

Marking Period	Unit Title	Recommended Instructional Days										
2	Rational Functions	15 - 20 days										
Domain:		Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit										
<p><b>NJSLS Strand:</b></p> <p><b>N-RN.1</b> Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.</p> <p><b>N-RN.2</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p> <p><b>A-APR.1</b> Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p> <p><b>N-RN.6</b> Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>,</p>	<p><b>Progress Indicator:</b> <b>Tests • Quizzes • Practice problems for homework • Online textbook • Worksheets • IXL • Leveled assessments</b></p>											
		<p><b>Essential Question/s:</b> What can the rule for a polynomial function reveal about its graph, and what can the graphs of polynomial functions reveal about the solutions of polynomial equations?</p> <p><b>Activity Description:</b> Graphing Rational functions Multiplying and dividing rational expressions Adding and subtracting Rational expressions Solving rational equations</p> <p><b>Interdisciplinary Connections:</b> <b>Music Domain: Artistic Process:</b> <b>Performing/Presenting/Producing</b></p> <p>A manager estimates a band’s profit <math>p</math> for a concert by using the function <math>p(t) = -200t^2 + 2500t - c</math>, where <math>t</math> is the price per ticket and <math>c</math> is the band’s operating cost. The table shows the band’s operating cost at three different concert locations. What range of ticket prices should the band charge at each location in order to make a profit of at least \$1000 at each concert?</p>										
		<table><tr><th colspan="2">Band’s Costs</th></tr><tr><th>Location</th><th>Operating Cost</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	Band’s Costs		Location	Operating Cost						
Band’s Costs												
Location	Operating Cost											

where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

**N-RN.7(+)** Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

**A-CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

**A-CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Freemont Park	\$900
Saltillo Plaza	\$1500
Riverside Walk	\$2500

**Answer:**

Freemont Park: between \$0.82 and \$11.68


Saltillo Plaza: between \$1.10 and \$11.40

Riverside Walk: between \$1.61 and \$10.89

**Example Tasks:**

At the end of each topic please review the Assessment Practice and Performance Tasks questions.

Mixed Review Available Online

 **ASSESSMENT PRACTICE**

33. Which function has a graph with a vertical asymptote at  $x = 3$ ? Select all that apply.

Ⓐ  $f(x) = \frac{x-2}{x^2+2x-15}$

Ⓑ  $f(x) = \frac{x-3}{x^2+7x+12}$

Ⓒ  $f(x) = \frac{x^2-9}{x+9}$

Ⓓ  $f(x) = \frac{x^2+6x+5}{x^2-9}$

**A-CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

**A-REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

**A-REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

**A-REI.11** Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find

**35. Performance Task** There is a relationship between the degree of the numerator and denominator of a rational function and the function's horizontal asymptote.

Function	Horizontal Asymptote
$f(x) = \frac{2x}{x^2}$	
$f(x) = \frac{5x^2}{2x^3}$	
$f(x) = \frac{9x^6}{7x}$	
$f(x) = \frac{-3x^7}{4x^4}$	

**Part A** Complete the right column of the table.

**Part B** What is the relationship between the degree of the numerator and denominator when the horizontal asymptote is  $y = 0$ ?

**Part C** What is the relationship between the degree of the numerator and denominator when there is no a horizontal asymptote?

solutions approximately; e.g., using technology to graph functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

**A-REI.12** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

**F-IF.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 in a verbal description of the relationship.

*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or*



### ASSESSMENT PRACTICE

35. Which of the following rational expressions simplify to  $\frac{y}{y+3}$ ? Select all that apply.

Ⓐ  $\frac{(2y^2 + y)(y + 3)}{(4y + 2)(y + 3)^2}$

Ⓑ  $\frac{3y^2 + y}{3y^2 + 10y + 3}$

Ⓒ  $\frac{2y^3 + 3y^2 + y}{(2y + 1)(y^2 + 4y + 3)}$

Ⓓ  $\frac{y^2 + 2y}{y^2 + 4y + 3}$

Ⓔ  $\frac{1}{y+3}$

negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\*

**F-IF.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.\**

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

b. Graph square root, cub root, and piecewise-defined functions, including step functions and absolute value functions.

**F-BF.3** Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $kf(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$

**37. Performance Task** The approximate annual interest rate  $r$  of a monthly installment loan is given by the formula:

$$r = \left[ \frac{24(nm - p)}{p + \frac{nm}{12}} \right],$$

where  $n$  is the total number of payments,  $m$  is the monthly payment, and  $p$  is the amount financed.

**Part A** Find the approximate annual interest rate (to the nearest percent) for a four-year signature loan of \$20,000 that has monthly payments of \$500.

**Part B** Find the approximate annual interest rate (to the nearest tenth percent) for a five-year auto loan of \$40,000 that has monthly payments of \$750.

**Spot Light on:**

*Acknowledge every student's comment or response, even if it's incorrect.*

<p>(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. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them</i></p> <p><b>F-BF.4</b> Find inverse functions.</p> <p>a. Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse.</p> <p>b. (+) Verify by composition that one function is the inverse of another.</p> <p>c. (+) Read values of an inverse function from a graph or table, given that the function has an inverse.</p> <p>d. (+) Produce an invertible function from a non-invertible function by restricting the domain.</p>		
<b>Mathematics Practices</b>		

<ol style="list-style-type: none"> <li>1. Make sense of problems and persevere in solving them.</li> <li>2. Reason abstractly and quantitatively.</li> <li>3. Construct viable arguments and critique the reason of others.</li> <li>4. Model with mathematics.</li> <li>5. Use appropriate tools strategically.</li> <li>6. Attend to precision.</li> <li>7. Look for and make use of structure.</li> <li>8. Look for and express regularity in repeated reasoning.</li> </ol>		
<b>Social and Emotional Learning:</b>	<b>Social and Emotional Learning:</b>	
<b><i>Competencies</i></b>	<b><i>Sub-Competencies</i></b>	
<p>Self- awareness</p> <p>Social Awareness</p> <p>Self- Management</p> <p>Relationship Skills</p> <p>Responsible Decision-Making</p>	<p>Recognizing the importance of self-confidence in handling daily tasks and challenges.</p> <p>Demonstrate an awareness of the expectations for social interactions in a variety of ways.</p> <p>Demonstrate an understanding of the need for mutual respect when viewpoints differ.</p> <p>Recognize the skills needed to establish and achieve personal and educational goals.</p> <p>Utilize positive communication and social skills to interact effectively with others.</p> <p>Develop, implement, and model effective problem solving and critical thinking skills.</p>	
<p><b>Assessments (Formative)</b></p> <p><i>To show evidence of meeting the standard/s, students will successfully engage within:</i></p>		<p><b>Assessments (Summative)</b></p> <p><i>To show evidence of meeting the standard/s, students will successfully complete:</i></p>

<b>Formative Assessments:</b> <ul style="list-style-type: none"><li>Entry and Exit Slips</li><li>Quizzes</li><li>Self Assessments</li></ul>		<b>Benchmarks:</b> <ul style="list-style-type: none"><li>Chapter Tests</li><li>Projects</li></ul> <b>Summative Assessments:</b> <ul style="list-style-type: none"><li>District Assessments</li><li>Midterms</li><li>Standardized Tests</li></ul>	
<b>Differentiated Student Access to Content:</b> <b>Teaching and Learning <i>Resources/Materials</i></b>			
<b>Core Resources</b>	<b>Alternate Core Resources</b> <i>IEP/504/At-Risk/ESL</i>	<b>ELL Core Resources</b>	<b>Gifted &amp; Talented Core Resources</b>
<ul style="list-style-type: none"><li>Textbooks websites</li><li>Achieve the core</li><li>Khan Academy</li><li>Desmos</li></ul>	<ul style="list-style-type: none"><li>Skill building worksheets</li><li>Math Manipulatives</li></ul>	<ul style="list-style-type: none"><li>Dictionary for native languages</li><li>Videos in their native language.</li></ul>	<ul style="list-style-type: none"><li>Leveled Assessments</li><li>Enrichment worksheets</li></ul>
<b>Supplemental Resources</b>			
<b>Technology:</b> <ul style="list-style-type: none"><li>Chromebooks, Graphing Calculators, Online math manipulatives</li></ul> <b>Other:</b> <ul style="list-style-type: none"><li>Zoom and Google Meets, Google Classroom, Interactive Textbooks</li></ul>			
<b>Differentiated Student Access to Content:</b> <b>Recommended <i>Strategies &amp; Techniques</i></b>			
<b>Core Resources</b>	<b>Alternate Core Resources</b> <i>IEP/504/At-Risk/ESL</i>	<b>ELL Core Resources</b>	<b>Gifted &amp; Talented Core</b>
<ul style="list-style-type: none"><li>Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed.</li></ul>	<ul style="list-style-type: none"><li>Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional</li></ul>	<ul style="list-style-type: none"><li>Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental</li></ul>	<ul style="list-style-type: none"><li>Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based</li></ul>



modify assessments and/or rubrics, repeat	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.	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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NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS	<b>Disciplinary Concept: Creativity and Innovation</b>	
	<b>Core Ideas:</b>	Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences
	<b>Performance Expectation/s:</b>	9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
	<b>Career Readiness, Life Literacies, &amp; Key Skills Practices</b>	
	<b>Act as a responsible and contributing community member and employee.</b> <b>Attend to financial well-being.</b> <b>Consider the environmental, social and economic impacts of decisions.</b> <b>Demonstrate creativity and innovation.</b> <b>Utilize critical thinking to make sense of problems and persevere in solving them.</b> <b>Model integrity, ethical leadership and effective management.</b> <b>Plan education and career paths aligned to personal goals.</b> <b>Use technology to enhance productivity, increase collaboration and communicate effectively.</b> <b>Work productively in teams while using cultural/global competence.</b>	

Content Area: Mathematics (NJSLS-M) Grades K - 12  
Grade:

Dev. Date:  
December 2021

New Jersey Legislative Statutes and Administrative Code  
(place an "X" before each law/statute if/when present within the curriculum map)

	Amistad Law: <i>N.J.S.A. 18A 52:16A-88</i>		Holocaust Law: <i>N.J.S.A. 18A:35-28</i>		LGBT and Disabilities Law: <i>N.J.S.A. 18A:35-4.35</i>	X	Diversity & Inclusion: <i>N.J.S.A. 18A:35-4.36a</i>		Standards in Action: <i>Climate Change</i>
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