Factoring for Zeros

Reporting Category	Equations and Inequalities	
Topic	Relating the roots (zeros) of a quadratic equation and the graph of the equation	
Primary SOL	A.4c	The student will solve multistep linear and quadratic equations in two variables, including solving quadratic equations algebraically and graphically.
	A.7c	The student will investigate and analyze function (linear and quadratic) families and their characteristics both algebraically and graphically, including zeros of a function.
Related SOL	A.7d	

Materials

- Graphing calculators
- Factoring for Zeros activity sheet (attached)

Vocabulary

zeros of a function, root of a function, factor, x-*intercept, quadratic equation* (A.4)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Distribute copies of the Factoring for Zeros activity sheet. Have students adjust the windows in their calculators as suggested for the beginning setup.
2. Direct students to work in pairs to investigate the graphs and the tables of the functions in Part I.
3. When students have finished Part I, hold a class discussion of the first five problems and the associated questions.
4. Have pairs of students continue with Part II. Discuss their results.
5. Repeat the process for Parts III and IV. Point out that for Part IV, students will need to factor first in order to have the second part to graph.

Assessment

- **Questions**
  - If you know the *x*-intercepts of a quadratic graph, how do you use that information to write the factors of the equation?
  - How do you use the factors to write the equation of the quadratic?
- **Journal/Writing Prompts**
  - Factor the quadratic equations in Part IV completely. Compare the factors to the *x*-intercepts of the graph of the equation, and explain the connection you see.

- **Other**
    - Give each pair of students a quadratic equation. Have each pair demonstrate on the overhead calculator the steps and procedures for graphing the quadratic and making connections to the *x*-intercepts, zeros, roots, and factors.

Extensions and Connections (for all students)

- Give students the zeros (roots), and have them find the quadratic equation for the given zeros.

Strategies for Differentiation

- Encourage use of graph paper or individual white boards with grids for students to make connections between the graphing technology and the content.

Factoring for Zeros

Name _____ **Date**_____

Set your viewing window on the calculator and table function as follows:

Window: [-8, 8] by [-8, 8] **Table: TblStart = −8 ΔTbl = 1**

Note: You *may* have to ADJUST your window in order to see the complete graph.

Part I

1. GRAPH
   Enter: $y_1 = x^2 + 4x + 3$ $y_2 = (x + 1)(x + 3)$
   Enter: $y_1 = x^2 + 7x + 10$ $y_2 = (x + 2)(x + 5)$
   Enter: $y_1 = x^2 + 7x + 6$ $y_2 = (x + 6)(x + 1)$
   Enter: $y_1 = x^2 + 8x + 7$ $y_2 = (x + 7)(x + 1)$
   Enter: $y_1 = x^2 + 10x + 9$ $y_2 = (x + 9)(x + 1)$
2. In how many "places" did these graphs cross (intersect) the *x*-axis
3. What is the *y*-coordinate of a point on the *x*-axis?
4. When the function crosses the *x*-axis, what is the value of *y*?
5. What is the significance of the *x*-intercepts of the graphs?

Part II

1. GRAPH
   Enter: $y_1 = x^2 - 5x + 4$ $y_2 = (x - 4)(x - 1)$
   Enter: $y_1 = x^2 - 8x + 15$ $y_2 = (x - 5)(x - 3)$
   Enter: $y_1 = x^2 - 8x + 12$ $y_2 = (x - 6)(x - 2)$
   Enter: $y_1 = x^2 - 9x + 14$ $y_2 = (x - 7)(x - 2)$
   Enter: $y_1 = x^2 - 13x + 30$ $y_2 = (x - 10)(x - 3)$
2. In how many "places" did these graphs cross (intersect) the *x*-axis?
3. What is the *y*-coordinate of a point on the *x*-axis?
4. When the function crosses the *x*-axis, what is the value of *y*?
5. What is the significance of the *x*-intercepts of the graphs?

Part III

1. GRAPH
   Enter: $y_1 = x^2 - 1$ $y_2 = (x + 1)(x - 1)$
   Enter: $y_1 = x^2 - 4$ $y_2 = (x + 2)(x - 2)$
   Enter: $y_1 = x^2 - 9$ $y_2 = (x + 3)(x - 3)$
   Enter: $y_1 = x^2 - 25$ $y_2 = (x + 5)(x - 5)$
   Enter: $y_1 = x^2 - 100$ $y_2 = (x + 10)(x - 10)$
2. In how many "places" did these graphs cross (intersect) the *x*-axis?
3. What is the *y*-coordinate of a point on the *x*-axis?
4. When the function crosses the *x*-axis, what is the value of *y*?
5. What is the significance of the *x*-intercepts of the graphs?

Part IV

1. GRAPH
   Enter: $y_1 = x^2 - x - 2$ $y_2 =$
   Enter: $y_1 = x^2 + x - 2$ $y_2 =$
   Enter: $y_1 = x^2 - x - 6$ $y_2 =$
   Enter: $y_1 = x^2 + x - 6$ $y_2 =$
   Enter: $y_1 = x^2 - 3x - 10$ $y_2 =$
2. In how many "places" did these graphs cross (intersect) the *x*-axis?
3. What is the *y*-coordinate of a point on the *x*-axis?
4. When the function crosses the *x*-axis, what is the value of *y*?
5. What is the significance of the *x*-intercepts of the graph?