Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title: Functions & Their Graphs
Chapter 1

Chapter 1 addresses functions and their representations in the Cartesian plane. Students are reintroduced to functions and learn to identify, categorize, and describe functions. They learn to graph functions and recognize simple transformations of the six most used functions in Algebra. The students will also investigate the composition of more than one function, inverse of a function, and the use of modeling real-world data. Finally, students will use specific math vocabulary associated with functions and their graphs.

Essential Questions	Learning Targets/Objectives
● What are the important defining characteristics of a function? ● How is the graph of a function used to determine the key elements of that function? ● How do you write equations and draw graphs for the simple transformations of functions? ● How do you combine two functions to form a new function? ● What is the inverse of a function, and how do you represent it graphically and algebraically?	Students will be able to: ● Determine whether a relation between two variables represent a function. ● Use function notation and evaluate functions. ● Find the domains of functions. ● Use functions to model and solve real life problems. ● Evaluate difference quotients. ● Find the domains and ranges of functions and use the vertical line tests for functions

	● Determine intervals in which functions are increasing, decreasing, or constant. ● Determine relative maximum and relative minimum values of functions. ● Identify and graph piecewise-defined functions. ● Recognize graphs of parent functions. ● Use vertical and horizontal shifts to sketch graphs of functions. ● Add, subtract, multiply, and divide functions. ● Find compositions of one function with another function. ● Use combinations of functions to model and solve real-life problems. ● Find inverse functions informally and verify that two functions are inverse functions of each other. ● Find inverse functions algebraically.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Function, domain, range, vertical line test, increase, decrease, constant, relative max and min, parent function, inverse	Difference quotient, piecewise functions, verify

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-APR.A.1	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.
2. A-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

3. A-CED.A.4	3. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving Equations Climate Change Example: Students may rearrange formulas related to the economic impact of climate change to highlight a quantity of interest, using the same reasoning as in solving equations.
4. A-REI.D.10	4. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
5. F-BF.A.1b	5. Combine standard function types using arithmetic operations.
6. F-BF.A.1c	6. Compose functions.
7. F-BF.B.3	7. Identify the effect on the graph of replacing ff(xx) by ff(xx) + kk, kk ff(xx), ff(kk), and ff(xx + kk) for specific values of kk (both positive and negative); find the value of kk given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology
8. F-BF.B.4a	8. Solve an equation of the form (xx) = cc for a simple function ff that has an inverse and write an expression for the inverse.
9. F-BF.B.4b	9. Verify by composition that one function is the inverse of another.
10. F-BF.B.4c	10. Read values of an inverse function from a graph or a table, given that the function has an inverse.
11. F-BF.B.4d	11. Produce an invertible function from a non-invertible function by restricting the domain.
12.. F-IF.A.1	12. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If ff is a function and xx is an element of its domain, then (xx) denotes the output of ff corresponding to the input xx. The graph of ff is the graph of the equation yy = (xx).
13. F-IF.A.2	13. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m, where c(m) is the number of molecules of carbon dioxide.
14. F-IF.B.4	14. 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.

15. F-IF.B.5	15. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
16. F-IF.B.6	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. Climate Change Example: Students may calculate the average rate of change of a function c(m) presented symbolically or as a table, where c(m) represents the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline).
17. F-IF.C.7a	17. Graph linear and quadratic functions and show intercepts, maxima, and minima.
18. F-IF.C.7b	18. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
19. F-LE.B.5	19. Interpret the parameters in a linear or exponential function in terms of a context.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	5. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	6. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	7. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-PS1-5	8. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.2.12.CAP.5	1. Assess and modify a personal plan to support current interests and postsecondary plans.
2. 9.4.12.CI.1	2. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

3. 9.4.5.DC.4 4. 9.4.12.TL.3 5. 9.4.12.CT.2	3. Model safe, legal, and ethical behavior when using online or offline technology 4. Analyze the effectiveness of the process and quality of collaborative environments. 5. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1 2. 8.1.2.DA.1 3. 8.1.2.DA.3 4. 8.1.2.DA.4 5. 8.1.2.AP.4 6. 8.1.5.DA.5	7. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences. 8. Collect and present data, including climate change data, in various visual formats. 9. Identify and describe patterns in data visualizations. 10. Make predictions based on data using charts or graphs. 11. Break down a task into a sequence of steps. 12. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

PreCalculus with Limits, A Graphing Approach 7th edition – Ron Larson, 2016

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- 1.5A Polynomial Functions and Complex Zeros
- 1.6 Polynomial Functions and End Behavior

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

1.2 Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Determine whether a relation between two variables represent a function. • Use function notation and evaluate functions. • Find the domains of functions. • Use functions to model and solve real life problems. • Evaluate difference quotients.	**Prerequisite skills:** determine the domain, range, interval of increasing, decreasing, concavity and constant, approximate zeros, inflection points and the y-intercept	Choose from the following pp. 24-28 Exs.1-6, 7-15 odd, 16, 17-21 odd, 29-37 odd, 49-53 odd, 65-72, 80, 87-94

1.3 Graphs of Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Find the domains and ranges of functions and use the vertical line tests for functions • Determine intervals in which functions are increasing, decreasing, or constant. • Determine relative maximum and relative minimum values of functions. • Identify and graph piecewise-defined functions.	**Prerequisite skills:** Determine if the graph represents a function.	Choose from the following pp. 37-40 Exs.1-13, 17-31 odd, 35-45 odd, 53, 54, 55-59 odd, 73-85 odd, 91, 95, 97-104, 110, 113-120

1.4 Shifting, Reflecting and Stretching Graphs		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Recognize graphs of parent functions. • Use vertical and horizontal shifts to sketch graphs of functions.	**Prerequisite skills** Determine the vertical and horizontal shift given the equation of a polynomial function.	Choose from the following pp. 47-49 Exs.1-4, 5-45 odd, 51-57 odd, 65-70, 80-86

1.5 Combinations of Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Add, subtract, multiply, and divide functions. • Find compositions of one function with another function. • Use combinations of functions to model and solve real-life problems.	**Prerequisite skills** Add, subtract and multiply the following expressions.	Choose from the following pp. 56-59 Exs.1-6, 7-25 odd, 37-49 odd, 55, 56, 61, 67-75 odd, 79, 80, 85, 86, 88-90, 96-100

1.6 Inverse Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Find inverse functions informally and verify that two functions are inverse functions of each other. • Find inverse functions algebraically.	**Prerequisite skills** As input values of a nonconstant polynomial function increase without bound, the output values will either increase or decrease without bound. The corresponding mathematical notation is $\lim_{x \to -\infty} p(x) = \infty$ or $\lim_{x \to -\infty} p(x) = -\infty$.	Choose from the following pp. 67-70 Exs.1-6, 7-13 odd, 15-18, 25-49 odd, 57-85 odd, 93-103 odd, 115, 118-124, 130, 133-140

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

<table>
<tr><th colspan="3">Assessments</th></tr>
<tr><th>Summative</th><th>Formative</th><th>Performance</th></tr>
<tr>
<td>The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period.

● Diagnostic Pre-Test
● Chapter Tests
● Periodic Benchmarks
● Standardized Tests</td>
<td>The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to:

● Teacher observations
● Self-Assessments
● Student record-keeping
● Quizzes
● Warm-ups
● Exit Tickets
● Participation in class discussions
● Independent practice</td>
<td>The following assessments require students to utilize various strands of mathematics.

● Projects
● Performance Tasks
● Homework
● Classwork</td>
</tr>
<tr><td colspan="3">List of Accommodations and Modifications
● Special Education
● 504 Students
● At Risk Students
● MLL
● Gifted and Talented</td></tr>
</table>

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 2A: Polynomial and Rational Functions (2.2-2.5)	
In Chapter 2, students learn to analyze and graph polynomial and rational functions. The chapter begins with identifying key characteristics and creating graphs of quadratic and other polynomial functions. Students then learn to use polynomial division to find both real and complex roots.	
Essential Questions	**Learning Targets/Objectives**
• How do you sketch the graphs of polynomial functions? • How do you divide a polynomial by another polynomial and use polynomial division to find the rational and real zeros of polynomials? • How do you perform operations with complex numbers? • How do you find all the zeros of a polynomial function?	Students will be able to: • Use transformations to sketch graphs of polynomial functions. • Use the Leading Coefficient Test to determine end behavior of graphs of polynomial functions. • Find and use zeros of polynomial functions as sketching aids. • Use the Intermediate Value Theorem to help locate zeros of polynomial functions. • Use synthetic division to divide polynomials by binomials of the form (x – k). • Use the imaginary unit i to write complex numbers. • Add, subtract, and multiply complex numbers. • Use complex conjugates to write the quotient of two complex numbers in standard form. • Use the Fundamental Theorem of Algebra to determine the number

	of zeros of a polynomial function. • Find all the zeros of a polynomial function. • Find conjugate pairs of complex zeros. • Find zeros of polynomials by factoring.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Leading coefficient test, end behavior, zeros, synthetic division, complex numbers, Fundamental Theorem of Algebra	Intermediate Value Theorem, complex conjugates, Rational Root theorem

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-CED.A.2	1. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
2 A-SSE.A.2	2. Use the structure of an expression to identify ways to rewrite it.
3. A-SSE.B.3a	3. Factor a quadratic expression to reveal the zeros of the function it defines.
4. A-APR.B.3	4. 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.
5. A -REI.B.4b	5. Solve quadratic equations by inspection (e.g., for x2 = 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 ± bi for real numbers a and b.

6. N-CN.A.1	6. Know there is a complex number ii such that $i^2 = –1$, and every complex number has the form $a^2 + b^2$ with aa and bb real.
7. N-CN.A.2	7. Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
8. N-CN.A.3	8. Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
9. N-CN.C.7	9. Solve quadratic equations with real coefficients that have complex solutions.
10. N-CN.C.8	10. Extend polynomial identities to the complex numbers.
11. N-CN.C.9	11. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
12 N-RN.A.3	12. Simplify radicals, including algebraic radicals [eg. cube-root of 54 = 3 cube-root of 2, simplify radical (32x^2)]
13. F-BF.B.3	13. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.
14. F-IF.B.4	14. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity
15. F-IF.C.7a	15. Graph linear and quadratic functions and show intercepts, maxima, and minima.
16. F-IF.C.7b	16. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
17. F-IF.C.7c	17. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
18. F-IF.C.8a	18. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.

2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.AG-PST.1	1. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
2. 9.4.12.CI.1	2. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
3. 9.4.5.DC.4	3. Model safe, legal, and ethical behavior when using online or offline technology
4. 9.4.12.TL.3	4. Analyze the effectiveness of the process and quality of collaborative environments.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1	1. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
2. 8.1.2.DA.1	2. Collect and present data, including climate change data, in various visual formats.
3. 8.1.2.DA.3	3. Identify and describe patterns in data visualizations.
4. 8.1.2.DA.4	4. Make predictions based on data using charts or graphs.
5. 8.1.2.AP.4	5. Break down a task into a sequence of steps.
6. 8.1.5.DA.5	6. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
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- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

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- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
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- Use Prior Results

- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
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Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols

- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Pre-Calculus with limits, A graphing approach 7th edition – Ron Larson, 2016

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- 1.5B Even and Odd Polynomials

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

2.2 Polynomial Functions of Higher Degree		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use transformations to sketch graphs of polynomial functions. • Use the Leading Coefficient Test to determine end behavior of graphs of polynomial functions. • Find and use zeros of polynomial functions as sketching aids. • Use the Intermediate Value Theorem to help locate zeros of polynomial functions. • Use synthetic division to divide polynomials by binomials of the form (x – k).	**Prerequisite skills:** Use the leading coefficient test to determine the end behavior for the following functions.	Choose from the following Day 1: pp. 109-110 Ex. 1 – 19, 23-79 odd Day 2: pp. 110-112 Ex. 81-109 odd, 111-120, 123-131 odd

2.4 Complex Numbers		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use the imaginary unit i to write complex numbers. • Add, subtract, and multiply complex numbers. • Use complex conjugates to write the quotient of two complex numbers in standard form.	**Prerequisite skills:** Multiply two complex numbers	Choose from the following pp. 133-134 Ex. 1 – 10, 11-95 odd, 97-100

2.5 The Fundamental Theorem of Algebra		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use the Fundamental Theorem of Algebra to determine the number of zeros of a polynomial function. • Find all the zeros of a polynomial function. • Find conjugate pairs of complex zeros. • Find zeros of polynomials by factoring.	**Prerequisite skills:** Solve a quadratic equation with complex solutions	Choose from the following pp. 140-141 Ex. 2-4, 5-27 odd, 45-61 odd, 65-71 odd, 72, 74-78

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Periodic Benchmarks ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 2B: Polynomial and Rational Functions (2.6-2.7)	
In Chapter 2B students will learn how to find asymptotes, intercepts and holes as they graph rational functions. Students will use specific math vocabulary associated with polynomial and	
Essential Questions	**Learning Targets/Objectives**
• How do you find the domain and asymptotes of a rational function? • How do you sketch the graph of a rational function?	Students will be able to: • Find the domain of a rational function. • Find vertical and horizontal asymptotes of graphs of rational functions. • Use rational functions to model and solve real-life problems. • Analyze and sketch graphs of rational functions. • Sketch graphs of rational functions that have slant asymptotes.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Domain, range, zeros, end behavior, x and y intercepts	Horizontal asymptotes, vertical asymptotes, slant asymptotes, points of discontinuity

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-APR.D.7	1. 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.
2. A-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales
3. A-SSE.A.1a	3. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
4. A-SSE.A.1b	4. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P
5. F-IF.A.1	5. Interpret parts of an expression, such as terms, factors, and coefficients.
6. F-IF.B.4	6. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
7. F-IF.C.7d	7. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	4. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	5. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

3. SL.PI.9-10.4	6. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1	5. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
2. 9.4.5.DC.4	6. Model safe, legal, and ethical behavior when using online or offline technology
3. 9.4.12.TL.3	7. Analyze the effectiveness of the process and quality of collaborative environments.
4. 9.4.12.CT.2	8. Explain the potential benefits of collaborating to enhance critical thinking and problem-solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1	1. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
2. 8.1.2.DA.1	2. Collect and present data, including climate change data, in various visual formats.
3. 8.1.2.DA.3	3. Identify and describe patterns in data visualizations.
4. 8.1.2.DA.4	4. Make predictions based on data using charts or graphs.
5. 8.1.2.AP.4	5. Break down a task into a sequence of steps.
6. 8.1.5.DA.5	6. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

PreCalculus with limits, A graphing approach 7th edition – Ron Larson, 2016

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- 1.9 Rational Functions and Vertical Asymptotes

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

2.6 Rational Functions and Asymptotes		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Find the domain of a rational function. • Find vertical and horizontal asymptotes of graphs of rational functions. • Use rational functions to model and solve real-life problems.	**Prerequisite Skills** Determine the domain and range of a polynomial function given its graph	Choose from the following Day 1: pp. 147-148 Ex. 2-16,17-43 odd, Day 2: pp. 148-150 Ex. 45-48, 50-52, 56-62

2.7 Graphs of Rational Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use rational functions to model and solve real-life problems. • Analyze and sketch graphs of rational functions. • Sketch graphs of rational functions that have slant asymptotes.	**Prerequisite Skills** Determine the end behavior of a polynomial function given its graph	Choose from the following Day 1: pp. 157-158 Ex. 1-4, 5-23 odd, 33-53 odd, 57-60, 61-67 odd Day 2: pp. 158-160 Ex. 71-77 odd, 83-85, 87-89, 91, 93-96, 99-104

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. • Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: • Teacher observations • Self-Assessments • Student record-keeping • Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	The following assessments require students to utilize various strands of mathematics. • Projects • Performance Tasks • Homework • Classwork

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 3: Exponential and Logarithmic Functions

In Chapter 3, students will work with exponential and logarithmic functions. They begin by writing, graphing, and recognizing the basic characteristics of exponential and logarithmic functions. Students learn how to use these functions to model real world problems including compound interest, radioactive decay, and human memory. They then expand their skills by using the properties of logarithms and exponents to manipulate expressions and solve equations. Finally, students will use specific math vocabulary associated with exponential and logarithmic functions.

Essential Questions	Learning Targets/Objectives
• How do you write and graph exponential functions? • How do you recognize, evaluate, and graph logarithmic functions? • How do you rewrite logarithmic expressions to simplify or evaluate them? • How do you solve exponential and logarithmic equations?	Students will be able to: • Recognize and evaluate exponential functions with base a. • Graph exponential functions with base a. • Recognize, evaluate, and graph exponential functions with base e. • Use exponential functions to model and solve real life problems. • Recognize and evaluate logarithmic functions with base a. • Graph logarithmic functions with base a. • Recognize, evaluate, and graph natural logarithmic functions. • Use logarithmic functions to model and solve real life problems. • Rewrite logarithms with different bases. • Use properties of logarithms to evaluate or rewrite logarithmic expressions.

	• Use properties of logarithms to expand or condense logarithmic expressions. • Solve simple exponential and logarithmic equations. • Solve more complicated exponential and logarithmic equations. • Use exponential and logarithmic equations to model and solve real life problems.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Parent function, exponential function, domain, range, vertical and horizontal asymptotes, compound interest compounded continuously and n times per year, extraneous	Logarithmic function, common logarithm, natural logarithm, change of base, quotient property, Inverse property

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-CED.A.2	1. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
2. A-SSE.A.1	2. Interpret expressions that represent a quantity in terms of its context.
3. A-SSE.A.2	3. Use the structure of an expression to identify ways to rewrite it.
4. ASSE.B.3c	4. Use the properties of exponents to transform expressions for exponential functions
5. F-BF.B.3	5. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both

	positive and negative); find the value of k given the graphs.
6. F-BF.B.4	6. Find inverse functions.
7. F-BF.B.5	7. Use the inverse relationship between exponents and logarithms to solve problems involving logarithms and exponents.
8. F-IF.A.2	8. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m, where c(m) is the number of molecules of carbon dioxide.
9. F-IF.B.4	9. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
10. F.IF.B.5	10. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
11. F-IF.C.7e	11. Graph exponential and logarithmic functions, showing intercepts and end behavior.
12. F-IF.C.8b	12. Use the properties of exponents to interpret expressions for exponential functions.
13. F-LE.A.1c	13. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another
14. F-LE.A.2	14. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs
15. F-LE.A.4	15. Understand the inverse relationship between exponents and logarithms. Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
16. F-LE.B.5	16. Interpret the parameters in a linear or exponential function in terms of a context.e.

NJSLS	Interdisciplinary Connections
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-LS2-1	4. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.1.12.PB.6	1. Describe and calculate interest and fees that are applied to various forms of spending, debt and saving
2. 9.1.12.PB.1	2. Explain the difference between saving and investing.
3. 9.4.12.CI.1	3. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
4. 9.4.5.DC.4	4. Model safe, legal, and ethical behavior when using online or offline technology.
5. 9.4.12.TL.3	5. Analyze the effectiveness of the process and quality of collaborative environments.
6. 9.4.12.CT.2	6. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1	1. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
2. 8.1.2.DA.1	2. Collect and present data, including climate change data, in various visual formats.
3. 8.1.2.DA.3	3. Identify and describe patterns in data visualizations.
4. 8.1.2.DA.4	4. Make predictions based on data using charts or graphs.
5. 8.1.2.AP.4	5. Break down a task into a sequence of steps.
6. 8.1.5.DA.5	6. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures

- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units

- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

PreCalculus with limits, A graphing approach 7th edition – Ron Larson, 2016

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- 2.3 Exponential Functions

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

3.1 Exponential Functions and Their Graphs		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Recognize and evaluate exponential functions with base a. • Graph exponential functions with base a. • Recognize, evaluate, and graph exponential functions with base e. • Use exponential functions to model and solve real life problems.	**Prerequisite Skills Practice**: Simplifying and analyzing algebraic expressions.	Choose from the following pp. 189-191 Exs.1-4, 5-15 odd, 17-20, 21-29 odd, 33-39 odd, 49-59 odd, 65-71 odd, 75-78, 80, 85 pp. 228-229 Exs. 21-23, 31-34

3.2 Logarithmic Functions and Their Graphs		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Recognize and evaluate logarithmic functions with base a. • Graph logarithmic functions with base a. • Recognize, evaluate, and graph natural logarithmic functions. • Use logarithmic functions to model and solve real life problems.	**Prerequisite Skills Practice**: Understanding and using shifts and reflections to transform functions.	Choose from the following Day 1: pp. 199-200 Examples 1-6, 7-41 odd, 51-71, 77-85 odd Day 2: pp. 200-202 Examples 89-103 odd, 109-112, 115-123 odd, 126, 133-141 odd Pp 231-232 Examples 59 & 60

3.3 Properties of Logarithms		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use logarithmic functions to model and solve real life problems. • Rewrite logarithms with different bases. • Use properties of logarithms to evaluate or rewrite logarithmic expressions. • Use properties of logarithms to expand or condense logarithmic expressions.	**Prerequisite Skills Practice**: Simplifying and analyzing algebraic expressions.	Choose from the following Day 1: pp. 207-208 Exs. 2-4, 5-65 odd, 66 Day 2: pp. 208-209 Exs. 69-101 odd, 107, 109-112, 120, 123-129 odd

3.4 Solving Exponential and Logarithmic Equations		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Solve simple exponential and logarithmic equations. • Solve more complicated exponential and logarithmic equations. • Use exponential and logarithmic equations to model and solve real life problems.	**Prerequisite Skills Practice**: Understanding and using shifts and reflections to transform functions.	Choose from the following Day 1: pp. 217-218 Exs. 1-6, 7-29 odd, 37-51 odd, 55-67 odd, 81-85 odd Day 2: pp. 218-220 Exs. 91-103 odd, 113-127 odd, 131-139 odd, 143-147 odd, 148, 149-153 odd, 154, 159-165 odd

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Periodic Benchmarks ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

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Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 4A: Trigonometric Functions (4.3, 4.8, 6.1, & 6.2)

In Unit 4A students will be introduced to trigonometric functions from a right triangle perspective. Relative to the angle theta students will explore the hypotenuse, opposite and adjacent sides. Students will then use their knowledge of right triangle trigonometry to model and solve real life application problems. Finally students will solve oblique triangles using the Laws of Sines and Cosine and find the area of oblique triangles.

Essential Questions	Learning Targets/Objectives
• How do you use trigonometry to find unknown side lengths and angle measures in right triangles? • How do you use trigonometric functions to solve real life problems? • How do you use the law of sines to solve oblique triangles? • How do you use the law of cosines to solve oblique triangles? • How do you use trigonometry to solve and find the areas of oblique triangles?	Students will be able to: • Evaluate trigonometric functions of acute angles and use a calculator to evaluate. • Use fundamental trigonometric identities. • Use fundamental trigonometric identities to model and solve real-life problems. • Define and describe angles. • Use angles to model and solve real life problems. • Solve real life problems involving right triangles. • Use the Law of Sines to solve oblique triangles.(AAS or ASA) • Use the Law of Sines to solve oblique triangles (SSA). • Find areas of oblique triangles and use the Law of Sines to model and solve real-world problems. • Use the Law of Cosines to solve oblique triangles (SSS or SAS).

	• Use the Law of Cosines to model and solve real-life problems. • Use Heron's Area Formula to find the areas of triangles.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Right triangle, angle, hypotenuse, adjacent side, opposite side, angle of elevation, angle of depression, sine, cosine and tangent, area	Law of Sines, Law of Cosines, oblique triangle, Heron's Area Formula

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. N-Q.A.1	1. Use units to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Climate Change Example: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
2. G-SRT.C.6	2. 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.
3. G-SRT.C.8	3. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
4. SRT.D.9	4. Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side

5. SRT.D.10	5. Prove the Laws of Sines and Cosines and use them to solve problems.
6. SRT.D.11	6. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces
7. G-MG.A.1	7. Use geometric shapes, their measures, and their properties to describe objects. Climate Change Example: Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
8. G-MG.A.3	8. Apply geometric methods to solve design problems Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.
9. F-TF.B.7	9. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology and interpret them in terms of the context.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	4. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	5. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	6. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1	5. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
2. 9.4.5.DC.4	6. Model safe, legal, and ethical behavior when using online or offline technology.
3. 9.4.12.TL.3	7. Analyze the effectiveness of the process and quality of collaborative environments.
4. 9.4.12.CT.2	8. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.

2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1 2. 8.1.2.DA.1 3. 8.1.2.DA.3 4. 8.1.2.DA.4 5. 8.1.2.AP.4 6. 8.1.5.DA.5	7. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences. 8. Collect and present data, including climate change data, in various visual formats. 9. Identify and describe patterns in data visualizations. 10. Make predictions based on data using charts or graphs. 11. Break down a task into a sequence of steps. 12. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
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- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
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- Use a Graph
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- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

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- Use Other Resources
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Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

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Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

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Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

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- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
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ML Resources
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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

4.3 Right Triangle Trigonometry		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Evaluate trigonometric functions of acute angles and use a calculator to evaluate. • Use fundamental trigonometric identities. • Use fundamental trigonometric identities to model and solve real-life problems. • Define and describe angles.	**Prerequisite Skills** Given a right triangle, students should be able to identify the hypotenuse, adjacent side, opposite side and the given acute angle.	Choose from the following Day 1 pp. 280-281 Ex. 1, 3-6, 7-19 odd, 21-52, 53-65 odd Day 2: pp 281-283 Ex. 67-75 odd, 77-81, 84-87, 90-98

4.8 Applications and Models		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use angles to model and solve real life problems. • Solve real life problems involving right triangles.	**Prerequisite Skills** Students will solve a right triangle	Choose from the following pp 332-334 Ex. 1-4, 5-17 odd; 19-27, 36-39

6.1 Law of Sines		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use the Law of Sines to solve oblique triangles.(AAS or ASA) • Use the Law of Sines to solve oblique triangles (SSA). • Find areas of oblique triangles and use the Law of Sines to model and solve real-world problems.	**Prerequisite Skills** Students will solve a proportion	Choose from the following Day 1: pp. 410-412 Ex. 7-19 odd, 27-51 odd, 54, 56-59

Section Number & Title		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use the Law of Cosines to solve oblique triangles (SSS or SAS).	**Prerequisite Skills** Given a right triangle, students will find the area.	Choose from the following Day 1: pp. 417-419 Ex. 1-6, 7-15 odd, 25-30, 31-41 odd, 47-50, 53, 55, 59, 60, 64, 67-70

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Periodic Benchmarks ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 4B: Trigonometric Functions (4.1, 4.2, & 4.4)	
In this Unit students learn how to evaluate trigonometric functions, their inverses, and their reciprocals. The chapter begins by introducing radian measure and the definitions of trigonometric functions on the unit circle. Students learn how to identify the basic characteristics of the trigonometric functions, their reciprocals, and their inverses. Students will use trigonometric ratios to solve problems in a variety of contexts, such as mechanics, biology, and navigation. Finally, students will learn to evaluate trigonometric functions of any angle.	
Essential Questions	**Learning Targets/Objectives**
• How do you describe angles and angular movement? • How do you evaluate trigonometric functions by using the unit circle? • How do you evaluate trigonometric functions of any angle? • How do you use trigonometric functions to solve real life problems?	Students will be able to: • Define and describe angles. • Use radian measure. • Use degree measure and convert between degrees and radians. • Identify the unit circle and describe its relationship to real numbers. • Evaluate trigonometric functions using the unit circle. • Use domain and period to evaluate sine and cosine functions and use a calculator to evaluate trigonometric functions, • Evaluate trigonometric functions of acute angles and use a calculator to evaluate trigonometric functions. • Use fundamental trigonometric identities. • Use trigonometric functions to model and solve real-life problems. • Evaluate trigonometric functions of any angle.

	• Determine reference angles. • Evaluate trigonometric functions of real numbers.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Trigonometry, angle, sine, cosine, tangent, reciprocal, theta, quadrants, pi,	Standard position, coterminal, radian, angular speed, linear speed, secant, cosecant, cotangent, Unit Circle, reference angle

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. F-TF.A.1	1. Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
2. F-TF.A.2	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.
3. F-TF.A.3	3. Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π–x, π+x, and 2π–x in terms of their values for x, where x is any real number
4. F-TF.A.4	4. Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
5. F-TF.C.8	5. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.
6. G-C.B.5	6. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius and

	define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
7. G-MG.A.1	7. Use geometric shapes, their measures, and their properties to describe objects Climate Change Example: Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
8. G-MG.A.3	8. Apply geometric methods to solve design problems Climate Change Example: Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-PS4-1	4. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.AG-PST.1	1. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
2. 9.4.12.CI.1	2. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
3. 9.4.5.DC.4	3. Model safe, legal, and ethical behavior when using online or offline technology.
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- WebAssign Platform
- Devices:

○ Chromebooks ○ Texas Instrument TI-84 Plus Graphing Calculator
ML Resources
● Multi-Language Glossary
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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

4.1 Radian and Degree Measures		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Define and describe angles. • Use radian measure. • Use degree measure and convert between degrees and radians.	**Prerequisite Skills** Solve the right triangle.	Choose from the following Day 1: pp. 261-262 Ex. 5-12, 13-29 odd, 30, 31, 35-85 odd Day 2: pp. 263-264

		Ex. 89-107 odd, 108-110, 113-118, 120, 123, 125

4.2 Trigonometric Functions: Unit Circle

Specific Learning Objective	Warm-Up/Starting Options	Practice & Apply Exercises
• Identify the unit circle and describe its relationship to real numbers. • Evaluate trigonometric functions using the unit circle. • Use domain and period to evaluate sine and cosine functions and use a calculator to evaluate trigonometric functions,	**Prerequisite Skills** Use degree measure and convert between degrees and radians.	Choose from the following Day 1: pp. 270-271 Ex. 1-12, 13-69 odd Day 2: pp. 271-272 Ex. 71-87, 91,93

4.4 Trigonometric Functions of Any Angle

Specific Learning Objective	Warm-Up/Starting Options	Practice & Apply Exercises
• Evaluate trigonometric functions of acute angles and use a calculator to evaluate trigonometric functions. • Use fundamental trigonometric identities. • Use trigonometric functions to model and solve real-life problems. • Evaluate trigonometric functions of any angle.	**Prerequisite Skills** Evaluate trigonometric functions using the unit circle.	Choose from the following Day 1: pp 289-290 Ex. 1-10, 11-21 odd, 23-26, 27-83 odd Day 2: pp 290-291 Ex. 91-117 odd, 123, 124, 126-131, 134, 135-139 odd

PART IV: EVIDENCE OF LEARNING

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Assessments		
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Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

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<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 5A: Analytic Trigonometry (5.1, 5.2)	
In Chapter 5, students learn strategies for simplifying trigonometric expressions and verifying trigonometric equations by using trigonometric identities. First, students learn how trigonometric functions can be rewritten by using fundamental identities. Students will then build upon this knowledge to verify trigonometric identities. Finally, students will use specific math vocabulary associated with analytic trigonometry.	
Essential Questions	**Learning Targets/Objectives**
• How do you rewrite trigonometric expressions in order to simplify and evaluate trigonometric functions? • How do you verify a trigonometric identity?	Students will be able to: • Recognize and write the fundamental trigonometric identities. • Use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions. • Verify trigonometric identities
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Evaluate, Simplify, Re-Write, Factor, Simplify, Conjugate, Converting, Reciprocal, Sine, Cosine, Tangent, Cotangent, Cosecant, Secant	Reciprocal Identities, Quotient Identities, Pythagorean Identities, Cofunction Identities, Even/Odd Identities, verify

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-SSE.A.2	1. Use the structure of an expression to identify ways to rewrite it.
2. N.Q.A.1	2. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **Climate Change Example**: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
3. G-SRT.C.8	3. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
4. F-TF.B.7	4. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
5. F-TF.C.8	5. 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.
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- 3.12A Equivalent Representations of Trigonometric Functions
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ML Resources

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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

5.1 Using Fundamental Identities		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
● Recognize and write the fundamental trigonometric identities. ● Use the fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions.	**Prerequisite Skills** Given the value of a trigonometric function, find the other 5 values.	Choose from the following Day 1: pp. 354-355 Exs. 1-6, 7-19 odd, 21-32, 33-61 odd Day 2: pp. 355-356 Exs. 65-71, 73, 79-89 odd, 95-103 odd, 107-113 odd, 117-121, 123-129 odd

5.2 Verifying Trigonometric Identities		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Verify trigonometric identities	**Prerequisite Skills** Given a trigonometric expression students will simplify to a single trigonometric expression by first applying a Pythagorean Identity	Choose from the following Day 1: pp. 362-363 Exs. 1-10, 11-23 odd, 29, 30, 31-41 odd, 53-61 odd Day 2: pp. 363-364 Exs. 63-77 odd, 79-84, 89, 90, 95, 97

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IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. • Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: • Teacher observations • Self-Assessments • Student record-keeping • Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	The following assessments require students to utilize various strands of mathematics. • Projects • Performance Tasks • Homework • Classwork

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 5B: Analytic Trigonometry (5.3, 5.5)

In this unit, students learn how to solve trigonometric equations written in quadratic form and equations containing more than one angle. Then they study equations containing sums and differences of angles. Students rewrite trigonometric expressions that contain functions of multiple or half-angles and that involve squares or products of trigonometric functions. Finally, students will use specific math vocabulary associated with analytic trigonometry.

Essential Questions	Learning Targets/Objectives
• How do you solve trigonometric equations written in quadratic form or containing more than one angle? • How do you simplify expressions and solve equations that contain sums or differences of angles? • How do you rewrite trigonometric expressions that contain functions of multiple or half-angles, or functions that involve squares or products of trigonometric expressions?	Students will be able to: • Use standard algebraic techniques to solve trigonometric equations. • Solve trigonometric equations of quadratic type. • Solve trigonometric equations involving multiple angles. • Use inverse trigonometric functions to solve trigonometric equations. • Use multiple-angle formulas to rewrite and evaluate trigonometric functions.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*

Equation, Sine, cosine, tangent, cosecant, secant, cotangent trigonometric identities, pythagorean identities, sum and difference identities, double angles	Principal value, trigonometric identities, pythagorean identities, sum and difference identities, double angles

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-SSE.A.2	1. Use the structure of an expression to identify ways to rewrite it
2. F-TF.A.3	2. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\frac{\pi}{3}$, $\frac{\pi}{4}$ and $\frac{\pi}{6}$ and use the unit circle to express the values of sine, cosines, and tangent for $\pi - x$, $\pi + x$ and $2\pi - x$ in terms of their values for x , where x is any real number.
3. F-TF.B.7	3. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.

3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1 2. 9.4.5.DC.4 3. 9.4.12.TL.3 4. 9.4.12.CT.2	5. Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 6. Model safe, legal, and ethical behavior when using online or offline technology. 7. Analyze the effectiveness of the process and quality of collaborative environments. 8. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1 2. 8.1.2.DA.1 3. 8.1.2.DA.3 4. 8.1.2.DA.4 5. 8.1.2.AP.4 6. 8.1.5.DA.5	7. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences. 8. Collect and present data, including climate change data, in various visual formats. 9. Identify and describe patterns in data visualizations. 10. Make predictions based on data using charts or graphs. 11. Break down a task into a sequence of steps. 12. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
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Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

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Online Resources

- Desmos Activities
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- Khan Academy
- Inside Mathematics
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- New Jersey Climate Education Hub

Videos

- 3.10 Trigonometric Equations and Inequalities

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

- Multi-Language Glossary

Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

5.3 Solving Trigonometric Equations		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use standard algebraic techniques to solve trigonometric equations. • Solve trigonometric equations of quadratic type. • Solve trigonometric equations involving multiple angles. • Use inverse trigonometric functions to solve trigonometric equations.	**Prerequisite Skills** Label the sides of a special right triangle	Choose from the following Day 1: pp. 373-374 Exs. 3, 4, 5-21 odd, 29-43 odd, 49-59 odd Day 2: pp. 374-376 Exs. 65-77 odd, 81-85 odd, 93-101 odd, 107- 116

5.5 Multiple-Angle Formulas		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use multiple-angle formulas to rewrite and evaluate trigonometric functions.	**Prerequisite Skills** Review inverse operations, combining like terms, taking the square root	Choose from the following Day 1: pp. 390-391 Exs. 1-15 odd, 21-35 odd, 45, 57-65 odd, 69-73 odd, 85, 87

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 4C: Trigonometric Functions (4.5-4.6)	
In this Unit, students will learn how to graph the trigonometric functions sine, cosine and tangent and how to identify the basic characteristics of the trigonometric functions and their inverses.	
Essential Questions	**Learning Targets/Objectives**
• How do you sketch the graphs of sine, cosine and tangent functions? • How do you evaluate and graph the inverses of trigonometric functions?	Students will be able to: • Sketch the graphs of basic sine, cosine, tangent functions. • Find key features of trigonometric functions to sketch their graphs. • Sketch translations of graphs of trigonometric functions. • Use sine, cosine, and tangent functions to model real-life data.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Sine, cosine, tangent, asymptotes, parent function, domain, range, curves, translations, transformations	Amplitude, period, vertical stretching, horizontal stretching, inverse graph, central axis, phase shift

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. F-TF.B.5	1. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
2. F-BF.B.3	2. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.
3. F-IF.A.1	3. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
4. F-IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
5. F-IF.B.5	5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Climate Change Example: Students may relate the domain of a function c(m) representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for c(m).
6. F-IF.C.7f	6. Graph trigonometric functions, showing period, midline, and amplitude.
7. N-Q.A.1	7. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **Climate Change Example**: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.

2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-PS4-1	4. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1	1. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
2. 9.4.5.DC.4	2. Model safe, legal, and ethical behavior when using online or offline technology.
3. 9.4.12.TL.3	3. Analyze the effectiveness of the process and quality of collaborative environments.
4. 9.4.12.CT.2	4. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1	1. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
2. 8.1.2.DA.1	2. Collect and present data, including climate change data, in various visual formats.
3. 8.1.2.DA.3	3. Identify and describe patterns in data visualizations.
4. 8.1.2.DA.4	4. Make predictions based on data using charts or graphs.
5. 8.1.2.AP.4	5. Break down a task into a sequence of steps.
6. 8.1.5.DA.5	6. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

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- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

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- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

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- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- 3.4 Sine and Cosine Function Graphs

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

4.5 Graphs of Sine and Cosine Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Sketch the graphs of basic sine and cosine functions. • Find key features of trigonometric functions to sketch their graphs. • Sketch translations of graphs of trigonometric functions. • Use sine and cosine functions to model real-life data.	**Prerequisite Skills** determine on what intervals a polynomial function is increasing or decreasing, concavity, and any relative extrema.	Choose from the following Day 1: pp. 299-300 Ex. 1-20, 21-37 odd, 57-69 odd, 71-74, 75-79 odd Day2: pp. 301-303 Ex. 81, 82, 83-87 odd, 89-92, 95-99, 101, 102, 105-108

4.6 Graphs of Other Trigonometric Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Sketch the graphs of basic tangent functions. • Find key features of trigonometric functions to sketch their graphs. • Sketch translations of graphs of trigonometric functions. • Use tangent functions to model real-life data.	**Prerequisite Skills** Determine the phase shift of a sine or cosine function	Choose from the following Day 1: pp. 311-312 Ex. 1-5, 9-11,

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period.	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork

• Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	• Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	

List of Accommodations and Modifications

- Special Education
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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 9A: Topics in Analytic Geometry (9.1)	
In this Unit, students will work with conic sections and equations in parametric form. The unit begins by defining the conic sections of both circles and parabolas. Students will learn to graph circles and parabolas. Write the equations of circles and parabola in standard form. Finally, students will use specific math vocabulary associated with analytic geometry.	
Essential Questions	**Learning Targets/Objectives**
1. How do you recognize each conic section and solve problems involving parabolas and circles?	Students will be able to: • Find the standard equation of a circle. • Graph a circle given its equation with the center at the origin and shifted. • Find the intercepts of a circle given an equation. • Find the standard equation of a parabola given the vertex and focus. • Find the standard equation of a parabola given the focus. • Find the focus of a parabola given its equation. • Graph a parabola with vertical and horizontal axis.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*

Circle, parabola, graph, radius, diameter, midpoint formula, distance formula, center, vertex, domain, range, standard form	Conic section, focus, directrix, general conic form

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-CED.A.2	1. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
2. A-SSE.A.2	2. Use the structure of an expression to identify ways to rewrite it.
3. F-BF.B.3	3. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.
4. F-IF.A.1	4. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
5. F.IF.B.4	5. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
6. F-IF.C.8a	6. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
7. G.GPE.A.1	7. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

8. G.GPE.A.2	8. Derive the equation of a parabola given a focus and directrix.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	1. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	3. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-ESS1-4	4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1	1. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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3. 9.4.12.TL.3	3. Analyze the effectiveness of the process and quality of collaborative environments.
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- Problem Solve

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- Understand Quantities
- Use Operations
- Contextualize
- Relationships
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- Use Prior Results
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- Build Arguments
- Analyze Conjectures

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- Justify Conclusions
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- Use Logic
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Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

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- Label Axes
- Calculate Accurately

- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

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Resources

Textbook

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Online Resources

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- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

Equation of a Circle

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- WebAssign Platform
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

- Multi-Language Glossary

Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

9.1 Circles and Parabolas		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Find the standard equation of a circle. • Graph a circle given its equation with the center at the origin and shifted. • Find the intercepts of a circle given an equation. • Find the standard equation of a parabola given the vertex and focus. • Find the standard equation of a parabola given the focus. • Find the focus of a parabola given its equation. • Graph a parabola with vertical and horizontal axis.	**Prerequisite Skills** Finding key characteristics of the graphs of a variety of functions.	Choose from the following Day 1: pp. 643 – 646: 7-39 odd, Day 2: pp. 643 – 646: 43-89 odd,

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Periodic Benchmarks ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Pre-Calculus Accelerated
Course Number: 034033

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Chapter 9B: Topics in Analytic Geometry (9.2-9.3)

In this Unit, students will work with conic sections and equations in parametric form. The unit continues by defining the conic sections of both ellipses and hyperbolas. Students will learn to graph ellipses and hyperbolas. Write the equations of ellipses and hyperbolas in standard form. Finally, students will use specific math vocabulary associated with analytic geometry.

Essential Questions	Learning Targets/Objectives
• How do you solve problems involving ellipses? • How do you solve problems involving hyperbolas? • How do you classify a conic from its general equation?	Students will be able to: • Write equations of ellipses in standard form. • Use properties of ellipses to model and solve real-life problems. • Find the standard equation of an ellipse given the foci and major axis. • Graph an ellipse given its equation with the center at the origin and shifted. • Analyze an ellipse and identify the center, vertices, and foci. • Write equations of hyperbolas in standard form • Find asymptotes of and graph hyperbolas • Use properties of hyperbolas to solve real-life problems • Classify conics from their general equations • Find the standard equation for a hyperbola given the asymptotes and vertices.

	• Graph a hyperbola given its equation. • Given a general equation, rewrite it in standard form.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Standard form, focus, center, horizontal, vertical, asymptotes, vertices, shifts	Ellipse, Major axis, Minor Axis, Hyperbola, Transverse axis, Rotation axis

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-CED.A.2	1. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
2. A-SSE.A.2	2. Use the structure of an expression to identify ways to rewrite it.
3. F-BF.B.3	3. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.
4. F-IF.A.1	4. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
5. F.IF.B.4	5. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative

	maximums and minimums; symmetries; end behavior; and periodicity.
6. F-IF.C.8a	6. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
7. G.GPE.A.3	7. Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.
NJSLS	**Interdisciplinary Connections**
1. L.KL.9-10.2.A	5. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level.
2. SL.PE.9-10.1.D	6. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. SL.PI.9-10.4	7. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
4. HS-ESS1-4	8. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.4.12.CI.1	5. Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
2. 9.4.5.DC.4	6. Model safe, legal, and ethical behavior when using online or offline technology.
3. 9.4.12.TL.3	7. Analyze the effectiveness of the process and quality of collaborative environments.
4. 9.4.12.CT.2	8. Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.CS.1	7. Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
2. 8.1.2.DA.1	8. Collect and present data, including climate change data, in various visual formats.
3. 8.1.2.DA.3	9. Identify and describe patterns in data visualizations.
4. 8.1.2.DA.4	10. Make predictions based on data using charts or graphs.

5. 8.1.2.AP.4 6. 8.1.5.DA.5	11. Break down a task into a sequence of steps. 12. Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

9.2 Ellipses		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Write equations of ellipses in standard form. • Use properties of ellipses to model and solve real-life problems. • Find the standard equation of an ellipse given the foci and major axis. • Graph an ellipse given its equation with the center at the origin and shifted. • Analyze an ellipse and identify the center, vertices, and foci.	**Prerequisite Skills** Derive the equation of a parabola or a circle by completing the square.	Choose fro the following pp. 653– 655: 1-40, 53-54, & 57. EXCLUDE eccentricity.

9.3 Hyperbolas		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Write equations of hyperbolas in standard form • Find asymptotes of and graph hyperbolas • Use properties of hyperbolas to solve real-life problems • Classify conics from their general equations • Find the standard equation for a hyperbola given the asymptotes and vertices. • Graph a hyperbola given its equation. • Given a general equation, rewrite it in standard form.	**Prerequisite Skills** Sketch the graph of an ellipse.	Choose from the following pp. 665: 1-64 all problems

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• Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	• Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	

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