LESSON 2.12

Exercise Set A

MM1A1d Investigate and explain the characteristics of a function: domain, range, zeros, intercepts, intervals of increase and decrease, maximum and minimum values, and end behavior.

MM1A3c Use a variety of techniques, including technology, tables, and graphs to solve equations resulting from the investigation of $x^2 + bx + c = 0$.

Determine whether the given value is a solution of the equation.

1. $x^2 - 2x + 15 = 0; 3$

2. $x^2 - 4x - 12 = 0; 2$

3. $-x^2 - 5x - 6 = 0; 3$

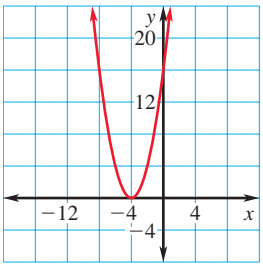
4. $x^2 + 3x - 4 = 0; 1$

5. $2x^2 + 9x - 5 = 0; -2$

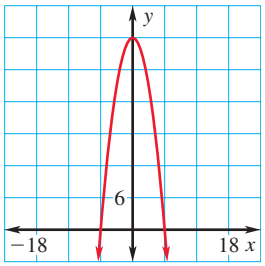
6. $3x^2 - 5x - 2 = 0; 2$

Use the graph to find the solutions of the given equation.

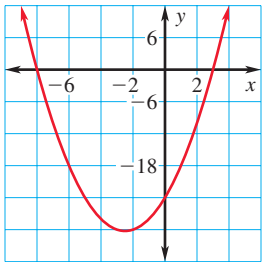
7. $x^2 + 8x + 16 = 0$



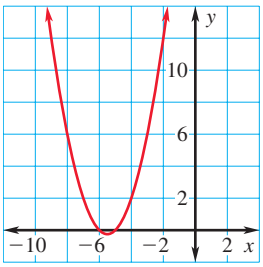
8. $-x^2 + 36 = 0$



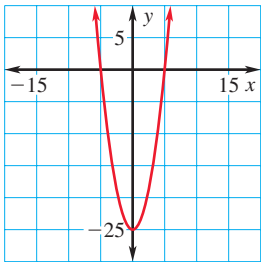
9. $x^2 + 5x - 24 = 0$



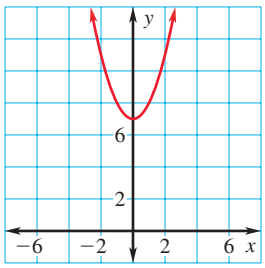
10. $x^2 + 11x + 30 = 0$



11. $x^2 - 25 = 0$



12. $x^2 + 7 = 0$



Solve the equation by graphing.

13. $-x^2 - 6x = 0$

14. $2x^2 = 2$

15. $x^2 - 7x + 10 = 0$

16. $x^2 = 10x$

17. $x^2 - 6x + 9 = 0$

18. $-x^2 + 9x = 18$

19. $x^2 - 6x + 8 = 0$

20. $2x^2 - x = -3$

21. $4x^2 - 5 = -8x$

Find the zeros of the function by graphing.

22. $f(x) = -x^2 - 5x - 10$

23. $f(x) = x^2 + 12x + 36$

24. $f(x) = 2x^2 + 24x$

25. $f(x) = x^2 - 49$

26. $f(x) = -x^2 + 1$

27. $f(x) = 3x^2 + 12x$

Exercise Set A *(continued)*

In Exercises 28–33, (a) graph the function, then (b) use the graph to approximate the zeros of the function to the nearest integer.

28. $f(x) = x^2 + 2x - 1$

29. $f(x) = -x^2 - 4x + 2$

30. $f(x) = x^2 - 6x + 3$

31. $f(x) = x^2 - 2x - 9$

32. $f(x) = -x^2 + 5x + 5$

33. $f(x) = -x^2 + 9x - 3$

34. Kickball The height y (in feet) of a soccer ball after it is kicked can be modeled by the graph of the equation

$$y = -0.03x^2 + 1.5x$$

where x is the horizontal distance (in feet) that the ball travels. the ball is not touched, and it lands on the ground. Find the distance that the ball was kicked.

35. Aircraft An aircraft hanger is a large building where planes are stored. The opening of one airport hanger is a parabolic arch that can be modeled by the graph of the equation

$$y = -0.009x^2 + 1.9x$$

where x and y are measured in feet. Graph the function. Use the graph to determine how wide, to the nearest tenth of a foot, the hanger is at its base.

36. Stunt Double A movie stunt double jumps from the top of a building 50 feet above the ground onto a pad on the ground below. The stunt double jumps with an initial vertical velocity of 10 feet per second.

a. Write and graph a function that models the height h (in feet) of the stunt double t seconds after she jumps.

b. How long does it take the stunt double to reach the ground?

37. Multiple Representations You throw a wad of used paper towards a wastebasket from a height of about 1.3 feet above the floor with an initial vertical velocity of 3 feet per second.

a. Writing a Function Write a function that models the height h (in feet) of the paper t seconds after it is thrown.

b. Drawing a Graph Graph the function from part (a).

c. Interpreting a Graph If you miss the wastebasket and the paper hits the floor, how long does it take for the ball of paper to reach the floor?

d. Interpreting a Graph If the ball of paper hits the rim of the wastebasket one-half foot above the ground, how long was the ball in the air?

LESSON 2.12

Exercise Set B

MM1A1d Investigate and explain the characteristics of a function: domain, range, zeros, intercepts, intervals of increase and decrease, maximum and minimum values, and end behavior.

MM1A3c Use a variety of techniques, including technology, tables, and graphs to solve equations resulting from the investigation of $x^2 + bx + c = 0$.

Solve the equation by graphing.

1. $x^2 = 4$

2. $x^2 + 3x = 4$

3. $-x^2 - 14x - 49 = 0$

4. $-x^2 + 6x + 16 = 0$

5. $x^2 + 10x + 25 = 0$

6. $x^2 + 8x + 15 = 0$

7. $x^2 + 2 = 0$

8. $x^2 = 4x + 12$

9. $-x^2 + 25 = 0$

10. $x^2 + 81 = -18x$

11. $-x^2 + 12x = 36$

12. $x^2 = 2x - 3$

13. $\frac{1}{4}x^2 - 16 = 0$

14. $-\frac{1}{2}x^2 + 2x = 6$

15. $-\frac{1}{4}x^2 + 6 = -\frac{1}{2}x$

Find the zeros of the function by graphing.

16. $f(x) = x^2 + 3x - 18$

17. $f(x) = -x^2 - 9x + 10$

18. $f(x) = x^2 - 9x - 36$

19. $f(x) = 2x^2 - 8x - 10$

20. $f(x) = -3x^2 - 6x + 24$

21. $f(x) = 4x^2 - 4x - 8$

In Exercises 22–27, (a) graph the function, then (b) use the graph to approximate the zeros of the function to the nearest integer.

22. $f(x) = -2x^2 + 5x + 1$

23. $f(x) = 3x^2 - 5$

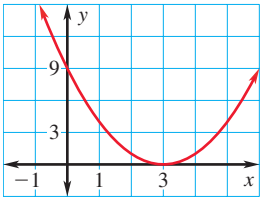
24. $f(x) = 4x^2 - 3x - 4$

25. $f(x) = 2x^2 + x - 4$

26. $f(x) = -3x^2 + 5x - 3$

27. $f(x) = 6x^2 + 48x + 30$

28. **Error Analysis** The graph of the function related to the equation $0 = x^2 - 6x + 9$ is shown. *Describe* and correct the error in solving the equation.

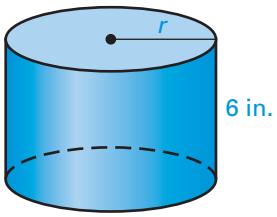


The only solution of the equation $0 = x^2 - 6x + 9$ is 9. ✗

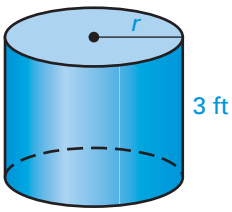
Exercise Set B *(continued)*

Use the given surface area *S* of the cylinder to find the radius *r* to the nearest tenth. (Use 3.14 for π.)

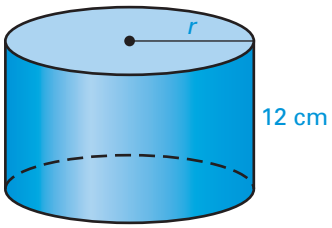
29. $S = 301$ in.^{2}



30. $S = 58$ ft^2



31. $S = 1356$ cm^2



32. **Multiple Representations** A cat jumps down to the floor from a countertop 30 inches above the floor. It jumps with an initial vertical velocity of 5 feet per second.

- **a. Writing a Function** Write a function that models the height h (in feet) of the cat t seconds after it jumps. *Explain* how you got your model.
- **b. Drawing a Graph** Graph the function from part (a).
- **c. Interpreting a Graph** How far above the ground is the cat after one half of a second?
- **d. Interpreting a Graph** How long does it take the cat to reach the ground?

33. **Basketball** A basketball player throws a ball towards a hoop at a height of 6 feet with an initial vertical velocity of 50 feet per second.

- **a.** Write and graph a function that models the height h (in feet) of the ball t seconds after it is thrown.
- **b.** If the player misses the hoop completely and the ball lands on the ground, how long was the ball in the air?
- **c.** If an opposing player catches the ball at a height of 5 feet, how long was the ball in the air? *Explain* your reasoning.

34. **Fountain** An arc of water sprayed from the nozzle of a fountain can be modeled by the graph of $y = -0.64x^2 + 8x$ where x is the horizontal distance (in feet) and y is the vertical distance (in feet) from the nozzle. The diameter of the circle formed by the arcs on the surface of the water is called the display diameter. Find the display diameter of the fountain. *Explain* your reasoning.

35. **Fire Hose** A stream of water from a fire hose can be modeled by the graph of $y = -0.002x^2 + 0.45x + 3$ where x and y are measured in feet. A firefighter is holding the hose 3 feet above the ground, 130 feet from a building. Will the stream of water pass through a window that is 4 feet tall if the top of the window is 27 feet above the ground? *Explain.*