Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus A
Course Number: 034300

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Functions & Their Graphs Chapter 1	Unit Summary: 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.
Grade Level(s): 11-12	
Essential Question(s): ● **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?**	**Enduring Understanding(s):** ● 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.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable
The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS
1. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	**1.** NJSLS.A-CED.A.2
2. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations	**2.** NJSLS.A-CED.A.4
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 (x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = (x)$.	**3.** NJSLS.F-IF.A.1
	4. NJSLS.F-IF.A.2
4. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes	**5.** NJSLS.F-IF.B.5
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.	**6.** NJSLS.F-IF.B.6
7. Interpret the parameters in a linear or exponential function in terms of a context.	**7.** NJSLS.F-LE.B.5
8. 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.	**8.** NJSLS.F-IF.B.4
	9. NJSLS.F-IF.C.7
9. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	
10. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	**10.** NJSLS.F-IF.C.7b
11. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology	**11.** NJSLS.F-BF.B.3
	12. NJSLS.F-BF.A.1
12. Write a function that describes a relationship between two quantities.	
	13. NJSLS.F-BF.A.1b
13. Combine standard function types using arithmetic operations.	
	14. NJSLS.F-BF.A.1c
14. Compose functions.	

15. Find inverse functions.	**15. NJSLS.F-BF.B.4**
16. Solve an equation of the form $(x) = c$ for a simple function f that has an inverse and write an expression for the inverse.	**16. NJSLS.F-BF.B.4a**
17. Verify by composition that one function is the inverse of another.	**17. NJSLS.F-BF.B.4b**
18. Read values of an inverse function from a graph or a table, given that the function has an inverse.	**18. NJSLS.F-BF.B.4c**
19. Produce an invertible function from a non-invertible function by restricting the domain.	**19. NJSLS.F-BF.B.4d**
20. 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).	**20. NJSLS.A-REI.D.10**

Inter-Disciplinary Connections:

Mathematical Modeling:
1. Many natural phenomena can be modeled by functions, such as the force of water against a face of a dam.
2. Graphs of functions provide visual relationships between two variables.
3. Recognizing the graphs of parent functions and knowing how to shift, reflect, and stretch graphs of functions can help students sketch or describe the graphs of a wide variety of simple functions.
4. Students can model the stopping distance of a car by combining the driver's reaction time with the car's braking distance.
5. Students can use inverse functions to find the European shoe sizes from the corresponding U.S. shoe sizes.

Students will engage with the following text, resources and tools:

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

Online Resources incorporated through the year, include but not limited to:
- WebAssign.com – publisher on-line assignments, resources, and text
- Kuta Software – program and/or KutaWorks
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Google Docs, Google Sheets, etc.

Calculators:
- TI – 83 Plus graphing calculator
- TI – 84 Plus graphing calculator

The following 21st century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:	Mathematical Practices:
● Critical thinking ● Creativity ● Collaboration ● Communication ● Information literacy ● Technology literacy ● Media literacy ● Flexibility ● Leadership ● Initiative ● Productivity ● Social skills	● Make sense of problems and persevere in solving them ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision ● Look for and make use of structure ● Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught. Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 1.2

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	pp. 24-28 Exs.1-6, 7-15 odd, 16, 17-21 odd, 29-37 odd, 49-53 odd, 65-72, 80, 87-94

Section1.3

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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

Section 1.4

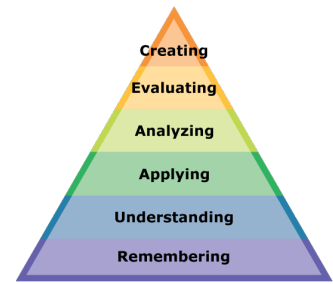|	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	pp. 47-49 Exs.1-4, 5-45 odd, 51-57 odd, 65-70, 80-86

Section 1.5

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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

Section 1.6

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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. IDENTIFY BLOOM'S LEVELS.

Creating
Evaluating
Analyzing
Applying
Understanding
Remembering

Formative Assessments:

The following assessments will be used to gage students' understanding of the key concepts and skills, as well as students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare students for summative assessments.
- **Quizzes (sections)**
- **Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks**
- **Monitoring of participation in small groups; use of self-assessments to monitor involvement/engagement in group work and evaluate contribution**
- **Self and peer assessments**

Accommodations/Modifications:

As per IEP or 504 Plan.

Summative Assessments:

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 Pre-Calculus curriculum/syllabus at the conclusion of an instructional time period.
- **Diagnostic Pre-Test**
- **Chapter Tests**
- **Periodic Benchmark Tests**
- **End-of-Course Assessment**
- **Standardized Tests**

Accommodations/Modifications:

As per IEP or 504 Plan.

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.
- **Projects**
- **Performance Tasks**
- **Homework**
- **Classwork**

Accommodations/Modifications:

As per IEP or 504 Plan.

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus A
Course Number: 034300

PART I: Unit Rationale

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Polynomial & Rational Functions Chapter 2	Unit Summary: 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. Next they learn how to find asymptotes, intercepts and holes as they graph rational functions. Students will use specific math vocabulary associated with polynomial and rational functions.
Grade Level(s): 11-12	
Essential Question(s): • **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 polynomials function?** • **How do you find the domain and asymptotes of a rational function?** • **How do you sketch the graph of a rational function?**	**Enduring Understanding(s):** • 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.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable
   The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1. Use the structure of an expression to identify ways to rewrite it.	1NJSLS.A-SSE.A.2
2. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	**2.** NJSLS.N-CN.A.1
3. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers**.**	**3.** NJSLS.N-CN.A.2
4. Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	4. NJSLS.N-CN.A.3
5. Solve quadratic equations with real coefficients that have complex solutions.	5. NJSLS.N-CN.C.7
6. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	6. NJSLS.A-REI.B.4b
7. Solve quadratic equations with real coefficients that have complex solutions.	7.NJSLS.N-CN.C.7
8. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	8. NJSLS.N-CN.C.9
9. Interpret complicated expressions by viewing one or more of their parts as a single entity.	9. NJSLS.A-SSE.A.1b
10. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	10. NJSLS.A-CED.A.2
11. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	11. NJSLS. F-IF.C.7
12. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	12. NJSLS.F-IF.C.7d

Inter-Disciplinary Connections:

Mathematical Modeling:

- **Students can use polynomial functions to model various aspects of nature, such as the growth of a red oak tree, as shown in Ex.112 pg. 111.**
- **Students will use complex numbers to model numerous aspects of the natural world, such as the impedance of an electrical circuit, as shown in Ex. 89 pg. 134.**
- **Students will be able to determine whether a football kicked with a given velocity can reach a certain height, as shown in Ex. 69 pg. 141.**
- **Students can determine the cost of supplying recycling bins to the population of a rural township, as shown in Ex. 49 pg. 150.**
- **Students can model the concentration of a chemical in the bloodstream after injection, as shown in Ex. 89 pg. 159.**

Students will engage with the following text, resources and tools:

Text:

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

Online Resources incorporated through the year, include but not limited to:

- WebAssign.com – publisher on-line assignments, resources, and text
- Kuta Software – program and/or KutaWorks
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Google Docs, Google Sheets, etc.

Calculators:

- TI – 83 Plus graphing calculator
- TI – 84 Plus graphing calculator

The following 21ˢᵗ century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21ˢᵗ Century skills:	Mathematical Practices:
• Critical thinking • Creativity • Collaboration • Communication • Information literacy • Technology literacy • Media literacy • Flexibility • Leadership • Initiative • Productivity • Social skills	• Make sense of problems and persevere in solving them • Reason abstractly and quantitatively • Construct viable arguments and critique the reasoning of others • Model with mathematics • Use appropriate tools strategically • Attend to precision • Look for and make use of structure • Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught.
Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS
DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 2.2

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	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

Section 2.4

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	pp. 133-134 Ex. 1 – 10, 11-95 odd, 97-100

Section 2.5

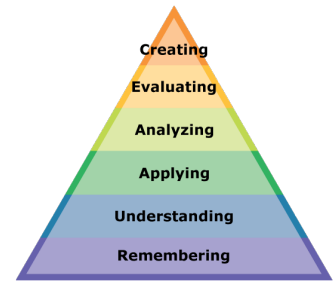|	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	pp. 140-141 Ex. 2-4, 5-27 odd, 45-61 odd, 65-71 odd, 72, 74-78

Section 2.6

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply	Day 1: pp. 147-148 Ex. 2-16,17-43 odd,

Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 2: pp. 148-150 Ex. 45-48, 50-52, 56-62	

Section 2.7

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	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.
IDENTIFY BLOOM'S LEVELS.

Creating
Evaluating
Analyzing
Applying
Understanding
Remembering

Formative Assessments:

The following assessments will be used to gauge students' understanding of the key concepts and skills, as well as the students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require the students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare the students for summative assessments.

- Quizzes (sections)
- Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks
- Monitoring of participation in small groups; Use of self-assessments to monitor involvement/engagement in group work and evaluate contribution.
- Self and Peer Assessments

Accommodations/Modifications:

As per student IEP or 504 Plan

Summative Assessments:

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 Pre-Calculus curriculum/syllabus at the conclusion of an instructional time period.

- Diagnostic Pre-Test
- Chapter Tests
- Periodic Benchmark Tests
- End of Course Assessment
- Standardized Tests

Accommodations/Modifications:

As per student IEP or 504 Plan

Performance Assessments:

The following assessments requires students to utilize various strands of mathematics.
- **Projects**
- **Performance Tasks**
- **Homework**
- **Classwork**

Accommodations/Modifications:

As per student IEP or 504 Plan

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus A

Course Number: 034300

PART I: UNIT RATIONALE

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

Course/Unit Title:	Unit Summary:
Exponential and Logarithmic Functions Chapter 3	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.
Grade Level(s):	
11-12	
Essential Question(s): • **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?**	**Enduring Understanding(s):** • 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.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable. The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1. Interpret expressions that represent a quantity in terms of its context.	1. NJSLS.A-SSE.A.1
2. Use the properties of exponents to transform expressions for exponential functions	2. NJSLS.ASSE.B.3c
3. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	3. NJSLS.F-IF.C.7e
4. Use the properties of exponents to interpret expressions for exponential functions.	4.NJSLS.F-IF.C.8b
5. Find inverse functions.	5. NJSLS.F-BF.B.4
6. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents	6. NJSLS.F-BF.B.5
7. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	7. NJSLS.F-LE.A.1c
8. Interpret the parameters in a linear or exponential function in terms of a context.	8. NJSLS.F-LE.B.5

Inter-Disciplinary Connections:

Mathematical Modeling:
1. Exponential functions are useful in modeling data that represents the depreciation of a new vehicle.
2. Logarithmic functions are useful in modeling data that represents the minimum required ventilation rates in public school classrooms.
3. Logarithmic functions can be used to model the number of decibels of sound.
4. Exponential and logarithmic equations can be used to model the average heights of men and women.

Students will engage with the following text, resources and tools:

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

Online Resources incorporated through the year, include but not limited to:
- WebAssign.com – publisher on-line assignments, resources, and text
- Kuta Software – program and/or KutaWorks
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Google Docs, Google Sheets, etc.

Calculators:
- TI – 83 Plus graphing calculator
- TI – 84 Plus graphing calculator

The following 21st century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:
- Critical thinking
- Creativity
- Collaboration
- Communication
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Social skills

Mathematical Practices:
- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught. Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

<u>How</u> will students uncover content and build skills.

Section 3.1

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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

Section 3.2

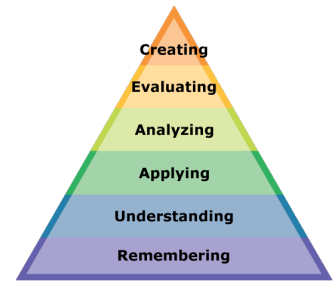|	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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

Section 3.3

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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

Section 3.4

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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.
IDENTIFY BLOOM'S LEVELS.

Creating
Evaluating
Analyzing
Applying
Understanding
Remembering

Formative Assessments:

The following assessments will be used to gage students' understanding of the key concepts and skills, as well as students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare students for summative assessments.

- Quizzes (sections)
- Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks
- Monitoring of participation in small groups; use of self-assessments to monitor involvement/engagement in group work and evaluate contribution
- Self and peer assessments

Accommodations/Modifications:

As per IEP or 504 Plan

Summative Assessments:

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 Pre-Calculus curriculum/syllabus at the conclusion of an instructional time period.

- Diagnostic Pre-Test
- Chapter Tests
- Periodic Benchmark Tests
- End-of-Course Assessment
- Standardized Tests

Accommodations/Modifications:

As per IEP or 504 Plan

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.

- **Projects**
- **Performance Tasks**
- **Homework**
- **Classwork**

Accommodations/Modifications:

As per IEP or 504 Plan.

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus A
Course Number: 034300

PART I: Unit Rationale
WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Trigonometric Functions Chapter 4	Unit Summary: In this Unit students learn how to evaluate and graph the 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 then learn how to find trigonometric ratios of the acute angle by drawing a right triangle, and of any angle by drawing a unit circle and a reference angle. They also learn how to graph trigonometric functions and how to identify the basic characteristics of the trigonometric functions, their reciprocals, and their inverses. Finally, students use trigonometric ratios to solve problems in a variety of contexts, such as mechanics, biology, and navigation. Students will use specific math vocabulary associated with trigonometric functions.
Grade Level(s): 11-12	
Essential Question(s): - How do you describe angles and angular movement? - How do you evaluate trigonometric functions by using the unit circle? - How do you use trigonometry to find unknown side lengths and angle measures in right triangles? - How do you evaluate trigonometric functions of any angle? - How do you sketch the graphs of sine, cosine and tangent functions? - How do you evaluate and graph the inverses of trigonometric functions? - How do you use trigonometric functions to solve real life problems?	**Enduring Understanding(s):** - Define and describe angles. - Use radian measure. - Use degree measure and convert between degrees and radians. - Use angles to model and solve real life problems. - 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. - 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. - Evaluate inverse trigonometric functions and compare to reciprocals. - Evaluate compositions of trigonometric functions. - Solve real life problems involving right triangles. - Solve real life problems involving harmonic motion.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable

The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1.Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	1.NJSLS.F-TF.A.1 -
2 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.	2.NJSLS.G-C.B.5 - [
3. 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. NJSLS.F-TF.A.2
4. Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	4. NJSLS.F-TF.A.4
5. Model periodic phenomena with trigonometric functions	5. NJSLS.F-TF.B
6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	6.NJSLS.G-SRT.C.6
7. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	7.NJSLS.G-SRT.C.8
8. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi–x$, $\pi+x$, and $2\pi–x$ in terms of their values for x, where x is any real number.	8. NJSLS.F-TF.A.3
9 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.	9. NJSLS.F-TF.C.8
10 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	10.NJSLS.F-TF.B.5
11. 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.	11.NJSLS.N-Q.A.1
12. 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.	12.NJSLS.F-TF.B.7

Inter-Disciplinary Connections:

Mathematical Modeling:

- Students can determine the measure of an angle generated as a skater performs and axel jump, as shown in Ex. 110 pg. 263.
- Students can model the displacement from equilibrium of an oscillating weight suspended by a spring as a function of time, as shown in Ex. 75 pg. 271.
- Students can approximate the angle of elevation of a zip-line, as shown in Ex. 78 pg 282.
- Students can use trigonometric functions to model the monthly sales of a seasonal product, such as wakeboards, as shown in Ex. 124 pg. 291.
- Students can use a trigonometric function to model the percent of the moon's face that is illuminated for any given day in 2016 as shown in Ex. 87 pg. 301.
- Students can use a tangent function to model and analyze the distance between a television camera and a parade unit, as shown in Ex. 64 pg. 312.
- Students can investigate the relationship between the height of a cone-shaped pile of rock salt, the angle of the cone shape and the diameter of its base, as shown in Ex. 99 pg. 324.
- Students can use a trigonometric function to model the length of the shadow of the Sundial Bridge in Redding, California, as shown in Ex. 35 pg. 333.

Students will engage with the following text, resources and tools:

Text:

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

Online Resources incorporated through the year, include but not limited to:

- WebAssign.com – publisher on-line assignments, resources, and text
- Kuta Software – program and/or KutaWorks
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Google Docs, Google Sheets, etc.

Calculators:

- TI – 83 Plus graphing calculator
- TI – 84 Plus graphing calculator

The following 21ˢᵗ century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21ˢᵗ Century skills:	Mathematical Practices:
● Critical thinking ● Creativity ● Collaboration ● Communication ● Information literacy ● Technology literacy ● Media literacy ● Flexibility ● Leadership ● Initiative ● Productivity ● Social skills	● Make sense of problems and persevere in solving them ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision ● Look for and make use of structure ● Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught.
Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph trigonometric functions (*sine, cosine, and tangent).

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

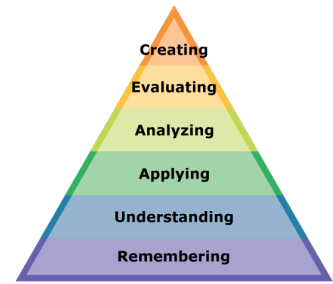**<u>How</u> will students uncover content and build skills.**

Section 4.1

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
	Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	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

Section 4.2

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
	Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 1: pp. 270-271 Ex. 1-12, 13-69 odd Day 2: pp. 271-272 Ex. 71-87, 91,93

Section 4.3

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.

| | Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.) | 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 | |

Section 4.4

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
	Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 1: pp289-290 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

Section 4.5

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
	Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	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, 83-87odd, 89-92, 95-99, 101, 102, 105-108

Section 4.6

		Accelerated
	Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.

Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 1: pp. 311-312 Ex. 1-8, 9-19odd, 29-47, 49, 51-55, 57 Day 2: pp 312-314 Ex. 59-66, 68-72, 75, 76, 78-87, 89

Section 4.7

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 1: pp. 322-323 Ex. 1-4, 5-13odd, 19-31 odd, 45-71 odd Day 2: pp 324-325 Ex. 73-79 odd, 99, 101, 102

Section 4.8

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	pp 332-334 Ex. 1-4, 5-17 odd; 19-27, 36-39

PART IV: EVIDENCE OF LEARNING
IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR
UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The following assessments will be used to gauge students' understanding of the key concepts and skills, as well as the students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require the students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare the students for summative assessments.

- **Quizzes (sections)**
- **Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks**
- **Monitoring of participation in small groups; Use of self-assessments to monitor involvement/engagement in group work and evaluate contribution.**
- **Self and Peer Assessments**

Accommodations/Modifications:

As per student IEP or 504 Plan

Summative Assessments:

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 PreCalculus curriculum/syllabus at the conclusion of an instructional time period.

- **Diagnostic Pre-Test**
- **Chapter Tests**
- **Periodic Benchmark Tests**
- **End of Course Assessment**
- **Standardized Tests**

Accommodations/Modifications:

As per student IEP or 504 Plan

Performance Assessments:

The following assessments requires students to utilize various strands of mathematics.
- Projects
- Performance Tasks
- Homework
- Classwork

Accommodations/Modifications:

As per student IEP or 504 Plan

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus

Course Number: 034300 & 034200

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title:	Unit Summary:
Analytic Trigonometry Chapter 5	In Chapter 5, students learn strategies for simplifying expressions and solving equations by using trigonometric identities. First, students learn how trigonometric functions can be rewritten by using identities and how to verify identities. Next, 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.
Grade Level(s): 10-12	
Essential Question(s): • **How do you rewrite trigonometric expressions in order to simplify and evaluate trigonometric functions?** • **How do you verify a trigonometric identity?** • **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?**	**Enduring Understanding(s):** • 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. • 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 sum and difference formulas to evaluate trigonometric functions, verify trigonometric identities and solve trigonometric equations. • Use multiple-angle formulas to rewrite and evaluate trigonometric functions. • Use half-angle formulas to rewrite and evaluate trigonometric functions.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable

The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline..	**1.** NJSLS.F-TF.B.5
2. Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	**2.** NJSLS.F-TF.B.6
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.	**3.** NJSLS.F-TF.B.7
4. 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.	**4.** NJSLS.F-TF.C.8
5. Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	**5.** NJSLS.F-TF.C.9
6. 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.	**6. NJSLS.N-Q.A.1**

Inter-Disciplinary Connections:

Mathematical Modeling:
1. The fundamental trigonometric identities can be used to simplify an expression for the coefficient of friction.
2. Students can use trigonometric identities to simplify an equation that models the length of a shadow cast by a gnomon (a device used to tell time).
3. Students can use trigonometric equations to help answer questions about monthly sales of skis.
4. Students can use sum and difference formulas to rewrite a trigonometric expression in a form that helps them find the equation of a standing wave.
5. Students can use a variety of trigonometric formulas to determine the apex angle of a sound wave cone caused by the speed of an airplane.

Students will engage with the following text, resources and tools:

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

Online Resources incorporated through the year, include but not limited to:
- WebAssign.com – publisher on-line assignments, resources and text
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Docs, Drive, Mail, etc.
- Kuta Works

Calculators:
- TI – 84 Plus graphing calculator

The following 21st century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:
- Critical thinking
- Creativity
- Collaboration
- Communication
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Social skills

Mathematical Practices:
- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught. Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 5.1

	Regular	
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.	
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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	

Section 5.2

	Regular	
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.	
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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	

Section 5.3

	Regular	
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics	

	MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.	
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	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	

Section 5.4

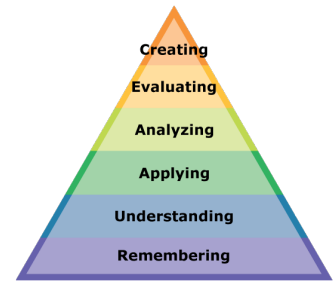|	**Regular**	
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.	
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	Day 1: pp. 381-382 Exs. 1-8, 11-25 odd, 31-39, 41, 45-67 odd Day 2: pp. 382-383 Exs. 69-89 odd, 90-93, 97-103 odd, 106, 107, 109, 111	

Section 5.5

	Regular	
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.	
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	Day 1: pp. 390-391 Exs. 1-15 odd, 21-35 odd, 45, 57-65 odd, 69-73 odd, 85, 87 Day 2: pp. 391-393 Exs. 89, 91, 97-105 odd, 111-139 odd	

PART IV: EVIDENCE OF LEARNING
IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.

Creating
Evaluating
Analyzing
Applying
Understanding
Remembering

Formative Assessments:

The following assessments will be used to gage students' understanding of the key concepts and skills, as well as students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare students for summative assessments.

- Quizzes (sections)
- Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks
- Monitoring of participation in small groups; use of self-assessments to monitor involvement/engagement in group work and evaluate contribution
- Self and peer assessments

Accommodations/Modifications:

As per IEP or 504 Plan.

Summative Assessments:

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 Pre-Calculus curriculum/syllabus at the conclusion of an instructional time period.

- Diagnostic Pre-Test
- Chapter Tests
- Periodic Benchmark Tests
- End-of-Course Assessment
- Standardized Tests

Accommodations/Modifications:

As per IEP or 504 Plan.

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.
- **Projects**
- **Performance Tasks**
- **Homework**
- **Classwork**

Accommodations/Modifications:

As per IEP or 504 Plan.

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus

Course Number: 034300

PART I: Unit Rationale

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title:	Unit Summary:
Additional Topics in Trigonometry Chapter 6	In this Unit, students learn how to apply trigonometry to oblique triangles, vectors, and complex numbers. They begin the chapter by learning how to find side lengths, angles, and areas of oblique triangles by using the Law of Sines and Law of Cosines. They will apply these skills to real-life problems. The students will use specific math vocabulary associated with Law of Sines & Law of Cosines.
Grade Level(s): 11 - 12	
Essential Question(s): • 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?	**Enduring Understanding(s):** • 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. • Represent vectors as directed line segments.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable

  The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1. 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	1. NJSLS.G-SRT.D.9
2. Prove the Laws of Sines and Cosines and use them to solve problems.	2. NJSLS.G-SRT.D.10
3. 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	3. NJSLS.G-SRT.D.11

Inter-Disciplinary Connections:

Mathematical Modeling:

- **Students can show how the Law of Sines can be used to help determine the distance from a boat to the shoreline, as shown in Ex. 48 pp. 411.**
- **Students can show how the Law of Cosines can be used to determine the lengths of the guy wires that anchor a tower, as shown in Ex. 53 pp. 418.**

Students will engage with the following text, resources and tools:

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

Online Resources incorporated through the year, include but not limited to:
- WebAssign.com – publisher on-line assignments, resources and text
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Docs, Drive, Mail, et
- Kuta Works

Calculators:
- TI – 84 Plus graphing calculator
- TI – 83 Plus graphing calculator

The following 21ˢᵗ century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21ˢᵗ Century skills:	Mathematical Practices:
- Critical thinking - Creativity - Collaboration - Communication - Information literacy - Technology literacy - Media literacy - Flexibility - Leadership - Initiative - Productivity - Social skills	- Make sense of problems and persevere in solving them - Reason abstractly and quantitatively - Construct viable arguments and critique the reasoning of others - Model with mathematics - Use appropriate tools strategically - Attend to precision - Look for and make use of structure - Look for and express regularity in repeated reasoning

Students will write:

Students will write notes and copy class examples to better comprehend the skills being taught. Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.
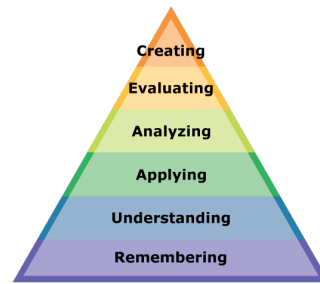
Section 6.1

	Regular
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	Day 1: pp. 410-412 Ex. 7-19 odd, 27-51 odd, 54, 56-59

Section 6.2

	Regular
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per the discretion of the teacher.)	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.
IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The following assessments will be used to gauge students' understanding of the key concepts and skills, as well as the students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require the students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary in order to prepare the students for summative assessments.

- Quizzes (sections)
- Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks
- Monitoring of participation in small groups; Use of self-assessments to monitor involvement/engagement in group work and evaluate contribution.
- Self and Peer Assessments

Accommodations/Modifications:

As per student IEP or 504 Plan

Summative Assessments:

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 PreCalculus curriculum/syllabus at the conclusion of an instructional time period.

- Diagnostic Pre-Test
- Chapter Tests
- Periodic Benchmark Tests
- End of Course Assessment
- Standardized Tests

Accommodations/Modifications:

As per student IEP or 504 Plan

Performance Assessments:

The following assessments requires students to utilize various strands of mathematics.
- **Projects**
- **Performance Tasks**
- **Homework**
- **Classwork**

Accommodations/Modifications:

As per student IEP or 504 Plan

Black Horse Pike Regional School District Curriculum Template
ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Pre-Calculus

Course Number: 034300

PART I: UNIT RATIONALE
WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title:	Unit Summary:
Topics in Analytic Geometry Chapter 9	In Chapter 9, students are introduced to polar forms for writing and graphing equations. They use polar coordinates to represent and solve problems. Students also work with these coordinates and equations by converting them from polar form to rectangular form and vice versa. Finally, students will use specific math vocabulary associated with analytic geometry.
Grade Level(s): 11-12	

Essential Question(s):	Enduring Understanding(s):
- How do you recognize each conic section and solve problems involving parabolas and circles? - How do you solve problems involving ellipses? - How do you solve problems involving hyperbolas? - How do you classify a conic from its general equation?	- 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. - 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 - Rotate the coordinate axes to eliminate the xy-term in equations of conics - 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.

Cartesian Standard Form

Circles	Ellipses
$(x-h)^2 + (y-k)^2 = r^2$	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$
Hyperbolas (Horizontal)	**Hyperbolas (Vertical)**
$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$-\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES
DESCRIBE THE LEARNING TARGETS.

After each target, identify the New Jersey Student Learning Standards that are applicable

   The standards for mathematical practices will be utilized throughout the chapter.

Learning Target	NJSLS:
1. 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.	1. NJSLS.G.-GPE.A.1
2. Derive the equation of a parabola given a focus and directrix.	2. NJSLS.G-GPE.A.2
3. 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.	3. NJSLS.G-GPE.A.3
4. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases...	4. NJSLS.F-IF.C.7
5. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.	5. NJSLS.A-REI.B.4a
6. Identify the effects of transformations and combinations of transformations [f(x) + k, k f(x), f(kx), and f(x + k)] on a function; find the value of k given the graph.	6. NJSLS.F.BF.B.3
7. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	7. NJSLS.G-CO.A.4
8. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder	8. NJSLS.G.-MG.A.1
9. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	9. 8. NJSLS.G.-MG.A.3

Inter-Disciplinary Connections:

Mathematical Modeling:
1. **Students can use parabolas to design roadways that allow water runoff.**
2. **Students can use circles to write an equation of a satellite's orbit around the earth.**
3. **Students can use ellipses to design support systems for bridges.**
4. **Hyperbolas are used in a navigation system known as LORAN (long range navigation).**
5. **Students can use hyperbolas to determine the distance a camera needs to be to create a panoramic photo.**

Students will engage with the following text, resources and tools:

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

Online Resources incorporated through the year, include but not limited to:
- WebAssign.com – publisher on-line assignments, resources, and text
- Kuta Software – program and/or KutaWorks
- Desmos – online graphing tool
- IXL – web-based software
- G Suite for education – Google Classroom, Google Docs, Google Sheets, etc.

Calculators:
- TI – 83 Plus graphing calculator
- TI – 84 Plus graphing calculator

The following 21st century skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:
- Critical thinking & Problem Solving
- Creativity & Innovation
- Communication & Collaboration
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Life & Career Skills

Mathematical Practices:
- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Act as a responsible and contributing citizen and employee.
- Apply appropriate academic and technical skills.
- Communicate clearly and effectively and with reason.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership, and effective management.
- Use technology to enhance productivity

<u>**Students will write:**</u>

Students will write notes and copy class examples to better comprehend the skills being taught. Students will write solutions to open-ended math problems and word problems dealing with real-world applications. Students will graph interpretations of functions.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

<u>**How**</u> **will students uncover content and build skills.**

Section 9.1

Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	Textbook problems pp. 643 – 646: 1 – 90, 97, 100, 113 - 119.

Section 9.2

	Accelerated
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure MP 8- Look for and express regularity in repeated reasoning.
Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	Textbook problems pp. 653– 655: 1-40, 53-54, & 57. **EXCLUDE eccentricity**.

Section 9.3

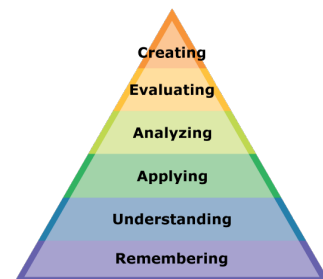|	**Accelerated**
Standards for Mathematical Practice	MP 1- Make sense of problems and persevere in solving them MP 2- Reason abstractly and quantitatively MP 3- Construct viable arguments and critique MP 4- Model with mathematics MP 5- Use appropriate tools strategically MP 6- Attend to precision MP 7- Look for and make use of structure

		MP 8- Look for and express regularity in repeated reasoning.
	Practice and Apply Assigning Homework (Tasks are assigned as per discretion of the teacher)	Textbook problems pp. 665: 1-64 all problems

PART IV: EVIDENCE OF LEARNING

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

Creating
Evaluating
Analyzing
Applying
Understanding
Remembering

Formative Assessments:

   The following assessments will be used to gage students' understanding of the key concepts and skills, as well as students' abilities to use their knowledge to engage in mathematical problem solving as per the New Jersey Learning Standards for Mathematics. These assessments require students to think independently as well as collaboratively. Teachers will use these assessments throughout the chapter to determine where interventions are necessary to prepare students for summative assessments.

- **Quizzes (sections)**
- **Assessment of classroom activities such as lesson warm-ups, exit tickets, educational tasks**
- **Monitoring of participation in small groups; use of self-assessments to monitor involvement/engagement in group work and evaluate contribution**
- **Self and peer assessments**

Accommodations/Modifications:

  As per IEP or 504 Plan.

Summative Assessments:

   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 Pre-Calculus curriculum/syllabus at the conclusion of an instructional time period.

- **Diagnostic Pre-Test**
- **Chapter Tests**
- **Periodic Benchmark Tests**
- **End-of-Course Assessment**
- **Standardized Tests**

Accommodations/Modifications:

As per IEP or 504 Plan.

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.

- Projects
- Performance Tasks
- Homework
- Classwork

Accommodations/Modifications:

As per IEP or 504 Plan.