

Marking Period: 1	Unit Title: Functions (Precalculus Review)	Recommended Instruction Days: 20 -25
Standard-New Jersey Student Learning Standards: F-IF, F-BF		
<p>Strand: F-IF: Interpreting Functions</p> <p>Understand the concept of a function and use function notation</p> <ol style="list-style-type: none">1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. <p>Interpret functions that arise in applications in terms of the context</p> <ol style="list-style-type: none">4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <p>Analyze functions using different representations</p> <ol style="list-style-type: none">7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<ol style="list-style-type: none">a. Graph linear and quadratic functions and show intercepts, maxima, and minimab. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.<ol style="list-style-type: none">a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.b. Use the properties of exponents to interpret expressions for exponential functions.		

9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

F-BF: Building Functions

Build a function that models a relationship between two quantities

1. Write a function that describes a relationship between two quantities
 - c. Compose functions

LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*

Stephen Hawking - Despite living with amyotrophic lateral sclerosis, Stephen Hawking is a world-renowned physicist who is credited with groundbreaking discoveries involving quantum theory and general relativity, among others.

The mission is to ensure that every student is able to see themselves in our rich and diverse history.

Social and Emotional Learning: <i>Competencies</i>	Social and Emotional Learning: <i>Sub-Competencies</i>
<p>Self-Awareness</p> <p>Social Awareness</p> <p>Self-Management</p> <p>Relationship Skills</p> <p>Responsible Decision-Making</p>	<ul style="list-style-type: none"> ● Recognizing the importance of self-confidence in handling daily tasks and challenges. ● Demonstrate an awareness of the expectations for social interactions in a variety of ways. ● Demonstrate an understanding of the need for mutual respect when viewpoints differ. ● Recognize the skills needed to establish and achieve personal and educational goals. ● Utilize positive communication and social skills to interact effectively with others. ● Develop, implement, and model effective problem solving and critical thinking skills.

**Recommended Activities, Investigations,
Interdisciplinary Connections, and/or Student
Experiences to Explore NJSLS-CLKS within Unit**

Essential Questions	Progress Indicators	Activity Description
<ul style="list-style-type: none"> ● What do the characteristics of a function tell us about the behavior of the graph of that function? ● How are the domain and range of rational functions determined? ● What is a piecewise function, and how are the domain and range of a piecewise function determined? ● How can functions be combined algebraically? 	<ul style="list-style-type: none"> ● Tests ● Quizzes ● Practice problems for homework ● Worksheets ● Leveled assessments ● Projects 	<ul style="list-style-type: none"> ❖ Domain and Range of Functions Algebraically ❖ Find Domain and Range from a Graph ❖ Simplifying Rational Functions ❖ Domain and Range of Rational Functions ❖ Identifying Holes and Asymptotes ❖ Graphing a Piecewise Function ❖ Domain and Range of Piecewise Functions ❖ Composition of Functions with Domain ❖ Example Tasks Below <p style="text-align: center;"><u>Interdisciplinary Connections:</u> <u>Science Domain: Energy and Matter</u></p> <p>According to the Global Wind Energy Council, a wind turbine can generate about 16,400 kWh of power each day. According to the Alternative Fuels Data Center, an average electric car can travel approximately 100 miles on 34 kWh of energy. An environmental nonprofit organization is interested in analyzing how wind power could offset the energy use of electric vehicles.</p> <ol style="list-style-type: none"> a. Write a function that represents the relationship between the number of wind turbines operating in a wind farm and the amount of energy they generate per day (in kilowatt-hours). Define the input and output. b. Write a function that represents the relationship between the energy expended by an electric car (in kilowatt-hours) and the number of miles driven. c. Write a function that could be used to determine the number of miles that an electric car could drive based on the number of wind turbines operating at a wind farm. Interpret this function in context.

- d. Determine the appropriate domain and range for part c. Explain why your domain and range are reasonable in this context.
- e. How many miles of driving could be generated daily by 20 wind turbines in a day?

Answer:

- a. $E(t) = 16400t$; t = number of turbines operating daily; $E(T) =$ energy (in kilowatt-hours) produced daily by the turbines.
- b. The relationship between miles driven and energy used is directly proportional, so $m = kE$. Since the car drives 100 miles using 34 kWh, $100 = k(34)$ and k is approximately 2.9. $m(e) = 2.9E$. E is the amount of energy expended by an average electric car (in kilowatt-hours). $m(e)$ is miles driven by the electric car.
- c. $m(E(t)) = m(16400t) = 2.9(16400t) = 47560t$; For every turbine operating in a wind farm daily, an average electric car can drive 47,560 miles.
- d. Domain: Whole numbers-the domain represents the number of turbines, which can only be represented with whole numbers. Range: Whole numbers-Given the function $m(E(t)) = 47560t$, the outputs are found by multiplying a whole number by an input that is a whole number, which always produces a whole number. The range represents miles drive, and these values cannot be negative.
- e. $m(E(20)) = 20(47560) = 951200$. 951,200 miles of driving can be generated.

Task

Graph the rational function $f(x) = (x^2 + x - 6) / (x^2 - x - 2)$. Identify the domain, x-and y-intercepts, asymptotes and/or holes.

Answer

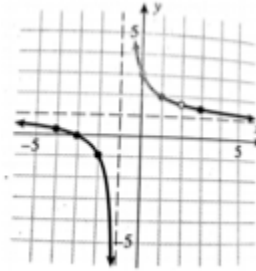
Domain $(-\infty, -1) \cup (-1, 2) \cup (2, \infty)$

x-intercept $(-3, 0)$

y-intercept $(0, 3)$

Hole: $x = 2$

Vertical Asymptote: $x = -1$
Horizontal Asymptote: $y = 1$



Task

Write the domain in interval notation for the following expressions

- $x^2 + 1$
- $\sqrt{x - 2}$
- $\frac{3}{x+5}$

Answer

- $(-\infty, \infty)$
- $[2, \infty)$
- $(-\infty, -5) \cup (-5, \infty)$

Mathematical Practices			
<ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. 			
Assessments (Formative) <i>To show evidence of meeting the standard/s, students will successfully engage within:</i>		Assessments (Summative) <i>To show evidence of meeting the standard/s, students will successfully complete:</i>	
<u>Formative Assessment:</u> <ul style="list-style-type: none"> ● Entry and Exit Slips ● Quizzes ● Self Assessments ● Focus Packets 		<u>Benchmarks:</u> <ul style="list-style-type: none"> ● Chapter Tests ● Projects <u>Summative Assessments:</u> <ul style="list-style-type: none"> ● District assessments 	
Differentiated Student Access to Content: Teaching and Learning Resources/Materials			

Core Resources	Alternate Core Resources <i>IEP/504/At-Risk/ESL</i>	ELL Core Resources	Gifted & Talented Core Resources
online albert resource online achievethecore resource online learnzillion resource online khanacademy resource online desmos resource online edulastic resource	Reteaching worksheets Skill building workbook Math manipulatives Leveled practice worksheets	Dictionary for native language Video tutorial in native language Success for English Learners worksheets Leveled Strategies for English Learners Linguistic Support	Enrichment worksheets Art of Problem Solving Leveled assessments
Supplemental Resources			
<ul style="list-style-type: none"> ● Technology: Chromebooks, Graphing Calculators, Smartboards, ● Other: Zoom and Google Meets, Schoology, Google Classroom 			
Differentiated Student Access to Content: Recommended <i>Strategies & Techniques</i>			
Core Resources	Alternate Core Resources <i>IEP/504/At-Risk/ESL</i>	ELL Core Resources	Gifted & Talented Core Resources
Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as	Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations,	Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary,	Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based

needed, modify assessments and/or rubrics, repeat	additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks.	supplemental materials including use of an online bilingual dictionary, and modified assessment and/or rubric.	extension activities, and connect student to related
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