Black Horse Pike Regional School District Curriculum Template

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

Course Name: Pre-Calculus & Pre-Calculus Honors
Course Number: 034300 & 034200

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title:	Unit Summary:
Functions & Their Graphs Chapter 1	Chapter 1 addresses functions and their representations in the Cartesian plane. Students are introduced to functions and learn to identify, categorize, and describe functions. They then learn to graph functions and represent simple transformations of the six most commonly 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): 10-12	

Essential Question(s):	Enduring Understanding(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?**	- 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 functions 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.

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. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	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 5. NJSLS-F-IF.B.5
4. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	6. NJSLS-F-IF.B.6
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* ★	7. NJSLS-F-LE.B.5 8. NJSLS-F-IF.B.4
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.	9. NJSLS-F-IF.C.7
7. Interpret the parameters in a linear or exponential function in terms of a context.	10. NJSLS-F-IF.C.7b 11. NJSLS-F-BF.B.3
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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* ★	12. NJSLS-F-BF.A.1 13. NJSLS-F-BF.A.1b
9. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	14. NJSLS-F-BF.A.1c
10. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	15. NJSLS-F-BF.B.4 16. NJSLS-F-BF.B.4a
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. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*	17. NJSLS-F-BF.B.4b 18. NJSLS-F-BF.B.4c
12. Write a function that describes a relationship between two quantities.	19. NJSLS-F-BF.B.4d
13. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and*	

relate these functions to the model.	**20. NJSLS-A-REI.D.10**
14. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time*	
15. Find inverse functions.	
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. *For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠1.*	
17. Verify by composition that one function is the inverse of another.	
18. Read values of an inverse function from a graph or a table, given that the function has an inverse.	
19. Produce an invertible function from a non-invertible function by restricting the domain.	
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).	

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:

Pre-Calculus with a limits: A Graphing Approach 7e By Ron Larson

Resources: CourseMate; a variety of technology tools and other texts as per teacher discretion.

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

	Regular	**Honors**
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.	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. 24-28 Exs.1-6, 7-15 odd, 16, 17-21 odd, 29-37 odd, 49-53 odd, 65-72, 80, 87-94	Day 1: pp. 24-28 Exs. 8-14 even, 18-28 even, 40-54, 73-78, 82, 84, 85-94

Section1.3

	Regular	**Honors**
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.	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. 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	Day 1: pp. 37-40 Exs. 7-10, 18-34 even, 48-52 eve, 60, 62, 64-90 even, 92-95, 99-120

Section 1.4

|	Regular	Honors
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.	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. 47-49 Exs.1-4, 5-45 odd, 51-57 odd, 65-70, 80-86	Day 1: pp. 47-49 Exs. 13-18, 22-28 even, 29-34, 36-50 even, 61-86

Section 1.5

	Regular	Honors
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.	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. 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	Day 1: pp. 56-59 Exs. 1-6, 16-32 even, 38-44 even, 50-66 even, 67-70, 76-79, 81-88, 89-100

Section 1.6

	Regular	Honors
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.	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. 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	Day 1: pp. 67-70 Exs. 15-18, 20-30 even, 40-58 even, 72-80 even, 86-90 even, 91-100, 102-110 even, 115, 117-140

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.
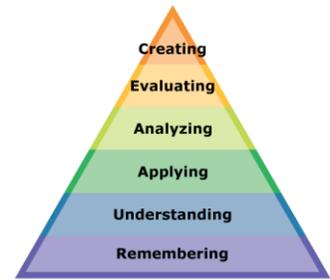
Formative Assessments:

The effectiveness of the instructional program will be based on numerous activities and strategies including the following: teacher observations, students collaborating with peers, questioning strategies, student record-keeping, quizzes, exit/admit assignments, peer/self assessments, learning/response logs, discussions and practice presentations.

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 Student 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.