rational and radical equations in one variable, use them to solve problems and show how extraneous solutions may arise. Create simple rational equations in one variable and use them to solve problems.
- For radical functions, 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.
- Derive the equation of a parabola given a focus and directrix.
- Graph logarithmic functions expressed symbolically and show key features of the graph (including intercepts and end behavior).
- Find approximate solutions for $f(x)=g(x)$, using technology to graph, make tables of values, or find

successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, logarithmic and exponential functions.

Instructional Plan

Suggested Activities

- [A.SSE.A.2 A Cubic Identity](#)
- [A.APR.B.2 The Missing Coefficient](#)
- [A.APR.B.3 Graphing from Factors III](#)
- [A.APR.C.4 Trina's Triangles](#)
- [F.IF.C.7c Graphs of Power Functions](#)
- [A.APR.D.6 Combined Fuel Efficiency](#)
- [A.REI.A.1 Products and Reciprocals](#)
- [A.REI.A.2 Radical Equations](#)
- [A.REI.A.2, A.CED.A.1 An Extraneous Solution](#)
- [G.GPE.A.2 Defining Parabolas Geometrically](#)
- [F.IF.C.7e Logistic Growth Model](#)
- [A.REI.D.11 Ideal Gas Law](#)

Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
- Document camera
- www.ixl.com
- www.purplemath.com
- www.brightstorm.com
- www.coolmath.com

Suggested Options for Differentiation

English Language Learners

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time

- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

Special Education/504 Plans

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- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities

- Group Projects
- Tiered Activities

Students at Risk of School Failure

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

- Algebra 2 Text
- www.kutasoftware.com
- Text Support Materials

Teacher Notes:

Unit 3: Logarithms, Periodic Models and the Unit Circle**Duration: 38 Days****Standards/Learning Targets****Focus Standards (Major Standards)**

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

F.BF.A.1b. 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.*

Supporting and Additional Standards

F.LE.A.4. Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.

F.TF.A.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F.TF.A.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

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

for more complicated cases.

F.IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

F.TF.C.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related

6a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

F.IF.C.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.

N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.

F.BF.B.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.B.4. Find inverse functions.

F.BF.B.4a. 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, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

MP.1	Make sense of problems and persevere in solving them	<ul style="list-style-type: none">● Find meaning in problems● Look for entry points● Analyze, conjecture and plan solution pathways● Monitor and adjust● Verify answers● Ask themselves the question: “Does this make sense?”
MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none">● Make sense of quantities and their relationships in problems● Learn to contextualize and de-contextualize● Create coherent representations of problems
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none">● Understand and use information to construct arguments● Make and explore the truth of conjectures● Recognize and use counterexamples● Justify conclusions and respond to arguments of others
MP.4	Model with Mathematics.	<ul style="list-style-type: none">● Apply mathematics to problems in everyday life● Make assumptions and approximations● Identify quantities in a practical situation● Interpret results in the context of the situation and reflect on whether the results make sense
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none">● Consider the available tools when solving problems● Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools)● Make sound decisions of which of these tools might be

helpful

MP.6 Attend to precision.

- Communicate precisely to others
- Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes
- Calculate accurately and efficiently

MP.7 Look for and make use of structure.

- Discern patterns and structures
- Can step back for an overview and shift perspective
- See complicated things as single objects or as being composed of several objects

MP.8 Look for and express regularity in repeated reasoning.

- Notice if calculations are repeated and look both for general methods and shortcuts
- In solving problems, maintain oversight of the process while attending to detail
- Evaluate the reasonableness of their immediate results is certain patterns and structures

Primary Interdisciplinary Connections: Infused within the unit are connections to the NJSLs for Mathematics, Language Arts Literacy

RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

- **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**
- **8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.**
- **A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations**
- **E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.**
- **F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**

21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at www.NJ.gov/education/aps/cccs/career/

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.3 Career and Technical Education- This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.mathx1forschool.com
- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

Other Assessments

Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now

	<ul style="list-style-type: none"> ● Notebook Checks ● Writing Prompts ● Exit Tickets ● Classroom Games ● Self-assessment <p>Summative</p> <ul style="list-style-type: none"> ● Chapter/Unit Test ● Quizzes ● Presentations ● Unit Projects <p>Benchmark</p> <ul style="list-style-type: none"> ● State Standardized Assessments ● Quarterly Benchmark Assessment <p>Alternative</p> <ul style="list-style-type: none"> ● Portfolio Project ● Modified assignments
Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● Radian measure of an angle as the length of the arc on the unit circle that is subtended by the angle ● Relationship between degrees and radians ● Relationship between the unit circle in the coordinate plane and graph of trigonometric functions. ● Periodic functions may model real-world scenarios. ● Functions of various types can be combined to model 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Use the radian measure of an angle to find the length of the arc in the unit circle subtended by the angle and find the measure of the angle given the length of the arc. ● Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles

real world situations

- Function notation representation of transformations
- For a function $f(x)$ that has an inverse, the domain/input for $f(x)$ is the inverse function's range/output and that the range/output for $f(x)$ is the inverse function's domain/input.

traversed counterclockwise around the unit circle.

- Graph trigonometric functions expressed symbolically, showing key features of the graph, by hand in simple cases and using technology for more complicated cases.
- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
- Use the Pythagorean identity $(\sin \theta)^2 + (\cos \theta)^2 = 1$ to find $\sin \theta$, $\cos \theta$, or $\tan \theta$, given $\sin \theta$, $\cos \theta$, or $\tan \theta$, and the quadrant of the angle.
- Represent nonlinear (exponential and trigonometric) data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems. Use given functions or choose a function suggested by the context; emphasize exponential and trigonometric models.
- Analyze and compare properties of two functions when each is represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- Construct a function that combines, using arithmetic operations, standard function types to model a relationship between two quantities.
- Identify the effect on the graph of a polynomial, exponential, logarithmic, or trigonometric function 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 and identify even and odd functions from graphs and equations.

Instructional Plan

Suggested Activities

- [F.TF.A.1 Bicycle Wheel](#)
- [F.TF.A.2 What exactly is a radian?](#)
- [F.TF.A.2 Trigonometric functions for arbitrary angles \(radians\)](#)
- [F.TF.A.2 Trig Functions and the Unit Circle](#)
- [F.IF.B.4, F.IF.C.7e Model air plane acrobatics](#)
- [F.TF.B.5 As the Wheel Turns](#)
- [F.TF.C.8 Trigonometric Ratios and the Pythagorean Theorem](#)
- [F.IF.C.9 Throwing Baseballs](#)
- [F.BF.A.1b A Sum of Functions](#)
- [F.BF.B.3 Exploring Sinusoidal Functions](#)
- [F.BF.B.3 Transforming the graph of a function](#)
- [F.BF.B.4a Temperatures in degrees Fahrenheit and Celsius](#)

Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
- Document camera
- www.ixl.com
- www.purplemath.com
- www.brightstorm.com
- www.coolmath.com

Suggested Options for Differentiation

English Language Learners

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time

- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

Special Education/504 Plans

- Provide clear and specific directions
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- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration

- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

Students at Risk of School Failure

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

- Algebra 2 Text
- www.kutasoftware.com
- Text Support Materials

Teacher Notes:

Unit 4: Rational Expressions and Conditional Probability**Duration: 42 Days****Standards/Learning Targets****Focus Standards (Major Standards)**

A.APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers closed under addition subtraction multiplication and division by a nonzero rational expression add subtract multiply and divide rational expressions

A.REI.2 Solve simple rational and radical equations in one variable and give examples showing how extraneous solutions may arise.

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.

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

A.SSE.B.4 Derive and/or explain the derivation of the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

S.IC.B.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S.IC.B.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling

S.IC.B.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between

parameters are significant

S.IC.B.6. Evaluate reports based on data.

Supporting and Additional Standards

F.IF. 7D. Graph rational functions identifying zeros and asymptotes when suitable factorizations are available and showing end behavior.

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

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.

S.ID.A.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S.IC.A.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

S.IC.A.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.A.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.A.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.A.3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, 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.A.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use 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 tenth grade. Do the same for other subjects and compare the results.*

S.CP.A.5. Recognize and explain the NEW 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.B.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.B.7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

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WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

● **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**

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- **A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations**
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Evidence of Student Learning

Performance Tasks/Use of Technology:

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- www.khanacademy.com

Other Assessments

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- Observation
- Homework

- www.desmos.com
- www.kahoot.com
- www.quizizz.com

- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

Benchmark

- State Standardized Assessments
- Quarterly Benchmark Assessment

Alternative

- Portfolio Project
- Modified assignments

Knowledge and Skills

Content

Students will know...

- Mean and standard deviation are used to fit in a normal distribution
- Population percentages may be estimated when the data

Skills

Students will be able to..

- Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population percentages, and recognize that there are data sets for which such a

are approximately normally distributed.

- Statistics is a process for making inferences about a population based on analysis of a random sample from the population.
- Random processes can be described mathematically by using a model: a list or description of possible outcomes.
- Collecting data from a random sample of a population makes it possible to draw conclusions about the whole population.
- Randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments.
- Sample surveys, experiments, and observational studies serve different statistical purposes allowing for different statistical analyses.
- Appropriately drawn samples of a population may be used to estimate a population mean or population proportion.
- Relationship between margin of error, variation with a data set, and variability in the population
- A statistically significant outcome is one that is unlikely to be due to chance alone.
- Events are described as subsets of a sample space.
- Two events A and B are independent if the probability of A and B occurring together is the product of their probabilities.
- Independence of event A and event B means that the

procedure is not appropriate (use calculators, spreadsheets, and tables to estimate areas under the normal curve).

- Identify and evaluate random sampling methods.
- Determine if the outcomes and properties of a specified model are consistent with results from a given data-generating process (e.g. using simulation).
- Identify the differences among and purposes of sample surveys, experiments, and observational studies, explaining how randomization relates to each.
- Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- Use data from a randomized experiment to compare two treatments and use simulations to decide if differences between parameters are significant; evaluate reports based on data.
- 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”).
- Use two-way frequency tables to determine if events are independent and to calculate conditional probability. Use everyday language to explain independence and conditional probability in real-world situations.
- Find the conditional probability of A given B as the

conditional probability of A given B is the same as the probability of, and the conditional probability of B given A is the same as the probability of B .

- Mutually exclusive events exist.

fraction of B 's outcomes that also belong to A and apply the Addition Rule [$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$].

Instructional Plan

Suggested Activities

- [S.IC.A.1 School Advisory Panel](#)
- [S.ID.A.4 Do You Fit in This Car?](#)
- [S.IC.A.2 Sarah, the chimpanzee](#)
- [S.IC.B.3 Strict Parents](#)
- [S.IC.B.4 Margin of Error for Estimating a Population Mean](#)
- [S.CP.A.1 Describing Events](#)
- [S.CP.A.2 Cards and Independence](#)
- [S.CP.A.3 Lucky Envelopes](#)
- [S.CP.A.4 Two-Way Tables and Probability](#)
- [S.CP.A.5 Breakfast Before School](#)
- [S.CP.B.6 The Titanic 1](#)
- [S.CP.B.7 The Addition Rule](#)
- [S.CP.B.7 Rain and Lightning](#)

Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
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- www.purplemath.com
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- www.coolmath.com

Suggested Options for Differentiation

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- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing

- Provide class notes ahead of time to allow students to preview material and increase comprehension
- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

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- Assign peer tutor
- Provide manipulatives
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- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
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Gifted and Talented

- Extension activities
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- Flexible Grouping
- Small Group Instruction
- Peer Buddies
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Core Instructional and Supplemental Materials

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- Text Support Materials

Teacher Notes: