

## Core Content

<b>Cluster Title: Create equations that describe numbers or relationships.</b>
<b>Standard A.CED.1:</b> Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>• Create simple rational, square root, cube root, polynomial, trigonometric, and logarithmic equations in one variable, and use them to solve problems.</li> <li>• Create simple rational, square root, cube root, polynomial, trigonometric, and logarithmic inequalities in one variable, and use them to solve problems.</li> <li>• Understand the meaning of solutions, including extraneous, in reference to context.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>• Creating and solving linear, exponential, and quadratic equations in one variable (I:A.REI.3, II:A.CED.1)</li> <li>• Creating and solving linear, exponential, and quadratic inequalities in one variable (I:A.REI.4, II:A.CED.1)</li> </ul>	
<b>Academic Vocabulary</b>	
rational equation, square root, cube root, logarithmic, extraneous solutions	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>• Focus on rational functions.</li> </ul>	NCTM Illuminations – Light It Up
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> Thomas Young devised a rule used by the medical community to determine medication dosages for children. His rule states that a child’s dose of a medication can be found by multiplying the child’s age by the amount of an adult dose and dividing the product by the child’s age plus 12. Given that the adult dose is 325 mg and the child’s dose is 65 mg, set up an equation and find the child’s age.</p>	<p><b>Problem Task:</b> A man is blowing up a balloon. His lung capacity is 6 liters of air. If he blows 5 times into the balloon, assuming the balloon is perfectly spherical, what would be your predication for the radius of the balloon? Justify your answer mathematically.</p>

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<b>Cluster Title: Create equations that describe numbers or relationships.</b>
<b>Standard A.CED.2:</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Write and graph equations to represent a rational, square root, cube root, polynomial, trigonometric and logarithmic relationships.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Write and graph equations representing linear, exponential, and quadratic relationships between two quantities (I: A.CED.2, II: A.CED.2).</li> <li>Understanding rates of change.</li> <li>Identifying independent and dependent variable relationships.</li> </ul>	
<b>Academic Vocabulary</b>	
asymptote, independent and dependent variables, extraneous solution, rational, square root, cube root, polynomial, logarithmic	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>This standard could be used to introduce the existence of asymptotes.</li> </ul>	<ul style="list-style-type: none"> <li>NCTM Illuminations: Light It Up</li> <li>NCSSM: Applications of Rational Functions</li> </ul>
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> Given the following sequence: <math>\frac{3}{5}, \frac{4}{6}, \frac{5}{7}, \dots</math> write and graph the rational equation that models the relationship between the term in the sequence and its value.</p>	<p><b>Problem Task:</b> (Based on NCSSM <i>Algebra 2 – Applications of Rational Functions</i>) You are buying a refrigerator. Refrigerator 1 costs \$550, the average cost per year in electricity is \$92, and is expected to last 10 years. Refrigerator 2 costs \$1200, electricity costs \$50 per year, and it is expected to last 20 years.</p> <ol style="list-style-type: none"> <li>Write and graph rational equations representing the average cost of each refrigerator per year.</li> <li>After how many years will the average cost per year be the same?</li> <li>Which refrigerator would you buy and why?</li> </ol>

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<b>Cluster Title: Create equations that describe numbers or relationships.</b>
<b>Standard A.CED.3:</b> Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i>
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Identify constraints such as domain, range, asymptotes, and points of discontinuity when given a context involving equations, inequalities, and systems.</li> <li>Interpret solutions as viable or non-viable based on the constraints.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Finding domain and range of equations and inequalities.</li> <li>Representing solution sets of inequalities and systems of inequalities, both discrete and continuous.</li> <li>Identifying extraneous solutions.</li> </ul>	
<b>Academic Vocabulary</b>	
constraint, viable, non-viable, domain, range, asymptotes, points of discontinuity, intersection, solution set, set notation, interval notation	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>Combine different types of functions within a system.</li> </ul>	<ul style="list-style-type: none"> <li>Illuminations: Whelk-Come to Mathematics</li> </ul>
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> (Adapted from <i>Precalculus</i> by Cynthia Young)</p> <p>The number of individuals infected by a virus can be determined by <math>n(t) = \frac{2000t-500}{3+t}</math>.</p> <ol style="list-style-type: none"> <li>Identify the domain, range, and any constraints.</li> <li>What happens to the number of infected people as time continues?</li> </ol>	<p><b>Problem Task</b></p> <p>You are going on a river rafting trip. The trip will cost at least \$1,000 and you can take up to 10 people. You want to keep the average cost under \$200 per person. Write a system of inequalities and graph the solution set representing the average cost per person based on the number of people you invite.</p> <ol style="list-style-type: none"> <li>Give the domain and range of the solution set.</li> <li>What are the constraints on the domains of the data?</li> <li>How many people will you invite and why?</li> </ol>

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<b>Cluster Title: Create equations that describe numbers or relationships.</b>
<b>Standard A.CED.4:</b> Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i>
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Solve rational, square root, cube root, polynomial, and logarithmic formulas for a quantity of interest.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Solving linear, exponential, and quadratic formulas for a quantity of interest (Secondary I: A.CED.4, Secondary II: A.CED.4)</li> </ul>	
<b>Academic Vocabulary</b>	
quantity of interest, variable, literal equations, formula, rational, square root, cube root, polynomial, logarithmic	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>Discuss the advantages of solving for a particular quantity of interest.</li> <li>Relate the concept to a variety of disciplines (e.g., biology, physics, medicine).</li> </ul>	
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> The thin lens equation is used in photography to find the power of a lens. It is as follows: <math>\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_1}</math>. Using this formula, solve for <math>d_0</math>.</p>	<p><b>Problem Task:</b> The following equation represents a particle moving linearly, in three dimensions in a straight line, with constant acceleration: <math>r = \frac{at^2}{2} + v_0t + r_0</math>. Two scientists solve the equation for <math>v_0</math> (the initial velocity) and their equations are as follows: Scientist 1: <math>v_0 = \frac{2r - 2r_0 - at^2}{2t}</math> and Scientist 2: <math>v_0 = \frac{r}{t} - \frac{at}{2} - \frac{r_0}{t}</math>. How did each scientist come up with his/her equation? Show the steps.</p>