8.5 Start Thinking

Solve the equation $f(x) = 2x^2 - x - 1$ by following these steps.

Step 1: Replace $f(x)$ with 0.

Step 2: Factor $2x^2 - x - 1$.

Step 3: Set up two equations such that each factor is equal to zero.

Step 4: Solve each equation separately.

8.5 Warm Up

Factor the expression.

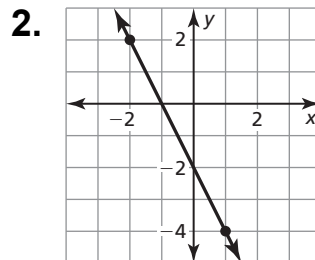**1.** $4x^2 - 49$

2. $x^2 + 6x + 8$
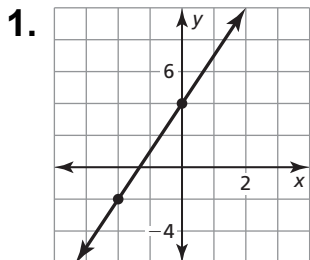
3. $2a^2 - 9a - 5$

4. $x^2 - 3x$

5. $a^2 + 5a + 4$

6. $2t^2 + 7t - 4$

8.5 Cumulative Review Warm Up

Write an equation in slope-intercept form of the line shown.

1.

2.

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In Exercises 1 and 2, find the *x*-intercepts and axis of symmetry of the graph of the function.

1.

$$y = (x + 2)(x - 2)$$

2. $y = -2(x + 1)(x + 4)$
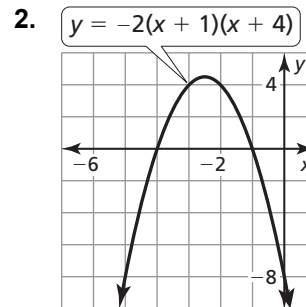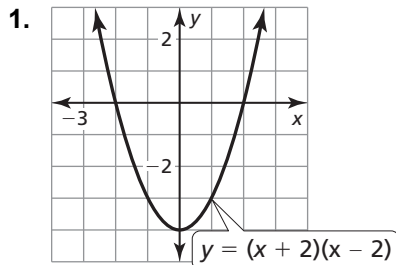
In Exercises 3–6, graph the quadratic function. Label the vertex, axis of symmetry, and *x*-intercepts. Describe the domain and range of the function.

3. $f(x) = (x + 3)(x - 1)$

4. $y = -(x - 5)(x + 1)$

5. $f(x) = 2x^2 - 16x$

6. $y = x^2 + 8x + 7$

In Exercises 7–10, find the zero(s) of the function.

7. $y = -4(x - 5)(x - 9)$

8. $f(x) = \frac{1}{4}(x + 3)(x - 2)$

9. $g(x) = x^2 - 7x - 30$

10. $y = 2x^2 - x - 10$

In Exercises 11–14, use zeros to graph the function.

11. $y = (x + 1)(x - 3)$

12. $f(x) = -2(x + 2)(x + 6)$

13. $g(x) = x^2 - 10x + 21$

14. $y = x^2 - x - 6$

In Exercises 15–19, write a quadratic function in standard form whose graph satisfies the given conditions.

15. vertex: $(-5, 4)$

16. *x*-intercepts: 2 and 7

17. passes through $(-3, 0)$, $(1, 0)$, and $(-1, 8)$

18. axis of symmetry: $x = -3$

19. passes through: $(-4, 0)$ and $(4, 0)$

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8.5 Practice B

In Exercises 1 and 2, find the *x*-intercepts and axis of symmetry of the graph of the function.

1. $f(x) = -\frac{1}{3}x(x + 5)$

2. $g(x) = 9(x + 6)(x - 4)$

In Exercises 3–6, graph the quadratic function. Label the vertex, axis of symmetry, and *x*-intercepts. Describe the domain and range of the function.

3. $f(x) = 4(x + 3)(x + 2)$

4. $y = -3(x - 4)(x + 2)$

5. $p(x) = x^2 - 7x + 12$

6. $y = 2x^2 + 20x + 42$

In Exercises 7–10, find the zero(s) of the function.

7. $f(x) = \frac{2}{3}(x + 8)(x - 5)$

8. $g(x) = 3x^2 + 13x + 4$

9. $y = (x^2 - 25)(x + 7)$

10. $y = x^3 - 81x$

In Exercises 11–14, use zeros to graph the function.

11. $f(x) = -2(x - 5)(x - 3)$

12. $g(x) = x^2 + 2x - 24$

13. $y = -4x^2 - 16x + 20$

14. $f(x) = 3x^2 - 12$

In Exercises 15–19, write a quadratic function in standard form whose graph satisfies the given conditions.

15. vertex: $(6, -2)$

16. *x*-intercepts: 5 and -8

17. passes through $(-4, 0)$, $(2, 0)$, and $(0, -4)$

18. *y* decreases as *x* increases when $x < 1$; *y* increases as *x* increases when $x > 1$

19. range: $y \le 6$

20. The cross section of a satellite dish can be modeled by the function $y = \frac{1}{6}(x^2 - 9)$, where *x* and *y* are measured in feet. The *x*-axis represents the top of the opening of the dish.

    a. How wide is the satellite dish?

    b. How deep is the satellite dish?

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8.5 Enrichment and Extension

Explore Higher Degree Polynomial Functions

1. Explain the word *simplify* in your own words.

2. Simplify the following and name the polynomial by degree and number of terms.

   a. $-x(x^2 - 7)(x - 5)$

   b. $\dfrac{1}{2}x^2(x + 1) - \dfrac{3}{4}x - 5$

   c. $-3 - 4(x - 2) + 2x$

3. Explain the word *factor* in your own words.

4. Factor the following after you name the polynomial by degree and number of terms.

   a. $x^9 + x^6 - x^3 - 1$

   b. $x^4 - 81$

   c. $-3x^2 - 20x - 12$

5. What are the roots of an equation? What are the zeros of a function?

6. Solve the equations by factoring if $f(x) = 0$. State how many zeros each function has.

   a. $f(x) = 4x^2 + 36x + 80$

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

   c. $f(x) = -x^2 + 10x - 25$

7. What do you notice about the degree of each polynomial function and the number of zeros?

8. What does it mean when a function has one zero? two zeros? no zeros ? You may use a drawing to explain.

8.5 Puzzle Time

What Did One Wall Say To The Other Wall?

Write the letter of each answer in the box containing the exercise number.

Find the vertex and the axis of symmetry of the graph of the function.

1. $y = x^2 - 16$

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

3. $r(x) = x^2 + 7x + 12$

4. $y = 3x^2 - 18x + 24$

Find the zeros of the function.

5. $s(x) = -3(x - 3)(x - 9)$

6. $h(x) = \frac{1}{6}(x + 4)(x - 12)$

7. $y = x^2 - 17x + 30$

8. $g(x) = -4x^2 + 12x + 72$

9. $y = x^3 - 144x$

10. $c(x) = (x + 14)(x^2 - 49)$

11. $v(x) = x^3 - x^2 - 16x + 16$

12. $k(x) = x^3 + 5x^2 - 4x - 20$

Write a quadratic function in standard form whose graph satisfies the given condition(s).

13. vertex: $(-9, -4)$

14. x-intercepts: -8 and 5

15. passes through $(-3, 0), (4, 0), (2, 20)$

16. passes through $(-3, 0), (7, 0), (6, -36)$

17. Write a cubic function in standard form whose graph has x-intercepts of $-4, -2,$ and 6.

18. Write a cubic function in standard form whose graph has x-intercepts of $-8, 1,$ and 5.

Answers

T. $(5, -25); x = 5$

O. $\left(-\frac{7}{2}, -\frac{1}{4}\right); x = -\frac{7}{2}$

M. $(3, -3); x = 3$

E. $(0, -16); x = 0$

R. $(-4, 0), (12, 0)$

Y. $(2, 0), (15, 0)$

O. $(-3, 0), (6, 0)$

H. $(3, 0), (9, 0)$

U. $(-4, 0), (1, 0), (4, 0)$

E. $(-12, 0), (0, 0), (12, 0)$

C. $(-5, 0), (-2, 0), (2, 0)$

T. $(-14, 0), (-7, 0), (7, 0)$

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

N. $f(x) = x^3 + 2x^2 - 43x + 40$

E. $f(x) = x^2 + 3x - 40$

R. $f(x) = x^3 - 28x - 48$

E. $f(x) = x^2 + 18x + 77$

T. $f(x) = 4x^2 - 16x - 84$

4	13	9	16		7	3	11		15	2		10	5	14		12	8	6	18	1	17