

**Investigation**

Class \_\_\_\_\_ Name \_\_\_\_\_

1. Find the zero of  $y = (x + 3)$  \_\_\_\_\_
2. Find the zeros of  $y = (x + 3)(x + 2)$  \_\_\_\_\_
3. Find the zeros of  $y = (x + 3)(x + 2)(x + 1)$  \_\_\_\_\_
4. Find the zeros of  $y = (x + 3)(x + 2)(x + 1)(x - 1)$  \_\_\_\_\_
5. Find the zeros of  $y = (x + 3)(x + 2)(x + 1)(x - 1)(x - 2)$  \_\_\_\_\_
6. Solve the equation  $(x + 3) = 0$  \_\_\_\_\_
7. Solve the equation  $(x + 3)(x + 2) = 0$  \_\_\_\_\_
8. Solve the equation  $(x + 3)(x + 2)(x + 1) = 0$  \_\_\_\_\_
9. Solve the equation  $(x + 3)(x + 2)(x + 1)(x - 1) = 0$  \_\_\_\_\_
- 10. Solve the equation  $(x - a)(x + b) = 0$  for  $x$ .** \_\_\_\_\_
11. Find the zero of  $y = (2x - 1)$  \_\_\_\_\_
12. Solve the equation  $(2x - 1) = 0$  \_\_\_\_\_
13. Find the zeros of  $y = (2x - 1)(3x - 1)$  \_\_\_\_\_
14. Solve the equation  $(2x - 1)(3x - 1) = 0$  \_\_\_\_\_
15. Find the zeros of  $y = (2x - 1)(3x - 1)(4x + 3)$  \_\_\_\_\_

16. Solve the equation  $(2x - 1)(3x - 1)(4x + 3) = 0$  \_\_\_\_\_

17. Find the zeros of  $y = (2x - 1)(3x - 1)(4x + 3)(5x + 7)$  \_\_\_\_\_

18. Solve the equation  $(2x - 1)(3x - 1)(4x + 3)(5x + 7) = 0$  \_\_\_\_\_

**19. Solve the equation  $(ax - b)(cx + d) = 0$  for  $x$ .** \_\_\_\_\_

20. If  $a \times b = 0$ , describe what you know about  $a$  and  $b$ . \_\_\_\_\_  
\_\_\_\_\_

21. If  $a \times b = -4$ , describe what you know about  $a$  and  $b$ . \_\_\_\_\_  
\_\_\_\_\_

22. Explain why the solutions to the equation  $(x - 1)(x + 2) = 10$ , are not 1 and  $-2$ ? \_\_\_\_\_  
\_\_\_\_\_

23. Can you tell from studying the parameters in the equation  $(x - 1)(x + 2) = 10$  what the solutions are? (Without pencil and paper or a calculator) \_\_\_\_\_

24. Can you tell from studying the parameters in the equation  $x^2 + x - 2 = 10$  what the solutions are? (Without pencil and paper or a calculator) \_\_\_\_\_

25. Can you tell from studying the parameters in the equation  $x^2 + x - 12 = 0$  what the solutions are? (Without pencil and paper or a calculator) \_\_\_\_\_

26. Can you tell from studying the parameters in the equation  $(x + 4)(x - 3) = 0$  what the solutions are? (Without pencil and paper or a calculator) \_\_\_\_\_

27. How are the zeros of  $y = 2x - 3$  and the solution to the equation  $2x - 3 = 0$  related? \_\_\_\_\_

## Teacher Notes:

Since this investigation is in Chapter Ten (quadratic function), we build on the zero product theorem. We address the common misconception that if  $a \times b = c$ , ( $c \neq 0$ ), then  $a = c$  or  $b = c$ . This activity is not the first one to make the connection between zeros of functions and solutions to equations. But the idea is simply revisited here, yet extended. Revisiting and extending concepts adds to long-term memory, and increases the likelihood of recall.

Like all activities and the overall text, functions or function behaviors are used first to connect to all other concepts and procedures in *Foundations 3e*. Students have worked with functions from the fourth or fifth day of the course. They have analyzed behaviors of the quadratic function in Chapters Two & Three. They have solved equations before, but they have not seen higher order equations or functions before this activity.

The investigations usually take a situation or single idea and ask a multitude of questions about the situation or idea. They are assigned after a topic has been developed in class. They usually require a graphing calculator. The intent of the investigations is to promote a thorough analysis of a topic or idea. For example, Section 2.2's investigation asks 14 questions about the electricity charge data from the North Carolina Public Utilities Commission. Or the Section 4.4 investigation has 26 questions about gasoline usage.

The investigations are an integral part of the overall assessment tools used with *Foundations for College Mathematics 3e*. Tools like the investigations measure a very different kind of learning than do skill-based midterms and the explorations that require "exploration" and a little tenacity, or the concept quizzes that ask students to be creative. Investigations require students anywhere from 10 minutes to an hour to finish – depending on the student and on the investigation.