# Kenilworth Public Schools
## Curriculum Guide

Content Area:  Algebra II/Pre-Calculus
Grade:  11-12
BOE Approved:  4/6/20

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BOE Revision Approved:  N/A

# Algebra 2/PreCalculus – Grades 10 -12 Scope and Sequence

| Unit 1- Quadratic Functions & Factoring | Unit 2- Polynomials and Polynomial Functions | Unit 3- Rational Functions | Unit 4- Rational Exponents and Radical Functions | Unit 5- Exponential and Logarithmic Functions | Unit 6- Sequences and Series, Data Analysis | Unit 7- Analytic Trigonometry, a Unit Circle Approach | Unit 8- Conic Sections |
|---|---|---|---|---|---|---|---|
| Weeks 1-2 (Review) | Weeks 3-8 | Weeks 9-15 | Weeks 16-19 | Weeks 20-24 | Weeks 25-29 | Weeks 30-34 | Weeks 35-39 |
| *Unit Description*: Graph, analyze, model, and solve quadratic functions. (Chapter 1) | *Unit Description:* Use properties of exponents. Graph, analyze, model, and solve polynomial functions. (Chapter 2, 7.1) | *Unit Description:* Graph, analyze, model and solve rational functions. (Alg2 Chapter 5, Symmetries (PreCalc 1.1, 1.4) Alg2 Section 7.5) | *Unit Description:* Understand and use rational exponents. Analyze and graph radical functions. Solve radical equations. (Chapter 3) | *Unit Description:* Graph, analyze, model, and solve exponential and logarithmic functions. (Chapter 4) | *Unit Description:* Define, analyze, and find sums of sequences and series. Apply the fundamentals of data analysis and probability distributions. (PreCalc Chap 9, sections 1-3,6, & Alg 2-6.3) | *Unit Description:* Understand and Apply Trigonometric Properties and Identities. (PreCalc Chap 5) | *Unit Description:* Understand and apply Conic Sections (PreCalc Chap 8) |
| *Unit Targets:*<br><br>• Graph quadratic functions in standard form.<br>• Graph quadratic functions in vertex or | *Unit Targets:*<br><br>• Use Properties of Exponents.<br>• Evaluate and Graph Polynomial Functions.<br>• Add, Subtract, and Multiply | *Unit Targets:*<br><br>• Model Inverse and Joint Variation.<br>• Graph Simple Rational Functions.<br>• Graph General Rational | *Unit Targets:*<br><br>• Evaluate $n$th Roots and use Rational Exponents.<br>• Apply Properties of Rational Exponents. | *Unit Targets:*<br><br>• Graph exponential growth functions.<br>• Graph exponential decay functions. | *Unit Targets:*<br><br>• Define and use Sequences and Series.<br>• Analyze arithmetic sequences and series.<br>• Analyze | *Unit Targets:*<br><br>• Verify Trigonometric Identities.<br>• Solve Trigonometric Equations.<br>• Write Trigonometric | *Unit Targets:*<br><br>• Find the inclination of a line, the angle between two lines, and the distance between a point and a line. |

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| intercept form.<br><br>• Solve $x^2+bx+c=0$ by factoring.<br>• Solve $ax^2+bx+c=0$ by factoring.<br>• Solve quadratic equations by find square roots.<br>• Perform Operations with complex numbers.<br>• Solve Quadratics by completing the square.<br>• Use the Quad Formula & the discriminant.<br>• Graph and Solve Quad. Inequalities. | Polynomials.<br>• Factor and Solve Polynomial Equations.<br>• Apply the Remainder and Factor Theorems.<br>• Find Rational Zeros.<br>• Apply the Fundamental Theorem of Algebra.<br>• Analyze Graphs of Polynomial Functions.<br>• Solve Systems with Non-linear Equations | Functions.<br>• Multiply and Divide Rational Expressions.<br>• Add and Subtract Rational Expressions.<br>• Solve Rational Equations.<br>• Describe and Compare Function Characteristics.<br>• Symmetries of Functions (1.1)<br>• Even and Odd Functions (1.4)<br>• Find Partial Fraction Decomposition (7.5) | • Perform Function Operations and Composition.<br>• Use Inverse Functions.<br>• Graph Square Root and Cube Root Functions.<br>• Solve Radical Equations. | • Use functions involving *e*.<br>• Evaluate logarithms and graph logarithmic functions.<br>• Apply properties of logarithms.<br>• Solve exponential and logarithmic equations.<br>• Create and apply exponential and power functions. | geometric sequences and series.<br>• Evaluate Sums of infinite geometric series.<br>• Counting Principles<br>• Construct and interpret Normal Distributions. | Functions and Models.<br>• Apply Sum and Difference Formulas.<br>• Apply Multiple-Angle Formulas. | • Recognize assorted conic sections as the intersections of a plane and a double-napped cone.<br>• Write the standard form of the equation of a parabola, ellipse, and hyperbola.<br>• Use properties of parabolas, ellipses, and hyperbolas to solve real-life problems. |

# Algebra II/PreCalculus - Grades 10-12 Unit One

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| **Unit Title:** Quadratic Functions and Factoring (Chapter 1 Review) | |
| **Unit Summary:** Graph, analyze, model and solve quadratic functions. | |
| **Primary Interdisciplinary Connections:** Business, Social Studies, Science | |
| **21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy | |

| Learning Targets |
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| **NJSLS Standards:** 9-12.F.IF.7a, 9-12.A.SSE.3a, 9-12.A.REI.4b, 9-12.N.CN.2, 9-12.A.REI.4a, 9-12.N.CN.7 | |
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 | |
| **Content Statements:** | |
| 1 | Quadratic functions in standard form |
| 2 | Quadratic functions in vertex or intercept form |
| 3 | Factoring $x^2+bx+c=0$ |
| 4 | Factoring $ax^2+bx+c=0$ |
| 5 | Square roots of Quadratic Equations |
| 6 | Complex numbers |
| 7 | Completing the square |
| 8 | The Quadratic Formula and the discriminant |
| 9 | Quadratic Inequalities |

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| **Big Idea:** Many real-life situations can be modeled using quadratic functions. | |

| Unit Essential Questions: | Unit Enduring Understandings: |
|---|---|
| • What is the shape and characteristics of the graph of a quadratic function? <br> • What real-world situations can be modeled by quadratics? <br> • How can quadratic functions be solved and how many solutions can exist? | • Quadratic functions are in the shape of a parabola. <br> • There are as many as two solutions for a quadratic function and a variety of techniques for finding them. |

**Unit Learning Targets**
*Students will…*

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

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Graph the parent function for quadratic functions, identify the characteristics of the graph, and explore the effects of changing the coefficients of quadratic functions in standard form. <br> 1. Graph the parent function. <br> 2. Identify the vertex and axis of symmetry. <br> 3. Explore the effect of changing the coefficient "a" to values greater than and less than one and to positive and negative values. <br> 4. Explore the effect of adding a "c" coefficient and changing its value. <br> 5. Explore the effect of adding a "b" coefficient and changing its value. <br> 6. Recognize that "c" is the y-intercept and discuss the formula for the x-coordinate of the vertex. | 20 minutes |
| • Model dropped objects with the quadratic function. | 30 minutes |

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| 1. Given the model function, calculate times for objects to fall to earth from various heights.  Discuss the relationship between the height and the time to drop to the earth.  Demonstrate with actual objects.  Discuss that mass does not affect the time to drop (assuming negligible air resistance).<br>2. Extend the discussion to include the path of all objects in flight, such as that of a batted baseball.  Discuss the independence of horizontal and vertical motion.<br>3. Find maximum heights of objects in flight. | Weeks 1-8 |

| *Teacher Resources* | *Teacher Note* |
|---|---|
| • Graphing software projected on a large screen<br>• Actual objects of various weights to drop as demonstrations<br>• Blackboard or whiteboard | If all students are provided graphing calculators, add an individual practice exercise to the first activity. |

## Differentiating Instruction:
## Students with Disabilities, English Language Learners,
## and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension

• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

| Unit Title: Polynomials and Polynomial Functions (Chapter 2, 7.1) |
|---|
| **Unit Summary:** Use properties of exponents. Graph, analyze, model, and solve polynomial functions. |
| **Primary Interdisciplinary Connections:** Business, Social Studies, Science |
| **21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy |
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## Learning Targets

| **NJSLS Standards:** 9-12.N.RN.1, 9-12.F.IF.7c, 9-12. A.APR.1, 9-12.A.SSE.2, 9-12.A.APR.2, 9-12.N.CN.9 | |
|---|---|
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 | |
| **Content Statements:** | |
| 1 | Properties of Exponents |
| 2 | Evaluate and Graph Polynomial Functions |
| 3 | Add, Subtract, and Multiply Polynomials |
| 4 | Polynomial Equations |
| 5 | Remainder and Factor Theorems |
| 6 | Rational Zeros |
| 7 | Fundamental Theorem of Algebra |
| 8 | Analyze Graphs Polynomial Functions |
| | |
| **Big Idea:** Perform Operations on Polynomial expressions and graph polynomial functions. | |

| Unit Essential Questions: | Unit Enduring Understandings: |
|---|---|
| <ul><li>How are addition, subtraction, multiplication, and division applied to polynomials?</li><li>How are polynomials factored?</li><li>What are the shapes and characteristics of the graphs of polynomial functions?</li></ul> | <ul><li>Operations can be performed on polynomials.</li><li>Polynomials can be factored using a variety of techniques.</li><li>The number of solutions of polynomial functions is at most the degree.</li><li>The domain is the set of all real numbers and the functions are continuous.</li></ul> |

**Unit Learning Targets**
*Students will…*

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

## Evidence of Learning

**Summative Assessment:**  Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Model volumes of geometric shapes with polynomial functions:  Given a rectangle, cylinder, and pyramid, each with dimensions that include variables, find the associated volumes.  Include binomials as needed (see pages 92 and 108). | 20 minutes |
| • Explore the graphs of polynomial functions: <br> 1. Graph a cubic function with a positive leading coefficient and a cubic function with a negative leading coefficient, on the same coordinate plane.  Note the characteristics of the graphs. (see page 98 example #5 for possible functions to use) <br> 2. Graph a quartic function with a positive leading coefficient and a quartic function with a negative leading coefficient, on the same coordinate plane.  Note the characteristics of the graphs (see page 98 example #5 for possible functions to use). <br> 3. Summarize the observations.  Make conclusions | 25 minutes |

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| about end behavior (see page 97).<br>1. objects in flight, such as that of a batted baseball. Discuss the independence of horizontal and vertical motion.<br>2. Find maximum heights of objects in flight. | |
| *Teacher Resources* | *Teacher Note* |
| • Graphing software projected on a large screen<br>• Actual objects of various weights to drop as demonstrations<br>• Blackboard or whiteboard | If all students are provided graphing calculators, add an individual practice exercise to the first activity. |

## Differentiating Instruction:
## Students with Disabilities, English Language Learners,
## and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
• Word walls
• Sentence frames

•Think-pair-share
•Cooperative learning groups

# Algebra II/PreCalculus - Grades 10-12 Unit Three

| **Unit Title:** Rational Functions (Alg 2 text Chapter 5, 7.5 and PreCalc text 1.1, 1.4) |
|---|
| **Unit Summary:** Graph, analyze, model and solve rational functions |
| **Primary Interdisciplinary Connections:** Business, Social Studies, Science |
| **21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy |
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## Learning Targets

| **NJSLS Standards:** 9-12.A.CED.2, 9-12.F.IF.7d, 9-12.A.APR.7, 9-12.A.REI.2, 9-12.F.IF.9 |
|---|
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 |

**Content Statements:**

| 1 | Inverse and Joint Variation |
|---|---|
| 2 | Simple Rational Functions |
| 3 | General Rational Functions |
| 4 | Multiply and Divide Rational Expressions |
| 5 | Add and Subtract Rational Expressions |
| 6 | Rational Equations |
| 7 | Characteristics of Function |
| 8 | Symmetries of Graphs |
| 9 | Even and Odd Functions |
| 10 | Partial Fraction Decomposition |

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**Big Idea:** Functions with variables in the denominator are defined as rational and can be used to model real-life situations.

| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
|---|---|
| • What are possible characteristics of the graphs of rational functions? <br><br> • What happens when the denominator of a rational expression/function becomes zero? <br><br> • How do we solve rational equations? | • The domain of rational functions may not be the set of all real numbers. <br><br> • The graphs of rational functions may contain holes and/or asymptotes. <br><br> • There are various ways to solve rational equations. |
| | |

**Unit Learning Targets**
*Students will…*

- Model Inverse and Joint Variation.
- Graph Simple Rational Functions.
- Graph General Rational Functions.
- Multiply and Divide Rational Expressions.
- Add and Subtract Rational Expressions.
- Solve Rational Equations.
- Describe and Compare Function Characteristics.
- Test for Symmetries of Graphs
- Determine whether a function is even, odd, or neither
- Find Partial Fraction Decompositions

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Given that two variables vary inversely, and given one pair of values that satisfy the relationship, write an equation for the function. Repeat this for several different inverse variation functions. Notice a pattern in this process. | 15 minutes |
| • Given one inverse variation function, one rational function that has a hole in the graph, one rational function that has a single vertical asymptote (not at x=0), and one rational function that has two vertical asymptotes: <br> 1. Discuss values that would not be possible for x. Describe the domain for each function. <br> 2. Display the graphs of each function to illustrate that these values for x indeed cannot exist. | 20 minutes |

| *Teacher Resources* | *Teacher Note* |
|---|---|
| • Graphing software projected on a large screen<br>• Actual objects of various weights to drop as demonstrations<br>• Blackboard or whiteboard | If all students have access to graphing calculators, students can graph the functions individually in order to make the observations |

## Differentiating Instruction:
## Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

# Algebra II/PreCalculus - Grades 10-12 Unit Four

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|---|
| **Unit Title:** Rational Exponents and Radical Functions (Chapter 3) |
| **Unit Summary:** Understand and use rational exponents. Analyze and graph radical functions. Solve radical equations. |
| **Primary Interdisciplinary Connections:** Business, Social Studies, Science |
| **21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy |
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| Learning Targets |
|---|
| **NJSLS Standards:** 9-12.N.RN.1, 9-12.N.RN.2, 9-12.F.BF.1, 9-12.F.BF.4, 9-12.F.IF.7b, 9-12.A.REI.2 |
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 |
| **Content Statements:** |

| | |
|---|---|
| 1 | Roots and Rational Exponents |
| 2 | Properties of Rational Exponents |
| 3 | Function Operations and Composition |
| 4 | Inverse Functions |
| 5 | Square Root and Cube Root Functions |
| 6 | Radical Equations |
| | |

**Big Idea:** Understand and use rational exponents and graph and solve radical functions.

| Unit Essential Questions: | Unit Enduring Understandings: |
|---|---|
| • What are the similarities and differences between rational exponents and radical expressions? <br> • What are inverse functions and composite functions? <br> • What are the characteristics of the graphs of square and cube root functions? <br> • How can radical equations be solved? | • All radical expressions have an equivalent rational exponent expression. <br> • Two functions composed in both directions will equal x if and only if the two functions are inverses of each other. <br> • The graphs of the square and cube root functions have distinct shapes and characteristics. <br> • Radical equations can be solved by raising each side of the equations to the power of the index. |

**Unit Learning Targets**
*Students will…*

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

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Simplify given nth roots where n=2, 3, 4 and 5.  List perfect squares, perfect cubes, perfect powers of four, and perfect powers of five.  Discuss a general procedure for simplifying roots. | 25 minutes |
| • Graph the parent function for square roots and explore the characteristics of the graph. <br> 1. Graph the parent function for square roots <br> 2. Change the leading coefficient to values that are less than and greater than one.  Note the effect on the graph. <br> 3. Change the leading coefficient to a negative value.  Note the effect on the graph. <br> 4. Add constants that translate the graph.  Note the effect on the graph. | 15 minutes |
| *Teacher Resources* | *Teacher Note* |
| • Graphing software projected on a large screen <br> • Actual objects of various weights to drop as demonstrations <br> • Blackboard or whiteboard | If all students have access to graphing calculators, students can graph the functions individually in order to make the observations |

## Differentiating Instruction:
## Students with Disabilities, English Language Learners,
## and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

# Algebra II/PreCalculus - Grades 10-12 Unit Five

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|---|---|
| **Unit Title:** Exponential and Logarithmic Functions (Chapter 4) | |

**Unit Summary:** Graph, analyze, model, and solve exponential and logarithmic functions.

**Primary Interdisciplinary Connections:** Business, Social Studies, Science

**21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy

## Learning Targets

**NJSLS Standards:** 9-12.F.IF.7e, 9-12.F.BF.5, 9-12.F.LE.4, 9-12.F.LE.2

**Content Statements:**

**Technology Standards:** 8.1.12.A.3, 8.1.12.C.1

| 1 | Exponential growth functions |
|---|---|
| 2 | Exponential decay functions |
| 3 | Functions involving $e$ |
| 4 | Evaluate logarithms and graph logarithmic functions |
| 5 | Properties of logarithms |
| 6 | Exponential and logarithmic equations |
| 7 | Exponential and power functions |

**Big Idea:** Exponential functions can be used to model growth and decay and can be solved using logarithms.

| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
|---|---|
| • What are the characteristics of the graphs of exponential and logarithmic functions? | • The graphs of exponential functions can be used to model growth and decay. |
| • What can be modeled using exponential functions? | • There are special properties for performing operations on logarithmic and exponential expressions. |
| • How can operations be performed on exponential and logarithmic functions? | • Exponential and logarithmic functions are inverses and can be used to solve each other. |
| • How can exponential and logarithmic functions be solved? | |

**Unit Learning Targets**
*Students will...*

- Graph exponential growth functions.
- Graph exponential decay functions.
- Use functions involving $e$.

- Evaluate logarithms and graph logarithmic functions.
- Apply properties of logarithms.
- Solve exponential and logarithmic equations.
- Create and apply exponential and power functions.

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Model a family tree with an exponential growth function.<br>   1. Beginning with oneself, draw a family tree for about four generations.<br>   2. Make a table of values for the number of generations, and the corresponding numbers of ancestors.<br>   3. Explore the pattern. Write a function for the number of ancestors as a function of the generation. Determine the number of ancestors one has going back for a large number of generations.<br>• Explore the graphs of exponential decay functions.<br>   1. Graph the parent function for exponential decay functions.<br>   2. Change the value and sign of the leading coefficient. Note the effect on the graph.<br>   3. Add constants that translate the graph. Note the effect on the graph. | 20 minutes<br><br><br><br>20 minutes |
| *Teacher Resources* | *Teacher Note* |
| • Graphing software projected on a large screen<br>• Blackboard or whiteboard | If all students have graphing calculators, the graphs can be made individually and the same changes |

and observations can be made.

## Differentiating Instruction:
## Students with Disabilities, English Language Learners,
## and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

# Algebra II/PreCalculus - Grades 10-12 Unit 6

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|---|
| **Unit Title:** Sequences and Series, Data Analysis (PreCalc Ch 9.1-9.3, 9.6, Alg 2 Section 6.3) |
| **Unit Summary:** Define, analyze, and find sums of sequences and series. Apply the fundamentals of data analysis and probability distributions. |
| **Primary Interdisciplinary Connections:** Business, Social Studies, Science |
| **21st Century Career and Life Themes:** Global Awareness, Financial, Economic, Business and Entrepreneurial Literacy, Life and Career Skills, Information Literacy |
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## Learning Targets

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|---|
| **NJSLS Standards:** NJSLS: 9-12.F.IF.3, 9-12.F.BF.2, 9-12.A.SSE.4, 9-12.A.SSE.3, 9-12.S.ID.4, 9-12.G.SRT.6 |
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 |
| **Content Statements:** |

| | |
|---|---|
| 1 | Sequences and Series |
| 2 | Arithmetic sequences and series |
| 3 | Geometric sequences and series |
| 4 | Infinite geometric series |
| 5 | Counting Principles |
| 6 | Construct and interpret Normal Distributions |

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| **Big Idea:** Identifying patterns in sequences and series allows us to create models and make predictions.  There are many ways to represent and analyze data via normal distributions |

| Unit Essential Questions: | Unit Enduring Understandings: |
|---|---|
| • What is a sequence or a series? <br><br> • What is the difference between arithmetic and geometric sequences/series? <br><br> • How does a normal curve model real data? | • Infinite sequences can be modeled mathematically. <br><br> • Understanding the mathematical model of a sequence allows us to find cumulative totals of a series. <br><br> • The normal curve can be applied to model numerous real-world scenarios. |

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| **Unit Learning Targets** <br> *Students will…* <br><br> • Define and use Sequences and Series. <br> • Analyze arithmetic sequences and series. <br> • Analyze geometric sequences and series. <br> • Evaluate Sums of infinite geometric series. |

- Construct and interpret Normal Distributions.

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Investigate an infinite geometric series with the activity on page 459. | 30 minutes |
| • Find the normal distribution of a set of data and analyze variations | 40 minutes |

| Teacher Resources | Teacher Note |
|---|---|
| • Graphing software projected on a large screen<br>• Blackboard or whiteboard | If all students have graphing calculators, the graphs can be made individually and the same changes and observations can be made. |

## Differentiating Instruction:
## Students with Disabilities, English Language Learners,
## and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

**Unit title:** Analytic Trigonometry  (Chapter 5)

**Unit summary:** Verify and use Trigonometric Identities, Solve Trigonometric Equations and Apply Sum-and-Difference, Multiple-Angle, Sum-to-Product and Product-to-Sum Formulas

**Primary interdisciplinary connections:** Business, Science

**21st Century Themes:** Global Awareness, Business and Entrepreneurial

## Learning Targets

**Standards:** NJSLS 9-12.F.TF.1, 9-12.F.TF.2, 9-12.F.TF.6, 9-12.G.SRT.11, 9-12.F.IF.7e, 9-12.F.TF.8, 9-12.F.TF.7, 9-12.F.TF.5, 9-12.F.TF.9

**Technology Standards:** 8.1.12.A.3, 8.1.12.C.1

**Content Statements:**

| 1 | Trigonometric Identities and Equations |
|---|---|
| 2 | Trigonometric Equations |
| 3 | Sum and Difference Formulas |
| 4 | Double-Angle and Half-Angle Formulas |
| 5 | Product-to-Sum and Sum-to-Product Formulas |

**Big Idea:** Use trig ratios and identities to solve various types of problems in many ways.

**Unit Essential Questions:**

- What are Fundamental Trigonometric Identities and how are they useful?
- What are Sum-and-Difference, Multiple-Angle, Sum-to-Product and Product-to-Sum formulas?

**Unit Enduring Understandings:**

- The Fundamental Trigonometric Identities are the heart of trigonometry and can be used to rewrite/simplify/evaluate trigonometric equations/functions.
- The various formulas are relationships that can be applied to solve problems that would otherwise be very difficult or even impossible to solve.

**Unit Learning Targets**
*Students will…*

- Learn the Fundamental Trigonometric Identities
- Solve/Evaluate Trigonometric Equations/Functions Using the Fundamental Trig Identities
- Apply assorted formulas to simplify or solve problems
- Use the Law of Signs and Law of Cosines to solve triangles and real life problems
- Perform operations on vectors and use vectors to solve problems

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Define and use the Unit Circle and Radian Measures<br>   1. Define Fundamental Trigonometric Identities and demonstrate how the relationships connect to what we already know about basic right triangle trigonometry.<br>   2. Use FTI to simplify complicated trig expressions<br>   3. Use FTI to prove that an equation either is not an identity or verify that it is an identity<br>   4. Independent practice | 15 minutes<br><br>10 minutes<br><br>5 minutes<br><br><br>10 minutes |
| *Teacher Resources* | *Teacher Note* |
| • Smart Notebook File with FTI (viewed on SmartBoard)<br>• Handouts- Fundamental Trigonometric Identities<br>• Textbook | |

| | |
|---|---|
| **Unit title:** Analytic Trigonometry- Conics  (PreCalculus Chapter 8) | |
| **Unit summary:** Define and use equations of conic sections to solve problems involving real life phenomena such as planetary orbits. | |
| **Primary interdisciplinary connections:** Business, Science | |
| **21<sup>st</sup> Century Themes:** Global Awareness, Business and Entrepreneurial | |

| **Learning Targets** | |
|---|---|
| **Standards:** NJSLS 9-12.G-GPE.1, 9-12.G-GPE.2, 9-12.G-GPE.3 | |
| **Technology Standards:** 8.1.12.A.3, 8.1.12.C.1 | |
| **Content Statements:** | |

| | |
|---|---|
| 1 | Conic Sections - Overview |
| 2 | The Parabola |
| 3 | The Ellipse (introduce Circles first, which can be considered special ellipses) |
| 4 | The Hyperbola |

**Big Idea:** Use equations of conic sections to find missing information about the conic or related information.

| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
|---|---|
| • What are Conic Sections and how do they relate to what I already know? | • Conic Sections are the intersections of a plane and a double-napped cone which can all be related to what we already know from Geometric and Algebra. |
| • What is a parabola in terms of conics and how is it different from what I already know to be a parabola? | • In chapter 2 we learned about the algebraic definition of a parabola.  This section looks at the parabolas from a geometric perspective. They are still the same thing, but viewed through different lenses. |
| • What is an ellipse, how are circles related to it, and what are their equations? | • Circles are special cases of an ellipse. An ellipse is an oval-like shape (which we will define formally in class), and they can be used to represent and solve real life problems. |
| • What is a hyperbola and how can equations of hyperbolas help solve real life problems? | • A hyperbola is a special conic section which looks much like two parabolas that open in opposite directions and do not intersect. Hyperbolas are used with systems such as GPS systems that we likely use regularly in today's |
| • What is the Polar Coordinate System and how can I use it? | |

world.

**Unit Learning Targets**

*Students will…*

- Recognize assorted conic sections as the intersections of a plane and a double-napped cone
- Write the standard form of the equation of a parabola, circle, ellipse, and hyperbola
- Use properties of parabolas, ellipses, and hyperbolas to solve real life problems
- Plot points on the polar coordinate system
- Convert points and equations from rectangular to polar form and vice versa
- Recognize special polar graphs

## Evidence of Learning

**Summative Assessment:** Quizzes, Tests

**Formative Assessments:**

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

## Lesson Plans

| Activities/Interdisciplinary Connections | Timeframe |
|---|---|
| • Ellipses and Circles<br>  1. Define Ellipses and show the connection between an ellipse and a circle as well as the equations of each and their similarities and differences.<br>  2. Take given information and write equations of ellipses and use equations of ellipses to find missing information.<br>  3. Graph ellipses based on given information or equations.<br>  4. Find eccentricity of ellipses.<br>  5. Independent practice. | 10 minutes<br><br>10 minutes<br><br>5 minutes<br><br>5 minutes<br>10 minutes |
| *Teacher Resources* | *Teacher Note* |
| • Smart Notebook File with interactive illustration of an ellipse (viewed on SmartBoard)<br>• Textbook | |