Unit 1: Quadratic Functions and Equations

Content Area: **Math**
Course(s): **Generic Course, WOOD I**
Time Period: **Marking Period 1**
Length: **20 days**
Status: **Published**

Standards

Math Standards

MA.F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.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.
MA.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.
MA.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.
MA.N-CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MA.N-CN.A.3	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
MA.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.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-REI.B.4	Solve quadratic equations in one variable.
MA.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.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.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MA.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.
MA.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 $(x^2 - y^2)(x^2 + y^2)$.
MA.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.
MA.A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

• Students will be able to independently use their learning to find multiple methods for solving quadratic equations so that they will be able to determine the connection between the solutions of a quadratic equation and the graph of a quadratic equation.

• Students will learn multiple methods for solving quadratic equations so that they will be able to determine the connection between the solutions of a quadratic equation and the graph of a quadratic function.

Concepts

Essential Questions

• How can you use quadratic models to represent real world data?

- How do quadratic functions model real world problems and their solutions?
- How do the constants a, h, and k effect the graph of the quadratic functions g(x) = a(x-h)^2 +k
- What is the focus and directrix of a parabola
- What type of symmetry does the graph of f(x) = a(x-h)^2 + k

Understandings

Students will understand that...

- Describe and write transformations of quadratic functions.
- graph quadratic functions using x-intercepts.
- write equations of parabolas.
- write quadratic equations to model data sets.

Critical Knowledge and Skills

Knowledge

Students will know:

- axis of symmetry
- directrix
- focus
- maximum value of a function
- minimum value of a function
- parabola
- quadratic model
- standard form
- vertex
- vertex form
- vertex of a parabola
- zeros of a function

Skills

Students will be able to:

- describe/write transformations of quadratic functions
- explore properties of parabolas
- explore the focus and directrix of a parabola
- find max and min values of quadratic funcitons
- graph parabolas given equations in standard and vertex form
- graph quadratic functions using x-intercepts
- solve real life problems
- write equations of parabolas

Assessment and Resources

School Formative Assessment Plan (Other Evidence)
- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

School Summative Assessment Plan
- Unit Assessment

Primary Resources
enVision Algebra 2

Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources
- IXL
- Khan Academy

- Desmos
- Kahoot
- Quizlet

Technology Integration and Differentiated Instruction

Technology Integration

● **Google Products**

    ○ Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)

    ○ GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

● **One to One Student's laptop**

    ○ All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

● **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❏	Within each lesson, the Gifted Students are given choice on topic and subject matter allowing them to explore interests appropriate to their abilities, areas of interest and other courses.

English Language Learners (N.J.A.C.6A:15)

❏	Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

❏	All assignments have been created in the student's native language.

❏	Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❏	Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

Special Education Students (N.J.A.C.6A:8-3.1)

❏	Within each lesson, special education students are given choice of topic and resources so that their materials are within their ability level and high-interest.

❏	All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

Interdisciplinary Connections

ELA- Students will apply reasoning skills to justify statements. With that, the students will justify statements through oral and written communication.

SCIENCE - Students will determine the height, in inches, that a person can jump while wearing a pair of jumping shoes.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY - Students will use mathematical modeling to compare rates for filling pools

with water.

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Lesson 1:

- Lesson 2.1 - Vertex Form of a Quadratic Function (5 days)
- Quiz 2.1 (1 day)

Lesson 2:

- Lesson 2..2 Standard Form of a uadratic Function (5 days)
- Quiz 2.2 (1 day)

Lesson 3:

- 2.3 Factored Form of a Quadratic Function (5 days)
- Lessons 1 - 3 Review (2 days)
- Test (1 day)

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Unit 2: Quadratic Equations

Content Area: **Math**
Course(s): **Generic Course, ALGEBRA II, WOOD I**
Time Period: **Marking Period 1**
Length: **25 days**
Status: **Published**

Standards

MA.F-IF.C.8a	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.
MA.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.
MA.N-CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
MA.A-CED.A.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.
MA.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.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MA.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.
MA.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 $(x^2 - y^2)(x^2 + y^2)$.

Math Standards

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Transfer Goals and Career Ready Practices

Transfer Goals

Students will be able to independently use their learning to...

- In this unit, students will independently use their learning to solve real world problems involving quadratic equations and complex numbers.

Concepts

Essential Questions

- How can you complete the square for a quadratic expression?
- How can you derive a general formula for solving a quadratic equation?
- How can you solve a non-linear system of equations?
- How can you use the graph of a quadratic equation to determine the number of real solutions of the equation?

Understandings

Students will understand that...

- add, subtract, and multiply complex numbers
- solve quadratic equations for real and complex solutions.
- solve systems of non-linear equations.

Critical Knowledge and Skills

Knowledge

Students will know:

- completing the square

- complex number

- imaginary number

- imaginary unit, i

- pure imaginary number

- quadratic equation in one variable

- quadratic formula and discriminent

- root of an equation

- system of non-linear equations

- zero of an equation

Skills

Students will be able to:

- add, subtract, and multiply complex numbers.

- analyze the discriminant.

- define and use the imaginary unit, i

- find complex solutions and zeros

- solve quadratic equations algebraically.

- solve quadratic equations by completing the square

- solve quadratic equations by graphing.

- solve quadratic equations by using square roots

- solve quadratic equations using the quadratic formula.

- solve real life problems

- solve systems of non-linear equations.

- write quadratic functions in vertex form

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Classwork
- Quizzes

- Exit Tickets
- Reflections

School Summative Assessment Plan

- Unit Assessment

Primary Resources

- enVision Algebra 2
- Pearson Education 2018 - www.pearsonrealize.com

Supplementary Resources

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- Khan Academy
- Desmos
- Kahoot
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Technology Integration and Differentiated Instruction

Technology Integration

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● **One to One Student's laptop**

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● **Additional Support Videos**

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Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❏ Within each lesson, the Gifted Students are given choice on topic and subject matter allowing them to explore interests appropriate to their abilities, areas of interest and other courses.

English Language Learners (N.J.A.C.6A:15)

❏ Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

❏ All assignments have been created in the student's native language.

❏ Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❏ Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

Special Education Students (N.J.A.C.6A:8-3.1)

❏ Within each lesson, special education students are given choice of topic and resources so that their

materials are within their ability level and high-interest.

❏   All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statments. Students will justify statement through oral and written communication.

SCIENCE - Students will discuss how the ground, the third dimension, and the boundaries of the goal of a soccer net influence the arc on a shot.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

<u>**Lesson 1:**</u>

- Lesson 2.4 Complex Numbers and Operations (5 days)

<u>**Lesson 2:**</u>

- Lesson 2.5 Completing the Square (5 days)

<u>**Lesson 3:**</u>

- Lesson 2.6 The Quadratic Formula(5 days)
- lesson 1 - 3 Quiz Review (1 day)
- Quiz (1 day)

<u>**Lesson 4:**</u>

- Lesson 2.7 Linear Quadratic Systems (5 days)

Lesson 5:

- Unit Review (2 days)
- Unit Test (1 days)

Unit 3: Polynomial Functions

Content Area: **Math**
Course(s): **Generic Course, WOOD I**
Time Period: **Marking Period 2**
Length: **30 days**
Status: **Published**

Standards

MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.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.
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.A-APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
MA.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 $p(x)$.
MA.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.
MA.A-APR.C.4	Prove polynomial identities and use them to describe numerical relationships.
MA.A-APR.C.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.
MA.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.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.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 $(x^2 - y^2)(x^2 + y^2)$.

Math Standards

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
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MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.

| MA.K-12.7 | Look for and make use of structure. |
| MA.K-12.8 | Look for and express regularity in repeated reasoning. |

Transfer Goals and Career Ready Practices

Transfer Goals

Students will be able to independently use their learning to...

- use their learning to solve real world problems involving polynomial functions.

Concepts

Essential Questions

- How can you cube a binomial?
- How can you determine whether a polynomial equation has a repeated solution?
- How can you determine whether a polynomial equation has imaginary solutions?
- How can you factor a polynomial?
- How can you transform the graph of a polynomial function?
- How many turning points can the graph of a polynomial function have?

Understandings

Students will understand that...

- Add, subtract, multiply, divide and factor polynomials.
- find solutions of polynomials, equations and zeros of polynomial functions.
- graph and analyze the graphs of polynomial functions.
- write polynomial functions.

Critical Knowledge and Skills

Knowledge

Students will know:

- end behavior
- factor by grouping
- factored completely
- finite differences
- local maximum/minimum
- polynomial function
- polynomial long division
- quadratic form
- repeated solution
- synthetic division

Skills

Students will be able to:

- add, subtract, multiply, divide polynomials.
- describe and write transformations of polynomial functions
- factor polynomials
- find solutions of polynomial equations and zeros of polynomial functions.
- graph polynomial functions using end behavior.
- identify even and odd functions.
- identify polynomial functions.
- use long and synthetic division to divide polynomials.
- use the factor theorem.
- use x-intercepts to graph polynomial functions

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Homework
- Classwork
- Quizzes

- Exit Tickets
- Reflections

School Summative Assessment Plan

- Unit Assessment

Primary Resources

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Supplementary Resources

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Technology Integration and Differentiated Instruction

Technology Integration

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❏   Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

❏   All assignments have been created in the student's native language.

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At-Risk Students (N.J.A.C.6A:8-4.3c)

❏   Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

Special Education Students (N.J.A.C.6A:8-3.1)

❏   Within each lesson, special education students are given choice of topic and resources so that their

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Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through written and oral communication.

SCIENCE -

SOCIAL STUDIES - Students will learn how to use a fitted curve to predict population growth.

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

PHYSICAL EDUCATION - Students will relate rules for sports to rules for operations with polynomials.

Learning Plan / Pacing Guide

Lesson 1:

- 3.1 Graphing Polynomial Funcitons (4 days)

Lesson 2:

- 3.2 Adding/Subtracting/Multiplying Polynomials (6 days)

Lesson 3:

- 3.3 Polynomial Identities (2 days)

Lesson 4:

- 3.4 Dividing Polynomials (5 days)
- Review lessons 1 - 4 (1 day)

- Quiz 3.1-3.4 (1 day)

Lesson 5

- 3.5 Zeros of Polynomial Functions (4 days)

Lesson 6

- 3.7 Trarnsformations of Polynomial Functions (4 days)
- Unit 3 Review (2 days)
- Unit 3 Test (1 day)

Unit 4: Rational Expressions

Content Area: **Math**
Course(s): **Generic Course, WOOD I**
Time Period: **Marking Period 2**
Length: **25 days**
Status: **Published**

Standards

MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.B.3	Identify the effect on the graph of replacing ▯(▯) by ▯(▯) + ▯, ▯▯(▯), ▯(▯▯), and ▯(▯ + ▯) for specific values of ▯ (both positive and negative); find the value of ▯ given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MA.F-BF.B.4a	Solve an equation of the form ▯(▯) = ▯ for a simple function ▯ that has an inverse and write an expression for the inverse.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.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.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.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.
MA.A-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

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Transfer Goals and Career Ready Practices

Transfer Goals

Students will be able to independently use their learning to...

- to solve real world problems, rational exponents and radical functions.

Concepts

Essential Questions

- How can you identify the domain and range of a radical function?
- How can you sketch the graph of the inverse of a function?
- How can you solve a radical equation?
- How can you use a rational exponent to represent a power involving a radical?
- How can you use properties of exponents to simplify products and quotients of radicals?

Understandings

Students will understand that...

- evaluate expressions using properties of rational exponents.
- explore inverse of functions
- graph radical functions
- solve equations containing radicals and rational exponents.

Critical Knowledge and Skills

Knowledge

Students will know:

- conjugate
- extraneous solutions
- index of a radical

- inverse functions
- like radical
- nth root
- radical equation
- radical function
- simplest form of a radical

Skills

Students will be able to:

- add, subtract, multiply, divide rational functions
- evaluate expressions with rational exponents
- explore inverses of functions
- find and verify inverses of non-linear functions
- find nth roots of numbers
- graph radical functions
- solve equations containing radicals and rational exponents.
- solve equations using nth roots.
- solve real life problems involving inverses,.
- write transformations of radical functions.

Assessment and Resources

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   o GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

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● **Additional Support Videos**

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Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

❏   Within each lesson, the Gifted Students are given choice on topic and subject matter allowing them to explore interests appropriate to their abilities, areas of interest and other courses.

English Language Learners (N.J.A.C.6A:15)

❏   Within each lesson, the English Language Learners are given choice of topic and resources so that their materials are within their ability to grasp the language.

❏   All assignments have been created in the student's native language.

❏   Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

❏   Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

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Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral

and written communication.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Lesson 1:

- 4.1 Inverse Variation and the Reciprocal Function (4 days)

Lesson 2:

- 4.2 Graphing Rational Functions (4 days)

Lesson 3:

- 4.3 Multiplying and Dividing Rational Expressions (5 days)
- Review of lesson 1 - 3 (1 day)
- Quiz (1 day)

Lesson 4:

- 4.4 Adding and Subtracting Rational Expressions (3 days)

Lesson 5:

- 4.5 Solving Rational Expressions (4 days)
- Unit Review (2 days)
- Test (1 day)

Unit 5: Exponential and Logarithmic Functions

Content Area: **Math**
Course(s): **Generic Course, WOOD I**
Time Period: **Marking Period 3**
Length: **27 days**
Status: **Published**

Standards

Math Standards

MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.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.
MA.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.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).
MA.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.
MA.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.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.
MA.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 $(x^2 - y^2)(x^2 + y^2)$.
MA.A-SSE.B.3c	Use the properties of exponents to transform expressions for exponential functions.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

| MA.K-12.5 | Use appropriate tools strategically. |
| MA.K-12.7 | Look for and make use of structure. |

Transfer Goals and Career Ready Practices

Transfer Goals

Students will be able to independentaly use their learning to...

- In this unit, students will solve real world problems involving exponential and logarithmic functions.

- recognize and solve practical or theoretical problems in math including those in which the solution approach is not obvious. by using mathematical reasoning and strategic thinking.

Concepts

Essential Questions

- How can you solve exponential and logarithmic equations?
- How can you transform the graphs of exponential and logarithmic functions?
- How can you use properties of exponents to derive properties of logarithms?
- What are some of the characteristics of the graph of a logarithmic function and exponential function?
- What is the natural base "e"?

Understandings

Students will understand that...

- Solve logarithmic equations.
- define and evaluate logarithms using the properties of logarithms and the change of base formula.
- graph logarithmic functions.
- transform graphs of logarithmic functions.

Critical Knowledge and Skills

Knowledge
Students will know:

- common logarithm
- decay factor
- exponential decay function
- exponential equations
- exponential function
- exponential growth function
- growth factor
- logarithmic
- logarithmic equations
- natural base of "e"
- natural logarithm

Skills
Students will be able to:

- define and evaluate logarithms
- define and use the natural base of "e"
- graph exponential growth and decay functions
- graph logarithmic functions
- graph natural base functions
- solve exponential equations
- solve logarithmic equations
- use the change of base formula to evaluate logarithms
- use the properties of logarithms to expand or condense logarithmic expressions
- write transformations of graphs of exponential and logarithmic functions

Assessment and Resources

School Formative Assessment Plan (Other Evidence)
- Homework
- Classwork

- Quizzes
- Exit Tickets
- Reflections

School Summative Assessment Plan
- Unit Tests

Primary Resources
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Interdisciplinary Connections

ELA -

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY -

BUSINESS EDUCATION - Students will learn when and how to use Benford's Law to determine the number of items a business must produce to sell to make a profit.

GLOBAL AWARENESS -

PHYSICAL EDUCATION - Students will extrapolate both the time and distance for a certain round of a running drill performed by an athlete.

Learning Plan / Pacing Guide

Lesson 1:

- 6.1 Key Features of Exponential Functions (2 days)

Lesson 2:

- 6.2 Exponential Models (2 dyas)
- Quiz Review (lesson 1-2, 1 day)
- Quiz 6.1/6.2 (1 day)

Lesson 3:

- 6.3 Logarithms (3 days)

Lesson 4:

- 6.4 Logarithmic Functions (4 days)

<u>Lesson 5:</u>

- 6.5 Properties of Logarithms (4 days)

<u>Lesson 6:</u>

- 6.6 Exponential and Logarithmic Equations (3 days)
- Quiz Review (lessons 3-6, 1 day)
- Quiz 6.3-6.6 (1 day)

<u>Lesson 7:</u>

- 6.7 Geometric Sequences and Series (2 days)
- Unit Review (2 days)
- Unit Test (1 day)

Unit 6: Trigonometric Functions

Content Area: **Math**
Course(s): **Generic Course, WOOD I**
Time Period: **Marking Period 4**
Length: **12 days**
Status: **Published**

Standards

Math Standards

MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
MA.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.
MA.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.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MA.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.
MA.F-TF.A.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
MA.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MA.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.
MA.G-SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
MA.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Mathematical Practices

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Transfer Goals and Career Ready Practices

Transfer Goals

Students will be able to independently use their learning to...

- recognize and solve practical or theoretical problems in math including those in which the solution approach is not obvious, by using mathematical reasoning and strategic thinking.
- solve real world problems involving trigonometric ratios and functions.

Concepts

Essential Questions

- How are trigonometric functions used to solve real world problems?
- How can ratios of lengths of sides within right triangles help determine other lengths and angle measures in the triangles?
- How can we extend the trigonometric ratios to angles greater than 90 degrees?
- How can you identify key features of sine and cosine functions?
- How do key features of one trigonometric function relate to key features of other trigonometric functions?
- How is the unit circle related to trigonometric functions?

Understandings

Students will understand that...

- For any right triangle, the ratios of the sides are always the same given the angle θ. The ratios define the six basic trigonometric functions.
- An angle in standard position has a vertex at the origin and an initial side along the positive x-axis. Reference angles on the unit circle are used to extend trigonometric ratios to angles greater than 90 degrees.

- Reference angles and reference triangles are used to find and evaluate the six trigonometric functions on the unit circle.
- Periodic functions are functions that repeata pattern of y-values at regular intervals. The sine function y = a sin bx and the cosine function y = a cos bx are periodic functions that have an amplitude of |a| and a frequency of b/2∏

Critical Knowledge and Skills

Knowledge
Students will know:

- cofunction
- cofunction identities
- cosecant
- cosine
- cotangent
- reciprocal trigonometric functions
- secant
- sine
- tangent
- coterminal angles
- initial side
- radian
- radian measure
- reference angle
- reference triangle
- standard position
- terminal side
- unit circle
- amplitude
- frequency
- midline

Skills
Students will be able to:

- Use special triangles to determine trigonometric ratios geometrically.
- Use trigonometric functions and the Pythagorean Theorem to find missing side lengths.
- Identify and explain trigonometric identities.
- Find the measure of an angle in standard position and its reference angle.
- Use raidan measure on the unit circle to find arc length.
- Convert between degrees and radians.
- Use reference angles and triangles to evaluate trigonometric functions and their reciprocal functions.
- Use the Pythagorean Identity to find the sine, cosine, and quadrant of an angle.
- Graph and identify the key features of sine and cosine functions.
- Find and interpret the average rate of change of a periodic function over a specified interval.
- Compare key features of different periodic functions.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their math models.
- Explain why the results from their mathematical models might not align exactly with the problem situation.
- Describe and compare key features of the graphs of trigonometric functions.
- Graph functions of the form f(x) - a tan bx and relate the graph of a function to the graph of the parent function.
- Identify how changing the parameters of the sine or cosine function affects the graph of the function.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)
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- Classwork
- Quizzes
- Exit Tickets
- Reflections

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Interdisciplinary Connections

ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will learn that visible light is only part of the electromagnetic spectrum and how visible rays affect humans.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will explore and apply concepts related to trigonometric functions.

Students will see and hear a musican playing a short piece of music. Students will be tasked with using information about the representation of a musical note to determine which note it is.

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Lesson 1

- Lesson 7.1: Trigonometric Functions and Acute Angles (2 days)
- Lesson 7.2: Angles and the Unit Circle (3 days)

Lesson 2

- Lesson 7.3: Trigonometric Functions and Real Numbers (2 days)
- Lesson 7.4: Graphing Sine and Cosine Functions (2 days)

Lesson 3

- Unit Review (2 days)
- Unit Test (1 day)

-

Unit 7: Probablity

Content Area: **Math**
Course(s):   **Generic Course, WOOD I**
Time Period: **Marking Period 4**
Length: **16 days**
Status: **Published**

Standards

MA.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").
MA.S-CP.A.2	Understand that two events ▯ and ▯ are independent if the probability of ▯ and ▯ occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
MA.S-CP.A.3	Understand the conditional probability of ▯ given ▯ as ▯(▯ ▯▯▯ ▯)/▯(▯), and interpret independence of ▯ and ▯ as saying that the conditional probability of ▯ given ▯ is the same as the probability of ▯, and the conditional probability of ▯ given ▯ is the same as the probability of ▯.
MA.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.
MA.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
MA.S-CP.B.6	Find the conditional probability of ▯ given ▯ as the fraction of ▯'s outcomes that also belong to ▯, and interpret the answer in terms of the model.
MA.S-CP.B.7	Apply the Addition Rule, ▯(▯ ▯▯ ▯) = ▯(▯) + ▯(▯) − ▯(▯ ▯▯▯ ▯), and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, ▯(▯ ▯▯▯ ▯) = [▯(▯)] × [▯(▯|▯)] = [▯(▯)] × [▯(▯|▯)], and interpret the answer in terms of the model.
MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
MA.S-MD.A.1	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
MA.S-MD.A.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
MA.S-MD.A.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.
MA.S-MD.A.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.
MA.S-MD.B.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
MA.S-MD.B.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
MA.S-MD.B.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
MA.S-MD.B.5a	Find the expected payoff for a game of chance.

| MA.S-MD.B.5b | Evaluate and compare strategies on the basis of expected values. |
| MA.G-SRT.C.8 | Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. |

Math Practices

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MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Transfer Goals and Career Ready Practices

Transfer Goals

- Students will be able to independently use their learning to: recognize and solve practical or theoretical problems in math including those in which the solution approach is not obvious, by using mathematical reasoning and strategic thinking. In this unit, students will solve real-world problems involving probability.

Concepts

Essential Questions

- How are conditional probability and independence related in real world experience?
- How are permutations and combinations useful when finding probabilities?
- How can you find the probability of events and combination of events?
- How can you use probability to make decision?
- How does describing events as mutually exclusively or independent effect how you find probabilities?
- What does a probability distribution tell you about an experiment?

- What does expected value tell you about situations involving probability?

Understandings

Students will understand that ...

- Two events that cannot both occur are mutually exclusive. Two events are independent if the occurrence of one does not affect the probability of the other. The probability that two independent events both occur is the product of their probabilities.
- The conditional probability that event A will occur, given that another event B has occurred is written as $P(A|B)$ and can be calculated by dividing $P(A$ and $B)$ by $P(B)$. Two events are independent if and only if $P(A|B) = P(A)$ and $P(B|A) = P(B)$.
- A permutation is an arrangement of items in which the order of the items matters, while a combination is an arrangement in which order does not matter.
- You can define a theoretical probability distribution by calculating the probability of each outcome in an experiment or an experimental probability distribution by using the real-world relative frequency of each outcome.
- Expected value is the probability-weighted average of all possible values of a variable. It can be interpreted as the average outcome for many trials of an experiment. Use expected value to find expected payoffs or to compare options with differing cost benefits.
- To determine whether a procedure is fair, compare the probabilities, of possible outcomes. To choose among options, compare expected values. In situations with two possible outcomes for each trial, use binomial probabilities.

Critical Knowledge and Skills

Knowledge

Students will know:

- independent events
- mutually exclusive
- conditional probability
- dependent events
- combination
- factorial
- Fundamental Counting Principle
- permuation
- binomial experiment
- binomial probability
- probability distribution
- uniform probability distribution

- expected value

Skills

Students will be able to:

- Explain independence of events in everyday language and everyday situations.
- Determine the probability of the union of two events (A or B) and their intersection of two independent events (A and B).
- Understand the conditional probability of A given B as the fraction of outcomes in B that also belong to A.
- Interpret independence of events in terms of conditional probability.
- Use a two-way frequency table to decide if events are independent and to approximate conditional probabilities.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of a mathematical model.
- Explain why the results from a mathematical model might not align exactly with the problem situation.
- Calculate the number of permutations and combinations in mathematical and real-world contexts.
- Use permutations and combinations to compute probabilities of compound events and solve problems.
- Develop a probability distribution based on theoretical probabilites or empirical data.
- Graph probability distributions.
- Calculate probability in binomial experiments.
- Calculate the expected value in situations involving chance.
- Weight the possible outcomes of a decision by comparing expected values and finding expected payoffs.
- Analyze decisions and evaluate fairness using probability concepts.

Assessment and Resources

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At-Risk Students (N.J.A.C.6A:8-4.3c)

❏　Within each lesson, the at-risk students are given choice of topic and resources so that their materials are within their ability level and high-interest.

Special Education Students (N.J.A.C.6A:8-3.1)

❏　Within each lesson, special education students are given choice of topic and resources so that their

materials are within their ability level and high-interest.

❏   All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

Interdisciplinary Connections

ENGLISH - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

SCIENCE - Students will learn that visible light is only part of the electromagnetic spetrum and how invisible rays affect humans.

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS - Students will use mathematical models to study how sounds are created by vibrations. As the vibrations tavel through the air, they create sound waves. The frequency of a sound is the measurement of the number of cycles of that wave per second (hertz, Hz).

APPLIED TECHNOLOGY -

BUSINESS EDUCATION -

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Lesson 1:

- Lesson 12.1 - Probability Events (2 days)

Lesson 2:

- Lesson 12.2 - Conditional Probability (2 days)

Lesson 3:

- Lesson 12.3 - Permutations and Combinations (2 days)
- Review Lessons 12.1 - 12.3 (1 day)
- Quiz 12.1 - 12.3 (1 day)

Lesson 4:

- Lesson 12.4 - Probability Distributions (2 days)

Lesson 5:

- Lesson 12.5 - Expected Value (2 days)

Lesson 6:

- Lesson 12.6 - Probability and Decision Making (2 days)
- Review Lessons 12.4 - 12.6 (1 day)
- Quiz 12.4 - 12.6 (1 day)

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