



# Exploring Polynomials—Factors, Roots, and Zeros

Name \_\_\_\_\_

Student Activity

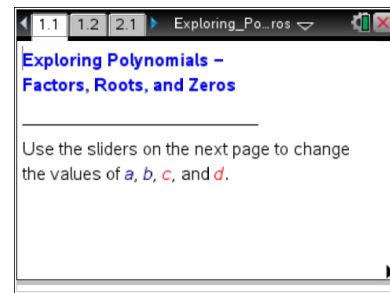


Class \_\_\_\_\_

Open the TI-Nspire document

*Exploring\_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.



Move to page 1.2.

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

**Move to page 2.2.**

2. Use the sliders to make  $f_1 = 1x + 4$ ,  $f_2 = 1x + 2$ , and  $f_3 = x - 1$ . 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  $f_1 = 1x + 4$ ,  $f_2 = 1x + 2$ , and  $f_3 = x - 1$ , what is  $f_4$ ?

c. How many times does  $f_4$  cross the  $x$ -axis and where?



- d. Show that the multiplication of the factors of  $f_1$ ,  $f_2$ , and  $f_3$  equal  $f_4$ .
- 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  $f_1 = x + 4$ ,  $f_2 = x + 2$ , and  $f_3 = x + 2$ .
- a. How has the graph changed? The value  $-2$  is called a double root.
- b. Change  $f_1 = 1x + 2$ . How has the graph changed?
4. Use the sliders to make  $f_1 = 3x - 3$ ,  $f_2 = x + 1$ , and  $f_3 = x - 2$ .
- a. Observe the graph and identify the zeros. What is  $f_4$ ?
- b. Now change the sliders to make  $f_1 = x - 1$ ,  $f_2 = x + 1$ , and  $f_3 = x - 2$ . Observe the graph. What are the zeros? What is  $f_4$ ?
- c. Identify similarities and differences between the sets of equations in 4a and 4b.