

# Topic 01: Linear Functions & Systems

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 1**  
Length: **2 weeks**  
Status: **Published**

## Standards

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### Math Standards

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

### Mathematical Practices

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MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

### Transfer Goals

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### Transfer Goals

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- Recognize and solve practical or theoretical problems involving mathematics, including those for which the solution approach is not obvious, by using mathematical reasoning and strategic thinking. In

this unit students will solve real-life problems involving key features of graphs.

## Concepts

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## Essential Questions

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- How do graphs and equations reveal information about a relationship between two quantities?
- What are the ways in which functions can be used to represent and solve problems involving quantities?
- What do the difference between the equation of a function and the equation of its parent function tell you about the differences in the graphs of the two functions?

## Understandings

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- Key features of a graph (domain, range, intercepts)

## Critical Knowledge and Skills

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## Knowledge

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Students will know:

- average rate of change
- interval notation
- maximum
- minimum
- set-builder notation
- zero of the function

## Skills

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Students will be able to:

- Identify key features of a graph of a function including the intercepts, positive and negative intervals, and areas where the function is increasing and decreasing.
- Calculate and interpret the average rate of change of a function over a specified interval.

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- **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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students

might also benefit by using concrete objects to demonstrate different concepts.

- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

#### **Interdisciplinary Connections**

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

**SCIENCE** - Students will analyze historical data on fuel efficiency for cars.

**SOCIAL STUDIES** -

**WORLD LANGUAGES** -

## **VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY** - Students will analyze the current used by power tools to determine whether the circuit can handle all three power tools.

## **BUSINESS EDUCATION -**

## **GLOBAL AWARENESS -**

### **Learning Plan / Pacing Guide**

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#### **Algebra 2: CP and ICR**

##### **Week 1: 9-3-18**

- Distribution of codes, course introduction, textbook tutorial
- Lesson 1.1 – Key Features of Functions (3days)

##### **Week 2: 9/10/18**

- Lesson 1.1 –Key Features of Functions (2 days)
- Performance Task

#### **Algebra 2: Honors**

##### **Week 1:**

- Lesson 1.1 - Features of Key Functions

# Topic 02: Quadratic Functions and Equations

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 1**  
Length: **5 weeks**  
Status: **Published**

## Standards

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### Math Standards

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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 $f(x) + k$ , $f(kx)$ , $f(x+k)$ , 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 $x^4 - 16$ as $(x^2)^2 - (4)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - 4)(x^2 + 4)$ .
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

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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- In this unit students will independently use their learning to solve real world problems involving polynomial functions.

## Concepts

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## Essential Questions

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- How can you solve a quadratic equation by completing the square?
- How can you use the Quadratic Formula to solve quadratic equations or to predict the nature of their solutions?
- How do you use quadratic functions to model situations and solve problems?
- How does the equation of a quadratic function in vertex form highlight key features of the function's graph?
- How is the factored form helpful in solving quadratic equations?
- What key features can you determine about a quadratic function from an equation in standard form?
- How can you represent and operate on numbers that are not on the real number line?
- How can you solve a system of two equations or inequalities in which one is linear and one is quadratic?

## Understandings

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- Quadratic functions are transformations of the parent function  $f(x) = x^2$
- The vertex form of a quadratic function highlights key features of the function's graph
- A quadratic function in vertex form can be rewritten in standard form to highlight different features of the function's graph
- The factored form of a quadratic function is used to find the zeros of the function
- A complex number contains both real and imaginary parts
- The four basic operations can be applied to complex numbers
- A quadratic equation can be solved by completing the square
- The quadratic formula can be used to solve a quadratic equation
- A linear-quadratic system consists of a linear equation and a quadratic equation. The points of intersection are the solutions.

## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- completing the square
- complex conjugates
- complex number
- discriminant

- imaginary number
- imaginary unit  $i$
- parabola
- Quadratic Formula
- quadratic function
- standard form of a quadratic function
- vertex form of a quadratic function
- Zero product property

## **Skills**

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Students will be able to:

- Create quadratic functions in vertex form to represent relationships between variables as shown in their graphs.
- Graph functions of coordinate axes using their key features.
- Interpret key features of the graph of a quadratic function.
- Create quadratic functions written in standard form.
- Identify key features of quadratic functions and graph a quadratic function written in standard form.
- Write a quadratic equation in factored form and use it to identify the zeros of the function it defines.
- Determine the intervals over which a quadratic function is positive or negative.
- Add, subtract and multiply complex numbers using the properties of operations and the relation  $i^2 = -1$ .
- Use complex numbers to represent numbers that are not on the real number line.
- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of their mathematical models.
- Explain why the results of their mathematical models might not align exactly with their problem situation.
- Transform a quadratic equation into the form  $(x-p)^2 = q$  by completing the square.
- Complete the square to reveal the minimum or maximum value of a quadratic expression.
- Use the Quadratic Formula to solve quadratic equations that have complex solutions.
- Use algebra to solve a linear-quadratic system.
- Solve a linear-quadratic system using graphing and explain why the points of intersections are the solutions.

## **Assessment and Resources**

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## **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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## **Supplementary Resources**

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## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- 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**

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- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
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- ☐ Pair ELL students with a student who is fluent in English.
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- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**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** - Students will use mathematical modeling to compare rates for filling pools with water.

**BUSINESS EDUCATION** - Students will learn about fixed and variable costs and how they relate to the profitability of a business.

**GLOBAL AWARENESS** -

## **Algebra 2: CP**

### **Week 1: Thursday & Friday of Week of 9/10/18**

- Lesson 2.1 - Vertex Form of a Quadratic Function (2 of 4 days)

### **Week 1: 9-17-18**

- Lesson 2.1 - Vertex Form of a Quadratic Function (last of 3 days)
- Lesson 2.2 - Standard Form of a Quadratic Function (3 days)
- Lesson 2.3 - Factored Form of a Quadratic Function (1 of 4 days)

### **Week 2: 9-24-18**

- Lesson 2.3 - Factored Form of a Quadratic Function (last 3 of 4 days)
- Benchmark testing (2 days)

### **Week 3: 10-1-18**

- Review 2.1-2.3 (1 day)
- Quiz 2.1-2.3 (1 day)
- Lesson 2.4 - Complex Numbers and Operations (2 of 3 days)

### **Week 4: 10-8-18**

- Lesson 2.4 - Complex Numbers and Operations (day 3 of 3 days)
- Lesson 2.5 - Completing the Square (2 of 3 days)

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### **\*\*\*\*\*Week 5: 10-15-18**

- Lesson 2.6 - The Quadratic Formula (1 of 2 days)
- Lesson 2.6 - The Quadratic Formula (2 of 2 days)
- Quiz 2.5-2.6 (1 day)
- Lesson 2.7 - Linear Quadratic Systems (2 days)
- Unit Review (2 days)
- Performance Assessment (1 day)
- Unit Test (1 day)
- Optional Day for STEM project/Your Task: Hit a Home Run

## **Algebra 2: Honors**

### **Week 1:**

- Topic 2 Readiness Assessment

### **Week 2:**

- Intro STEM Project/Lesson 2.1 - Vertex Form of a Quadratic Function
- Lesson 2.2 - Standard Form of a Quadratic Function
- Lesson 2.3 - Factored Form of a Quadratic Function

### **Week 3:**

- Review 2.1-2.3
- Quiz 2.1-2.3
- Lesson 2.4 - Complex Numbers and Operations
- Mathematical Modeling in 3 Acts/Swift Kick

### **Week 4:**

- Lesson 2.5 - Completing the Square
- Lesson 2.6 - The Quadratic Formula
- Quiz 2.4-2.6

### **Week 5:**

- Lesson 2.7 - Linear Quadratic Systems
- Unit Review
- Performance Assessment

### **Week 6:**

- Unit Test
- Optional Day for STEM project/Your Task: Hit a Home Run

## **Algebra 2: ICR**

### **Week 1: 9-17-18**

- Lesson 2.1 - Vertex Form of a Quadratic Function (4 days)
- Quiz 2.1 (1 day)

### **Week 2: 9-24-18**

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- Lesson 2.2 - Standard Form of a Quadratic Function (4 days)
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- Quiz 2.2 (1 day)

### **Week 3: 10-1-18**

- Factoring Review

**Week 4: 10-8-18**

- Complete Factoring Review
- PSATs
- Lesson 2.3 - Factored Form of a Quadratic Function (2 days)
- Quiz 2.3 (1 day)

**Week 5: 10-15-18**

- Continue Lesson 2.3 - Factored Form of a Quadratic Function (2 days)
- Review 2.1-2.3
- Quiz 2.1-2.3

**Week 6: 10-22-18**

- Lesson 2.4 - Complex Numbers and Operations (4 days)
- Quiz 2.4 (1 day)

**Week 7: 10-29-18**

- Lesson 2.5 - Completing the Square (4 days)
- Quiz 2.5 (1 day)

**Week 8: 11-5-18**

- Lesson 2.6 - The Quadratic Formula (2 days)
- NJEA Break

**Week 9: 11-12-18**

- Lesson 2.7 - Linear and Quadratic Systems (4 days)
- Quiz 2.7 (1 day)

**Week 10: 11-19-18**

- Unit 2 Review
- Unit 2 Test



# Topic 03: Polynomial Functions

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 2**  
Length: **6 weeks**  
Status: **Published**

## Standards

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### Math Standards

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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 $f(x)$ 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.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
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-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.N-CN.C.9	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
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 $f(x)$ and a number $a$ , the remainder on division by $x - a$ is $f(a)$ , so $f(a) = 0$ if and only if $(x - a)$ is a factor of $f(x)$ .
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 $\frac{f(x)}{g(x)}$ in the form $\frac{q(x)}{g(x)} + \frac{r(x)}{g(x)}$ , where $q(x)$ , $r(x)$ , $g(x)$ , and $f(x)$ are polynomials with the degree of $q(x)$ less than the degree of $g(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - 7x^2 + 12$ as $(x^2)^2 - (x^2)^2 + 12$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - 3)(x^2 + 4)$ .

## Mathematical Practices

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.

## Transfer Goals

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### Transfer Goals

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- In this unit students will independently use their learning to solve real world problems involving polynomial functions.

## Concepts

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## Essential Questions

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- What can the rule for a polynomial function reveal about its graph, and what can the graphs of polynomial functions reveal about the solutions of polynomial equations?
- How are symmetry and transformations represented in the graph and equation of a polynomial

function?

- How are the roots of a polynomial equation related to the coefficients and degree of the polynomial?
- How are the zeros of a polynomial function related to an equation and graph of the function?
- How can you divide polynomials?
- How can you use polynomial identities to rewrite expressions efficiently?
- How do the key features of a polynomial function help you sketch its graph?
- How do you add, subtract, and multiply polynomials?

## **Understandings**

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- A polynomial function is a function whose rule is either a monomial or a sum of monomials.
- The key features of the graph of a polynomial function (end behavior, intercepts, turning points, zeros) can be used to sketch its graph
- Properties of operations can be used to add, subtract and multiply polynomials
- Polynomial identities and the binomial theorem are helpful tools for rewriting expressions
- Polynomial expressions can be divided by linear factors using long division or synthetic division
- The remainder theorem is used to determine the remainder of a division problem
- The zeros of a polynomial function can be determined using factoring or synthetic division.
- Theorems such as rational root theorem, the fundamental theorem of algebra, and the conjugate root theorems are helpful tools for determining the roots of a polynomial function
- Polynomial functions are categorized as even, odd, or neither

## **Critical Knowledge and Skills**

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## **Knowledge**

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Students will know:

- Binomial Theorem
- degree of a polynomial
- end behavior
- even function
- identity
- leading coefficient
- multiplicity of a zero
- odd function
- Pascal's Triangle
- polynomial function
- relative maximum
- relative minimum
- Rational Root Theorem

- Remainder Theorem
- standard form of a polynomial
- synthetic division
- turning point

## **Skills**

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Students will be able to:

- Graph polynomial functions and show the key features of the graph.
- Predict the end behavior of polynomial functions by interpreting the leading coefficients and degrees.
- Sketch graphs showing key features, given a verbal description.
- Add, subtract and multiply polynomials and understand that polynomials are closed under these operations.
- Compare a polynomial function represented algebraically with one represented graphically.
- Prove polynomial identities and use them to multiply and factor polynomials.
- Expand binomials using the Binomial Theorem and coefficients determined by Pascal's triangle.
- Divide polynomial expressions using long division.
- Use synthetic division to rewrite rational expressions.
- Identify the zeros of a function by factoring or using synthetic division.
- Use the zeros of a polynomial function to sketch its graph.
- 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.
- Extend polynomial theorems and identities to find the real and complex solutions of polynomial equations.
- Write polynomial functions using conjugates.
- Recognize even and odd functions from their graphs and algebraic equations.
- Identify the effect on the graphs of cubic and quartic functions of replacing  $f(x)$  with  $f(x)+k$ ,  $kf(x)$ ,  $f(kx)$  and  $f(x+k)$ .

## **Assessment and Resources**

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## **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork

- Quizzes
- Exit Tickets
- Reflections

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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

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**Algebra 2: CP and ICR**

### **Week 1: 10-22-18**

- Intro to STEM project/Lesson 3.1 - Graphing Polynomial Functions (2 days)
- Lesson 3.2 - Adding/Subtracting/Multiplying Polynomials (2 days)
- Lesson 3.3 - Polynomial Identities (1 of 2 days)

### **Week 2: 10-29-18**

- Lesson 3.3 - Polynomial Identities (2 of 2 days)
- Lesson 3.4 - Dividing Polynomials (2 days)
- Review 3.1 - 3.4 (1 day)
- Quiz 3.1 - 3.4 (1 day)

### **Week 3: 11-5-18**

- Lesson 3.5 - Zeros of Polynomial Functions (2 days)

### **Week 4: 11-12-18**

- Lesson 3.6 - Theorems About Roots of Polynomial Equations (2 days)
- Lesson 3.7 - Transformations of Polynomial Functions (2 days)
- Review Unit 3 (1 of 2 days)

### **Week 5: 11-19-18**

- Review Unit 3 (2 of 2 days)
- Unit 3 Test (1 day)
- STEM Project time

### **Week 6: 11-26-18**

- Performance Assessment

## **Algebra 2: Honors**

### **Week 1:**

- Intro to STEM project/Lesson 3.1 - Graphing Polynomial Functions
- Lesson 3.2 - Adding/Subtracting/Multiplying Polynomials
- Lesson 3.3 - Polynomial Identities

### **Week 2:**

- Lesson 3.4 - Dividing Polynomials
- Review 3.1 - 3.4
- Quiz 3.1 - 3.4
- Lesson 3.5 - Zeros of Polynomial Functions

### **Week 3:**

- Lesson 3.6 - Theorems About Roots of Polynomial Equations



- Lesson 3.7 - Transformations of Polynomial Functions
- Review Unit 3

**Week 4:**

- Unit 3 Test
- STEM Project time
- Performance Assessment

# Topic 04: Rational Functions

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 2**  
Length: **5 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $f(x) - k$ , $f(kx)$ , 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.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.A-APR.D.6	Rewrite simple rational expressions in different forms; write $\frac{f(x)}{g(x)}$ in the form $q(x) + \frac{r(x)}{g(x)}$ , where $q(x)$ , $r(x)$ , and $g(x)$ are polynomials with the degree of $r(x)$ less than the degree of $g(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.
MA.A-APR.D.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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
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-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
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 $x^4 - 7x^2 + 12$ as $(x^2)^2 - (x^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - 3)(x^2 + 4)$ .

### Mathematical Practices

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

## Transfer Goals

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### Transfer Goals

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- 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 rational functions.

## Concepts

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## Essential Questions

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- How are inverse variations related to the reciprocal function?
- How can you graph a rational function?
- How can you solve rational equations and identify extraneous solutions?
- How do you calculate with functions defined as quotients of polynomials, and what are the key features of their graphs?
- How do you rewrite rational expressions to find sums and differences?

- How does understanding operations with fractions help you multiply and divide rational expressions?

## Understandings

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- The reciprocal function is used to model inverse variation, which is a proportional relationship between two variables such that when one variable increases, the other decreases.
- A rational function is any function  $R(x) = P(x)/Q(x)$  where  $P(x)$  and  $Q(x)$  are polynomial functions. The domain is all real values except any values for which  $Q(x) = 0$ . The graph has one or more asymptotes which guide the end behavior of the graph.
- Rational expressions form a system similar to the system of rational numbers which can be multiplied and divided by applying the properties of operations as they apply to rational expressions.
- The properties of operations used to add and subtract rational numbers can be applied to adding and subtracting rational expressions.
- Rational equations contain a rational expression and can be solved by multiplying each side of the equation by a common denominator to eliminate the fractions. Any solution that is excluded from the domain of the original equation is extraneous.

## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- asymptote
- constant of variation
- inverse variation
- reciprocal function
- rational expression
- rational function
- simplified form of a rational expression
- compound fraction
- extraneous solution
- rational equation

### Skills

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Students will be able to:

- Use inverse variation to write and graph the reciprocal function.

- Identify the effect of transformations on the graph of the reciprocal function and define the effects of  $h$  and  $k$  on the function  $f(x) = (1/(x-h)) + k$ .
- Graph rational functions by identifying asymptotes and end behavior.
- Rewrite simple rational expressions in different forms using long division.
- Use the structure of rational expressions to rewrite simple rational expressions in different forms.
- Understand that rational expressions form a system analogous to the system of rational numbers and use that understanding to multiply and divide rational expressions.
- Understand that rational expressions form a system analogous to the system of rational numbers and use that understanding to add and subtract rational expressions.
- Solve rational equations in one variable.
- Identify extraneous solutions to rational equations and give examples of how they arise.
- 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.

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

### **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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#### **• 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

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- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

## **Interdisciplinary Connections**

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**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**

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### **Algebra 2: CP and ICR**

#### **Week 1: 12-3-18**

- Intro STEM Project/Manufacturing Costs/Lesson 4.1 - Inverse Variation and the Reciprocal Function (2 days)
- Lesson 4.2 - Graphing Rational Functions (2 days)
- Lesson 4.3 - Multiplying and Dividing Rational Expressions (day 1 of 2)

#### **Week 2: 12-10-18**

- Lesson 4.3 - Multiplying and Dividing Rational Expressions (day 2 of 2)
- Review Lessons 4.1 - 4.3 (1 day)
- Quiz 4.1 - 4.3 (1 day)
- Lesson 4.4 - Adding and Subtracting Rational Expressions (2 days)

#### **Week 3: 12-17-18**

- Lesson 4.5 - Solving Rational Equations (2 days)
- Mathematic Modeling in 3 Acts/Real Cool Waters (1 day)
- Unit Review (Day 1 of 2)



## **Week 4: 12-31-18**

- Unit Review (Day 2 of 2)
- Performance Assessment (1 day)
- Unit Test (1 day)

## **Algebra 2: Honors**

### **Week 1:**

- Intro STEM Project/Manufacturing Costs/Lesson 4.1 - Inverse Variation and the Reciprocal Function
- Lesson 4.2 - Graphing Rational Functions
- Quiz 4.1 - 4.2

### **Week 2:**

- Lesson 4.3 - Multiplying and Dividing Rational Expressions
- Lesson 4.4 - Adding and Subtracting Rational Expressions
- Review Lessons 4.3 - 4.4
- Quiz 4.3 - 4.4

### **Week 3:**

- Lesson 4.5 - Solving Rational Equations
- Mathematic Modeling in 3 Acts/Real Cool Waters
- Unit Review
- Unit Test
- Performance Assessment

# Topic 05: Rational Exponents and Radical Functions

Content Area: **Math**  
Course(s): **Generic Course, ALGEBRA II, WOOD I**  
Time Period: **Marking Period 3**  
Length: **6 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.A.1c	Compose functions.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $f(x) - k$ , $f(kx)$ , 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.4	Find inverse functions.
MA.F-BF.B.4a	Solve an equation of the form $f(x) = k$ for a simple function $f$ that has an inverse and write an expression for the inverse.
MA.F-BF.B.4b	Verify by composition that one function is the inverse of another.
MA.F-BF.B.4c	Read values of an inverse function from a graph or a table, given that the function has an inverse.
MA.F-BF.B.4d	Produce an invertible function from a non-invertible function by restricting the domain.
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.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MA.G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
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.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - x^4$ as $(x^2)^2 - (x^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - x^2)(x^2 + x^2)$ .

## Mathematical Practices

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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- In this unit students will independently use their learning to solve real world problems rational exponents and radical functions.

## Concepts

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## Essential Questions

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- How are exponents and radicals used to represent roots of real numbers?
- How are rational exponents and radical equations used to solve real-world problems?
- How can properties of exponents and radicals be used to rewrite radical expressions?
- How can you find the inverse of a function and verify the two functions are inverse?
- How can you solve equations that include radicals or rational exponents?
- How can you use what you know about transformations of functions to graph radical functions?
- How do you combine, multiply, divide, and compose functions, and how do you find the domain of the resulting function?

## Understandings

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- Rational exponents and radicals represent the number of roots a polynomial has. The roots of the polynomial are used to simplify expressions and solve equations.
- The properties of integer exponents can be applied to terms with rational exponents, as well as to radicals. The properties of exponents and radicals can be used to rewrite radical expressions.
- The function  $g(x) = a\sqrt[n]{x-h} + k$  represents the transformation of the parent radical function  $f(x) = \sqrt[n]{x}$ , where  $a$  stretches the graph vertically,  $h$  translates the graph horizontally and  $k$  translates the graph vertically
- Solving equations that include radicals or rational exponents are similar to solving rational equations.
- Functions can be combined by operations and by composition. The result of the operation or composition can be described as a single function. The domain of the result of may be different from the domain of the original functions.
- The inverse of a function is found by exchanging the roles of the independent and dependent variables. Composition can be used to verify the two functions are inverses.

## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- index
- nth root
- radicand
- radical symbol
- like radicals
- reduced radical form
- radical function
- composite function

- composition of function
- inverse function
- inverse relation

## **Skills**

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Students will be able to:

- Find all real  $n$ th roots of a number.
- Evaluate expressions with rational exponents.
- Use  $n$ th roots to solve equations by rewriting expressions using the properties of exponents.
- Use the properties of exponents and radicals to identify ways to rewrite radical expressions.
- Interpret radical expressions that represent a quantity in terms of its context.
- Graph radical functions, including square root and cube root functions.
- Identify the effect of transformations on the key features of the graphs of radical functions.
- Solve radical equations in one variable.
- Explain how extraneous solutions may arise when solving radical equations.
- Solve radical inequalities and apply the solution within a real-world context.
- 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 their problem situation.
- Combine functions by addition, subtraction, multiplication, or division and identify the domain of the result.
- Compose functions, specifying the order in which the functions are applied and describing the domain of the composite function.
- Use tables, graphs, and equations to represent the inverse of a relation.
- Write an equation for the inverse of a function by restricting the domain.
- Verify that one function is the inverse of another, using composition.

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes

- Exit Tickets
- Reflections

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate

differentiated practice based on student performance.

☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

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

☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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

**SCIENCE** - Students will analyze the electromagnetic spectrum and design goggles to protect the vision of a space traveler.

**SOCIAL STUDIES** - Students will use polynomial functions to analyze population growth.

**WORLD LANGUAGES** -

**VISUAL/PERFORMING ARTS** - Students will investigate different ways to tune a piano, select a musical piece, and decide what tuning sound best for it.

**APPLIED TECHNOLOGY** -

**BUSINESS EDUCATION** -

**GLOBAL AWARENESS** -

### **Learning Plan / Pacing Guide**

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**Algebra 2: CP and ICR**



### **Week 1: 1-7-19**

- Intro STEM Project/Tune a Piano- Lesson 5.1 - nth Roots, Radicals and Rational Exponents (2 days)
- Lesson 5.2 - Properties of Exponents and Radicals (2 days)
- Lesson 5.3 - Graphing Radical Functions (Day 1 of 2)

### **Week 2: 1-14-19**

- Lesson 5.3 - Graphing Radical Functions (Day 2 of 2)
- Lesson 5.4 - Solving Radical Equations (2 days)
- Review 5.1-5.4 (1 day)

### **Week 3: 1-21-19**

- MIDTERMS

### **Week 4: 1-28-19**

- Quiz 5.1-5.4 (1 day)
- Mathematical Modeling in 3 Acts/The Snack Shack (1 day)
- Lesson 5.5- Function Operations (2 days)

### **Week 5: 2-4-18**

- Lesson 5.6 - Inverse Relations and Functions (2 days)
- Unit 5 Review (2 days)
- STEM DAY (1 day)

### **Week 6: 2-11-18**

- Performance Task (1 day)
- Unit 5 Test (1 day)

## **Algebra 2: Honors**

### **Week 1:**

- Intro STEM Project/Tune a Piano- Lesson 5.1 - nth Roots, Radicals and Rational Exponents
- Lesson 5.2 - Properties of Exponents and Radicals

- Lesson 5.3 - Graphing Radical Functions

### **Week 2:**

- Lesson 5.3 - Graphing Radical Functions
- Lesson 5.4 - Solving Radical Equations
- Review 5.1-5.4
- Quiz 5.1-5.4

### **Week 3:**

- Mathematical Modeling in 3 Acts/The Snack Shack
- Lesson 5.5 - Function Operations
- Lesson 5.6 - Inverse Relations and Functions
- Unit 5 Review
- STEM DAY

### **Week 4:**

- Performance Task
- Unit 5 Test

# Topic 06: Exponential and Logarithmic Functions

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 4**  
Length: **6 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.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.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $af(x)$ , $f(bx)$ , 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.5	Use the inverse relationship between exponents and logarithms to solve problems involving logarithms and exponents.
MA.F-BF.B.4a	Solve an equation of the form $f(x) = k$ for a simple function $f$ that has an inverse and write an expression for the inverse.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
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-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 $ab^t = k$ to the $ab^t$ power = $k$ where $a$ , $b$ , and $k$ 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.S-ID.B.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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
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 $x^4 - 7x^2 + 12$ as $(x^2)^2 - (x^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - 3)(x^2 + 4)$ .

$$2^n(2^n + 2^n).$$

MA.A-SSE.B.4	Derive and/or explain the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
MA.A-SSE.B.3c	Use the properties of exponents to transform expressions for exponential functions.

## Mathematical Practices

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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- 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 exponential and logarithmic functions.

## Concepts

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## Essential Questions

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- How are the properties of logarithms used to simplify expressions and solve logarithmic equations?
- How can you develop exponential models to represent and interpret situations?
- How can you represent and use geometric sequences and series?
- How do graphs and equations reveal key features of exponential growth and decay function?
- How do properties of exponents and logarithms help you solve equations?
- How do you use exponential and logarithmic functions to model situations and solve problems?
- How is the relationship between logarithmic and exponential functions revealed in the key features of their graphs?
- What are logarithms and how are they evaluated?

## Understandings

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- The rate of exponential growth or decay is the ratio between two consecutive output values in an exponential function.
- Exponential models are useful for representing situations in which rate increases by the same percent for each period of time and for interpreting problems that involve compound interest. Exponential regression can be used to generate exponential models for real-world contexts.
- A logarithmic function is the inverse of an exponential function. Logarithms are found by determining the exponent that must be applied to the base to yield a given result.
- The inverse relationship between exponential and logarithmic functions reveals key features of the graphs of both functions. Logarithmic functions can be used to model several real world situations.
- Properties of logarithms can be used to rewrite logarithmic expressions and to evaluate logarithms by changing the base.
- Some exponential equations can be solved by rewriting both sides with a common base. For others, rewriting the equations of logarithms and applying properties of logarithms is a more efficient method.
- A geometric sequence is a sequence of numbers in which terms are related by to the previous term by a common ratio  $r$ . A geometric series is the sum of a certain number of terms in a geometric sequence.

## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- decay factor
- exponential decay function
- exponential function
- exponential growth function
- growth factor
- compound interest formula
- continuously compounded interest formula

- natural base  $e$
- common logarithm
- logarithm
- logarithmic function
- natural logarithm
- Change of Base formula
- exponential equation
- logarithmic equation
- common ratio
- geometric sequence
- geometric series

## **Skills**

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Students will be able to:

- Interpret key features of exponential functions represented by graphs, tables, and equations.
- Graph transformations of exponential functions showing intercepts and end behavior.
- Rewrite exponential functions to identify rates.
- Interpret the parameters of an exponential function within the context of compound interest problems.
- Construct exponential models given two points or using regression.
- Use mathematical modeling to represent a problem 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.
- Understand the inverse relationship between exponents and logarithms.
- Use logarithms to solve exponential models.
- Evaluate logarithms using technology.
- Graph logarithmic functions, and interpret their key features.
- Write and interpret the inverses of exponential and logarithmic functions.
- Use Properties of Logarithms to rewrite logarithmic expressions.
- Use the Change of Base Formula to evaluate logarithmic expressions and solve equations.
- Use logarithms to express the solutions to exponential models.
- Solve exponential and logarithmic equations.
- Construct a geometric sequence given a graph, table, or description of a relationship.
- Translate between geometric sequences written in recursive and explicit forms.

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

### **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.



- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**MATH -**

**SCIENCE - Students will use probability to simulate weather conditions.**

**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**

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### **Algebra 2: CP and ICR**

#### **Week 1: 3-25-19**

- Intro STEM Project/Analyze Elections - Lesson 6.1: Key Features of Exponential Functions (2 days)
- Lesson 6.2: Exponential Models (2 days)
- Mathematical Modeling in 3 Acts (1 day)

#### **Week 2: 4-1-19**

- Review 6.1-6.2 (1 day)
- Quiz 6.1-6.2 (1 day)
- Lesson 6.3: Logarithms (2 days)
- Lesson 6.4: Logarithmic Functions (Day 1 of 2)

#### **Week 3: 4-8-19**

- Lesson 6.4: Logarithmic Functions (Day 2 of 2)
- Lesson 6.5: Properties of Logarithms (2 days)
- Lesson 6.6: Exponential and Logarithmic Equations (2 days)

#### **Week 4: 4-15-19**

- Review 6.3-6.6 (1 day)
- Quiz 6.3-6.6 (1 day)
- STEM day

#### **Week 5: 4-22-19**

- Lesson 6.7: Geometric Sequences and Series (2 days)
- Unit Review (Day 1 of 2)

#### **Week 6: 4-29-18**

- Unit Review (Day 2 of 2)
- Performance Task (1 day)
- Unit Test (1 day)

\*We will leave a week blank here for state testing

## **Algebra 2: Honors**

### **Week 1:**

- Intro STEM Project/Analyze Elections - Lesson 6.1: Key Features of Exponential Functions
- Lesson 6.2: Exponential Models
- Mathematical Modeling in 3 Acts
- Review 6.1-6.2
- Quiz 6.1-6.2

### **Week 2:**

- Lesson 6.3: Logarithms
- Lesson 6.4: Logarithmic Functions
- Lesson 6.5: Properties of Logarithms

### **Week 3:**

- Lesson 6.6: Exponential and Logarithmic Equations
- Review 6.3-6.6
- Quiz 6.3-6.6
- STEM day

### **Week 4:**

- Lesson 6.7: Geometric Sequences and Series
- Unit Review
- Performance Task
- Unit Test

# Topic 07: Trigonometric Functions

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 4**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$ , $f(x) - k$ , $f(kx)$ , 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 $\pi - \theta$ , $\pi + \theta$ , and $2\pi - \theta$ in terms of their values for $\theta$ , where $\theta$ 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

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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- 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 trigonometric ratios and functions.

## Concepts

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## Essential Questions

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- 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 find and use translations of graphs of trigonometric functions?
- 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

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- For any right triangle, the ratios of the sides are always the same given the angle  $\theta$ . 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 repeat a 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  $b/2\pi$ .

## Critical Knowledge and Skills

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## Knowledge

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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
- period
- periodic function
- phase shift

## **Skills**

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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 radian 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.
- Use trigonometric functions to model situations with specified amplitude, frequency, and midline.

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets

- Reflections

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate

differentiated practice based on student performance.

- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**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 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 musician 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**

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**Algebra 2: CP and ICR**

\*We left a week blank prior to this for state testing

### **Week 1: 5-13-19**

- Intro STEM Project/Design Space Goggles - Lesson 7.1: Trigonometric Functions and Acute Angles (2 days)
- Lesson 7.2: Angles and the Unit Circle (2 days)

### **Week 2: 5-20-19**

- Lesson 7.3: Trigonometric Functions and Real Numbers (2 days)
- Lesson 7.4: Graphing Sine and Cosine Functions (2 days)
- Mathematical Modeling in 3 Acts/What Note Was That? (1 day)

### **Week 3: 5-27-19**

- Unit Review (2 days)
- Performance Task (1 day)
- STEM Day (1 day)

### **Week 4: 6-3-19**

- Unit Test
- Final Exam Review!!!!

## **Algebra 2: Honors**

### **Week 1:**

- Intro STEM Project/Design Space Goggles - Lesson 7.1: Trigonometric Functions and Acute Angles
- Lesson 7.2: Angles and the Unit Circle
- Lesson 7.3: Trigonometric Functions and Real Numbers

### **Week 2:**

- Lesson 7.4: Graphing Sine and Cosine Functions
- Mathematical Modeling in 3 Acts/What Note Was That?

### **Week 3:**

- Unit Review
- Performance Task
- STEM Day
- Unit Test



# Topic 11: Data Analysis and Statistics

Content Area: **Math**  
Course(s): **ALGEBRA II**  
Time Period: **Marking Period 1**  
Length: **5 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.S-IC.B.6	Evaluate reports based on data.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.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.

### Mathematical Practices

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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.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

## Transfer Goals

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## Transfer Goals

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- Apply mathematical knowledge, skill, and reasoning to solve real world problems
- Construct viable arguments involving mathematics and statistics and critique the reasoning of others.
- Students will be able to use their knowledge of statistics to determine whether real or hypothetical medical treatments are effective.

## Concepts

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## Essential Questions

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- How can you use the normal distribution to explain where data values fall within a population?
- There are three types of statistical studies: experiments, sample surveys, and observational studies. The way in which samples are chosen for a study affects how well they represent the population. To avoid bias, samples should be random.
- A data distribution can be normal, skewed left, or skewed right. Normal distributions are described using the mean and standard deviation. For skewed distribution, median and quartiles are used to describe the data
- A statistical question is a question that can be answered by collecting many pieces of information, or data. The data can be categorical (qualitative) or statistical (quantitative). The data are measured by parameters, which describe a sample of the population.
- The normal distribution is used to explain where data values fall within a population. The standard normal distribution allows for a comparison of values across different population distributions.

## **Understandings**

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- A statistical question is a question that can be answered by collecting many pieces of information, or data. The data can be categorical (qualitative) or statistical (quantitative). The data are measured by parameters, which describe a sample of the population.
- There are three types of statistical studies: experiments, sample surveys, and observational studies. The way in which samples are chosen for a study affects how well they represent the population. To avoid bias, samples should be random.
- A data distribution can be normal, skewed left, or skewed right. Normal distributions are described using the mean and standard deviation. For skewed distribution, median and quartiles are used to describe the data.
- The normal distribution is used to explain where data values fall within a population. The standard normal distribution allows for a comparison of values across different population distributions.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- Categorical Variable
- Parameter
- Quantitative Variable
- Sample
- Statistic
- Statistical Question
- Statistical Variable
- Bias
- Control Group
- Experiment
- Experimental Group
- Observational Study
- Sample Survey
- Simple Random Sample
- Normal Distribution
- Skewed Distribution
- Standard Deviation
- Symmetrical Distribution
- Percentile
- Standard Normal Distribution
- Z-Score

## **Skills**

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Students will be able to:

- Define and recognize a statistical question
- Define and identify the type of statistical variable that is represented by a question or the data represented on a graph
- Distinguish between quantities such as population/sample and parameter/statistic for the purpose of descriptive modeling
- Identify experiments, sample surveys, and observational studies
- Recognize bias in sampling methods
- Identify a sampling method that provides a random sample from a population
- Find measures of center and spread, such as median, mean, interquartile range, and standard deviation
- Compare data sets using statistical measures that are appropriate for the distribution of the data
- Fit a normal distribution to data
- Compare and evaluate data using z-scores
- Use technology to calculate the area under the standard normal distribution curve

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

### **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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#### **• 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**

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

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

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

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

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

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

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.

- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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

**SCIENCE** - Students will use mathematical models to estimate the number of deer in Yellowstone Park.

**SOCIAL STUDIES** -

**WORLD LANGUAGES** -

**VISUAL/PERFORMING ARTS** -

**APPLIED TECHNOLOGY** -

**BUSINESS EDUCATION** - Students will learn to use surveys to see how public opinion impacts public spaces.

**GLOBAL AWARENESS** -

### **Learning Plan / Pacing Guide**

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#### **Algebra 2: CP and ICR**

##### **Week 1: 2-18-19**

- Intro STEM Project/Plan a Public Space - Lesson 11.1: Statistical Questions and Variables (2 days)
- 11.2: Statistical Studies and Sampling Methods (2 days)

##### **Week 2: 2-25-19**

- 11.3: Data Distributions (2 days)
- 11.4: Normal Distributions (2 days)
- Review 11.1 - 11.4 (1 day)

##### **Week 3: 3-4-19**

- Quiz 11.1-11.4
- Lesson 11.5: Margin of Error (2 days)

- Lesson 11.6: Introduction to Hypothesis Testing (Day 1 of 2)

#### **Week 4: 3-11-19**

- Lesson 11.6: Introduction to Hypothesis Testing (Day 2 of 2)
- Mathematical Modeling in 3 Acts/Mark and Recapture (1 day)
- Unit Review (2 days)
- Performance Task (1 day)

#### **Week 5: 3-18-19**

- STEM Project
- Unit Test (1 day)

#### **Algebra 2: Honors**

**Independent Study: Students will work on this unit at an individual pace using the resources provided by the teacher. Assessments will take place in class.**

- Intro STEM Project/Plan a Public Space **(in class)**
- Lesson 11.1: Statistical Questions and Variables
- Lesson 11.2: Statistical Studies and Sampling Methods
- Lesson 11.3: Data Distributions
- Lesson 11.4: Normal Distributions
- Lesson 11.5: Margin of Error
- Lesson 11.6: Introduction to Hypothesis Testing
- Mathematical Modeling in 3 Acts/Mark and Recapture **(in class)**
- Unit Review
- Performance Task
- STEM Project
- Unit Test **(in class)**

# Topic 12: Probability

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

## Standards

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### Math Standards

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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 $A$ 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.
MA.S-CP.A.3	Understand the conditional probability of $A$ given $B$ as $\frac{P(A \text{ and } B)}{P(B)}$ , 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 $B$ .
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 $A$ given $B$ as the fraction of $B$ 's outcomes that also belong to $A$ , and interpret the answer in terms of the model.
MA.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.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B A)] = [P(B)] \times [P(A B)]$ , 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.

## Mathematical Practices

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

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

## Transfer Goals

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### Transfer Goals

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- 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

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## Essential Questions

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- 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 combinations of events?
- How can you use probability to make decisions?
- How does describing events as mutually exclusive or independent affect 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

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- 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  $P(A \text{ and } B)$  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

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## Knowledge

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Students will know:

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

## **Skills**

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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 probabilities 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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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Classwork
- Quizzes
- Exit Tickets
- Reflections

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Algebra 2

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
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- Desmos
- Kahoot
- Quizlet

## **Technology Integration and Differentiated Instruction**

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## **Technology Integration**

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### **• Google Products**

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## **Differentiated Instruction**

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#### **Interdisciplinary Connections**

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**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 spectrum 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 travel 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**

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### **Algebra 2: Honors**

#### **Week 1:**

- Intro STEM Project/Simulate Weather Conditions/Lesson 12.1 - Probability Events
- Lesson 12.2 - Conditional Probability
- Lesson 12.3 - Permutations and Combinations
- Review Lessons 12.1 - 12.3

#### **Week 2:**

- Lesson 12.4 - Probability Distributions
- Lesson 12.5 - Expected Value
- Lesson 12.6 - Probability and Decision Making
- Review Lessons 12.4 - 12.6
- Quiz 12.4 - 12.6

#### **Week 3:**

- Mathematic Modeling in 3 Acts/Place Your Guess
- Unit Review
- Unit Test
- Performance Assessment