

## Core Content

<b>Cluster Title: Understand the relationship between zeros and factors of polynomials.</b>
<b>Standard A.APR.2:</b> Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Recognize that if <math>p(a) = 0</math> then <math>(x - a)</math> is a factor of <math>p(x)</math>.</li> <li>Recognize that if <math>(x - a)</math> is a factor of <math>p(x)</math> then <math>p(a) = 0</math></li> <li>Use the Remainder Theorem to determine factors of polynomials.</li> </ul>

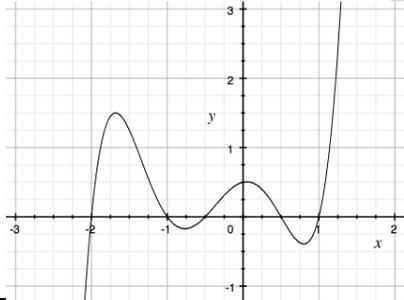
## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Factoring a quadratic expression to reveal the zeros of the function it defines (II.A.ASSE.3)</li> </ul>	
<b>Academic Vocabulary</b>	
Remainder Theorem, factor	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>Verify factors of polynomials using the Remainder Theorem</li> <li>Connect the factors of a polynomial to the roots of an equation.</li> </ul>	<ul style="list-style-type: none"> <li>Illustrativemathematics.org</li> </ul>
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> Using the Remainder Theorem, decide whether <math>(x - 5)</math> and <math>(x + 2)</math> are factors of the polynomial <math>f(x) = 2x^3 - 5x^2 - 28x + 15</math>.</p>	<p><b>Problem Task:</b> If 1 is a root of <math>p(x)</math>, explain why <math>p(x)</math> has a factor of <math>(x - 1)</math>.</p>

## Core Content

<b>Cluster Title: Understand the relationship between zeros and factors of polynomials.</b>
<b>Standard A.APR.3:</b> Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
<b>Concepts and Skills to Master</b>
<ul style="list-style-type: none"> <li>Use the Remainder Theorem to draw a rough graph of a polynomial.</li> <li>Recognize that repeated factors indicate multiplicity of roots and graph polynomials with repeated factors.</li> </ul>

## Supports for Teachers

<b>Critical Background Knowledge</b>	
<ul style="list-style-type: none"> <li>Graphing quadratic functions by hand, showing intercepts, and maxima or minima (II.2.F.IF.7)</li> </ul>	
<b>Academic Vocabulary</b>	
Remainder Theorem	
<b>Suggested Instructional Strategies</b>	<b>Resources</b>
<ul style="list-style-type: none"> <li>Using graphing calculator applications to explore expanded and factored forms of multiple polynomials.</li> <li>Use a number line model to show where the function is positive, negative, or equal to zero.</li> </ul>	
<b>Sample Formative Assessment Tasks</b>	
<p><b>Skill-Based Task:</b> Sketch a graph of <math>f(x) = (x-2)(x+3)(x+1)</math> and identify roots.</p> <p>Identify the factors of the polynomial graphed below.</p> 	<p><b>Problem Task:</b> Given a fourth degree polynomial, how could you have:</p> <ul style="list-style-type: none"> <li>Zero real roots?</li> <li>One real root?</li> <li>Two real roots?</li> <li>Three real roots?</li> <li>Four real roots?</li> </ul>