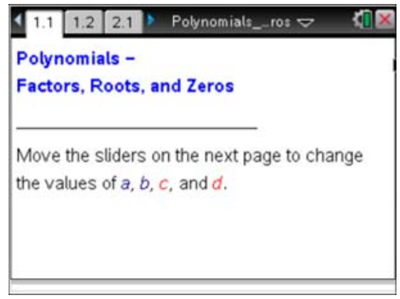
Polynomials—Factors, Roots, and Zeros
Student Activity

Name ______________

Class ______________

Open the TI-Nspire document ***Polynomials_Factors_Roots_and_Zeros.tns*.**

This activity examines the connections between the roots or zeros of a polynomial equation and the x-intercepts of the graph of the polynomial function. It also looks at how the graph of the function can help identify the factors of the equation.



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Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

1. Using the sliders, set $y_1 = 1x + 1$ and $y_2 = 1x – 2$. Observe that the graph of $y_1 = 1x + 1$ appears to cross the x-axis at $x = –1$. When $x = –1$, $y_1 = 0$ because $–1 + 1 = 0$.
   $x = –1$ is called a *zero* or *root* of the function $y_1 = 1x + 1$.
   a. Where does the graph of $y_2 = 1x – 2$ appear to cross the x-axis?

   b. Write a simple equation to verify that this value of x is a zero of y_2.

   c. When $y_1 = 1x + 1$ and $y_2 = 1x – 2$, what is the function y_3?

   d. The graph of y_3 is a parabola. How many times does the graph of y_3 cross the x-axis?

   e. What are the zeros of y_3?

   f. Factor y_3.

g. Given the information below, use the sliders to fill in the rest of the table:

y_1	y_2	Zeros of y_1	Zeros of y_2	y_3	Zeros of y_3	Factors of y_3
(x + 4)	(x + 3)					
				$2x^2 + 0x - 8$		
						(x – 5)(–1x – 2)
(3x + 3)			–4			
					–1 and 4	
						(2x + 4)(3x – 3)

h. Write a conjecture about the relationship between the zeros of the linear functions and the zeros of the quadratic function.

i. How do the factors of the quadratic equation relate to the zeros of the function?

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2. Use the sliders to make *f1* = 1x + 4, *f2* = 1x + 2, and *f3* = x – 1. Observe that the graphs of each appear to cross the x-axis at –4, –2, and 1, respectively.
   a. Verify algebraically that each is a zero of each linear function.

   b. When *f1* = 1x + 4, *f2* = 1x + 2, and *f3* = x – 1, what is *f4*?

   c. How many times does *f4* cross the x-axis and where?

d. Show that the multiplication of the factors of *f1*, *f2*, and *f3* equal *f4*.

e. Try other slider values and make a conjecture about the relationship between the zeros of the linear equations and the zeros of the cubic function.

3. Use the sliders to make *f1* = *x* + 4, *f2* = *x* + 2, and *f3* = *x* + 2.
   a. How has the graph changed? The value –2 is called a double root.

   b. Change *f1* = 1*x* + 2. How has the graph changed?

4. Use the sliders to make *f1* = 3*x* – 3, *f2* = *x* + 1, and *f3* = *x* – 2.
   a. Observe the graph and identify the zeros. What is *f4*?

   b. Now change the sliders to make *f1* = *x* – 1, *f2* = *x* + 1, and *f3* = *x* – 2. Observe the graph. What are the zeros? What is *f4*?

   c. Identify similarities and differences between the sets of equations in 4a and 4b.