

Evaluate each expression if $r = -1$, $n = 3$, $t = 12$, $v = 0$, and $w = -\frac{1}{2}$.

- 9. $6r + 2n = 0$
- 10. $2nt - 4rn = 84$
- 11. $w(n - r) = -2$
- 12. $n + 2r - 16v = 1$
- 13. $(4n)^2 = 144$
- 14. $n^2r - wt = -3$
- 15. $2(3r + w) = -7$
- 16. $\frac{3v + t}{5n - t} = 4$
- 17. $-w[t + (t - r)] = 25/2$
- 18. $\frac{rv^3}{n^2} = 0$
- 19. $9r^2 + (n^2 - 1)t = 105$
- 20. $7n - 2v + \frac{2w}{r} = 22$

Evaluate each expression.

- 1. $3(4 - 7) - 11 = -20$
- 2. $4(12 - 4^2) = -16$
- 3. $1 + 2 - 3(4) \div 2 = -3$
- 4. $12 - [20 - 2(6^2 \div 3 \times 2^2)] = 88$
- 5. $20 \div (5 - 3) + 5^2(3) = 85$
- 6. $(-2)^3 - (3)(8) + (5)(10) = 18$
- 7. $18 - [5 - [34 - (17 - 11)]] = 41$
- 8. $[4(5 - 3) - 2(4 - 8)] \div 16 = 1$
- 9. $\frac{1}{2}[6 - 4^2] = -5$
- 10. $\frac{1}{4}[-5 + 5(-3)] = -5$
- 11. $\frac{-8(13 - 37)}{6} = 32$
- 12. $\frac{(-8)^2}{5 - 9} - (-1)^2 + 4(-9) = -53$

Name the sets of numbers to which each number belongs.

- 1. $34 \rightarrow$ real, rational, integer
- 2. -525 real, rational, integer
- 3. 0.875 real, rational
- 4. $\frac{12}{3}$ real, rational, integer
- 5. $-\sqrt{9}$ real, irrational
- 6. $\sqrt{30}$ real, irrational

Simplify each expression.

- 19. $3x + 5y + 2x - 3y = 5x + 2y$
- 20. $x - y - z + y - x + z = 0$
- 21. $-(3g + 3h) + 5g - 10h = 2g - 13h$
- 22. $a^2 - a + 4a - 3a^2 + 1 = -2a^2 + 3a + 1$
- 23. $3(m - z) + 5(2m - z) = 13m - 8z$
- 24. $2x - 3y - (5x - 3y - 2z) = -3x + 2z$
- 25. $6(2w + v) - 4(2v + 1w) = 10w - 2v$
- 26. $\frac{1}{3}(15d + 3c) - \frac{1}{2}(8c - 10d) = 10d - 3c$

Solve each equation. Check your solution.

15. $4m + 2 = 18$ $m = 4$

16. $x + 4 = 5x + 2$ $x = 1/2$

17. $3t = 2t + 5$ $t = 5$

18. $-3b + 7 = -15 + 2b$ $b = 22/5$

19. $-5x = 3x - 24$ $x = 3$

20. $4v + 20 - 6 = 34$ $v = 5$

21. $a - \frac{2a}{5} = 3$ $a = 5$

22. $2.2n + 0.8n + 5 = 4n$ $n = 5$

Solve each equation or formula for the specified variable.

23. $I = prt$, for p $p = \frac{I}{rt}$

24. $y = \frac{1}{4}x - 12$, for x $x = 4(y + 12)$

25. $A = \frac{x+y}{2}$, for y $y = 2A - x$

26. $A = 2\pi r^2 + 2\pi rh$, for h $h = \frac{A - 2\pi r^2}{2\pi r}$

Evaluate each expression if $a = -1$, $b = -8$, $c = 5$, and $d = -1.4$.

1. $|6a| = 6$

2. $|2b + 4| = 12$

3. $-|10d + a| = -15$

4. $|17c| + |3b - 5| = 114$

5. $-6|10a - 12| = -132$

6. $|2b - 1| - |-8b + 5| = -52$

7. $|5a - 7| + |3c - 4| = 23$

8. $|1 - 7c| - |a| = 33$

9. $-3|0.5c + 2| - |-0.5b| = -17.5$

10. $|4d| + |5 - 2a| = 12.6$

11. $|a - b| + |b - a| = 14$

12. $|2 - 2d| - 3|b| = -19.2$

Solve each equation. Check your solutions.

13. $|n - 4| = 13$ $n = -9, 17$

14. $|x - 13| = 2$ $x = 15, 11$

15. $|2y - 3| = 29$ $y = -13, 16$

16. $7|x + 3| = 42$ $x = -9, 3$

17. $|3u - 6| = 42$ $u = -12, 16$

18. $|5x - 4| = -6$ no solutions

19. $-3|4x - 9| = 24$ no solutions

20. $-6|5 - 2y| = -9$ $y = 7/4, 13/4$

21. $|8 + p| = 2p - 3$ $p = 11$

22. $|4w - 1| = 5w + 37$ $w = -4$

23. $4|2y - 7| + 5 = 9$ $y = 3$ or 4

24. $-2|7 - 3y| - 6 = -14$ $y = 1, 1/3$

25. $2|4 - s| = -3s$ $s = -8$

26. $5 - 3|2 + 2w| = -7$ $w = -3, 1$

27. $5|2r + 3| - 5 = 0$ $r = -2, -1$

28. $3 - 5|2d - 3| = 4$ no solutions

Solve each inequality. Then graph the solution set on a number line.

1. $8x - 6 \geq 10 \quad x \geq 2$

2. $23 - 4u < 11 \quad u > 3$

3. $-16 - 8r \geq 0 \quad r \leq -2$

4. $14s < 9s + 5 \quad s < 1$

5. $9x - 11 > 6x - 9 \quad x > \frac{2}{3}$

6. $-3(4w - 1) > 18 \quad w < -5/4$

7. $1 - 8u \leq 3u - 10 \quad u \geq 1$

8. $17.5 < 19 - 2.5x \quad x < 6$

9. $9(2r - 5) - 3 < 7r - 4 \quad r < 4$

10. $1 + 5(x - 8) \leq 2 - (x + 5) \quad x \leq 6$

11. $\frac{4x - 3}{2} \geq -3.5 \quad x \geq -1$

12. $q - 2(2 - q) \leq 0 \quad q \leq \frac{4}{3}$

Solve each inequality. Graph the solution set on a number line.

5. $-8 \leq 3y - 20 < 52 \quad 4 \leq y \leq 24$

6. $3(5x - 2) < 24$ or $6x - 4 > 4 + 5x \quad x < 2$ or $x > 8$

7. $2x - 3 > 15$ or $3 - 7x < 17 \quad x > -2$

8. $15 - 5x \leq 0$ and $5x + 6 \geq -14 \quad x \geq 3$

9. $|2w| \geq 5 \quad w \leq -5/2$ or $w \geq 5/2$

10. $|y + 5| < 2 \quad -7 < y < -3$

11. $|x - 8| \geq 3 \quad x \leq 5$ or $x \geq 11$

12. $|2z - 2| \leq 3 \quad -1/2 \leq z \leq 5/2$

13. $|2x + 2| - 7 \leq -5 \quad -2 < x < 0$

14. ~~$|x| > x - 1$~~

15. $|3b + 5| \leq -2$ no solutions

16. $|3n - 2| - 2 < 1 \quad -1/3 < n < 5/3$

State the domain and range of each relation. Then determine whether each relation is a *function*. If it is a function, determine if it is *one-to-one*, *onto*, *both* or *neither*.

1. Domain: 100, 200, 300; Range: 50, 100, 150. It is a function.

2. Domain: 3; Range: 1, 5. Not a function.

3. Domain: 1, 2, 3; Range: 2, 4, 6. It is a function.

x	y
1	2
2	4
3	6

4. Domain: $0 \leq x \leq 10$; Range: $-2 \leq y \leq 8$. It is not a function.

Find each value if $f(x) = 2x - 1$ and $g(x) = 2 - x^2$.

- 9. $f(0) = -1$
- 10. $f(12) = 23$
- 11. $g(4) = -14$
- 12. $f(-2) = -5$
- 13. $g(-1) = 1$
- 14. $f(d) = 2d - 1$

Find the x-intercept and the y-intercept of the graph of each equation. Then graph the equation using the intercepts.

15. $y = 3x - 6$
 x-int: (2, 0)
 y-int: (0, -6)

16. $y = -2x$
 x-int: = y-int = (0, 0)

17. $x + y = 5$
 x-int: (5, 0)
 y-int: (0, 5)

18. $2x + 5y = 10$
 x-int: (5, 0)
 y-int: (0, 2)

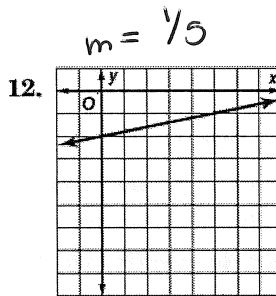
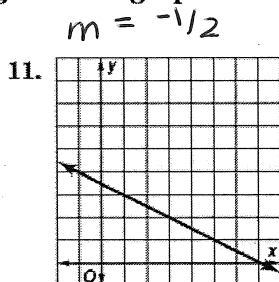
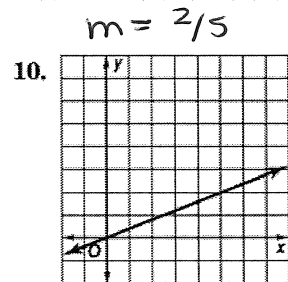
Find the slope of the line that passes through each pair of points.

1. (1, 5), (-1, -3) $m = 4$ 2. (0, 2), (3, 0) $m = -\frac{2}{3}$ 3. (1, 9), (0, 6) $m = 3$

4. (8, -5), (4, -2) $m = -\frac{3}{4}$ 5. (-3, 5), (-3, -1) $m = \text{Undefined}$ 6. (-2, -2), (10, -2) $m = 0$

7. (4, 5), (2, 7) $m = -1$ 8. (-2, -4), (3, 2) $m = \frac{6}{5}$ 9. (5, 2), (-3, 2) $m = 0$

Determine the rate of change of each graph.



Write an equation in slope-intercept form for the line described.

1. slope 3, y-intercept at -4

$y = 3x - 4$

2. perpendicular to $y = \frac{1}{2}x - 1$,

x-intercept at 4

$y = -2x - 8$

3. parallel to $y = \frac{2}{3}x + 6$,
passes through (6, 7)

$y = \frac{2}{3}x + 3$

4. parallel to $y = -\frac{1}{4}x - 2$,
x-intercept at 4

$y = -\frac{1}{4}x + 1$

5. perpendicular to $y = -4x + 1$,
passes through (-8, -1)

$y = \frac{1}{4}x - 3$

6. slope $\frac{3}{5}$, x-intercept at -10

$y = \frac{3}{5}x + 6$

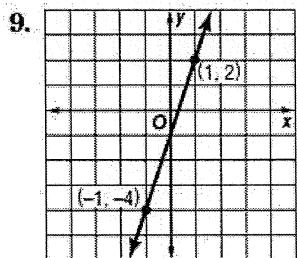
7. parallel to $y = 9x + 3$,
y-intercept at -2

$y = 9x - 2$

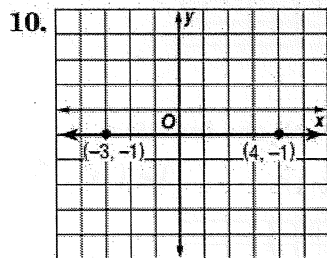
8. slope $\frac{5}{6}$, passes through (12, 4)

$y = \frac{5}{6}x - 6$

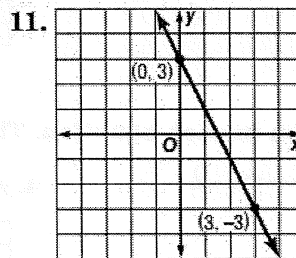
Write an equation in slope-intercept form for each graph.



$y = 3x$



$y = -1$



$y = -2x + 3$

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

12. slope 3, passes through (1, -3)

$$y = 3x - 6$$

13. slope -1, passes through (0, 0)

$$y = -x$$

14. slope -2, passes through (0, -5)

$$y = -2x - 5$$

15. slope 3, passes through (2, 0)

$$y = 3x - 6$$

16. passes through (-1, -2) and (-3, 1)

$$y = \frac{3}{2}x + \frac{11}{2}$$

17. passes through (-2, -4) and (1, 8)

$$y = 4x + 4$$

18. passes through (2, 0) and (0, -6)

$$y = 3x - 6$$

19. passes through (2.5, 0) and (0, 5)

$$y = -2x + 5$$

20. passes through (3, -1), perpendicular to the graph of $y = -\frac{1}{3}x - 4$.

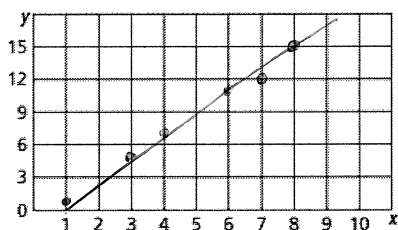
$$y = 3x - 10$$

For Exercises 1-3, complete parts a-c.

- Make a scatter plot and a line of fit, and describe the correlation.
- Use two ordered pairs to write a prediction equation.
- Use your prediction equation to predict the missing value.

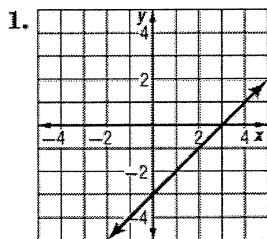
1.

x	y
1	1
3	5
4	7
6	11
7	12
8	15
10	?

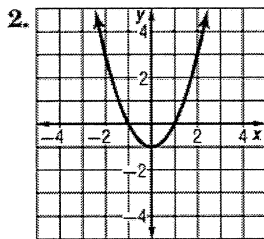


- positive, strong correlation
- example: $y - 11 = 2(x - 6)$
- example: $19 = y$

Identify the type of function represented by each graph.



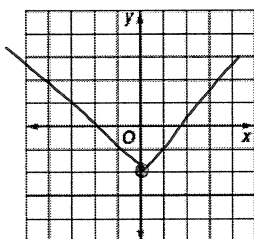
linear



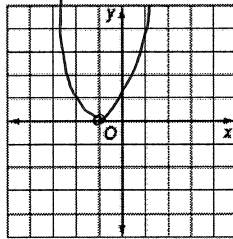
quadratic

Describe the translation in each equation. Then graph the function.

3. $y = |x| - 2$ down 2

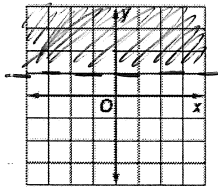


4. $y = (x + 1)^2$ left 1

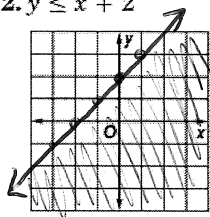


Graph each inequality.

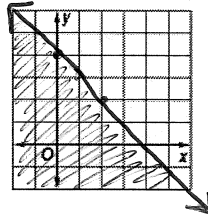
1. $y > 1$



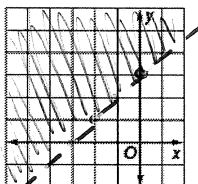
2. $y \leq x + 2$



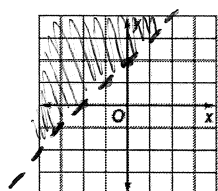
3. $x + y \leq 4 \rightarrow y \leq -x + 4$



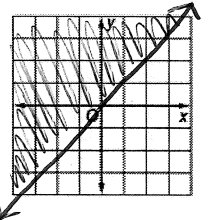
4. $x + 3 < y$



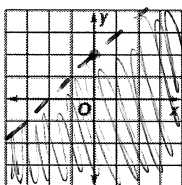
5. $2 - y < x \rightarrow y > -x + 2$



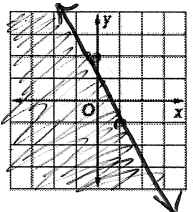
6. $y \geq -x$



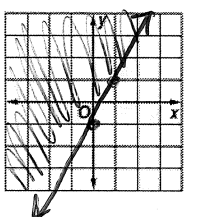
7. $x - y > -2 \rightarrow y < x + 2$



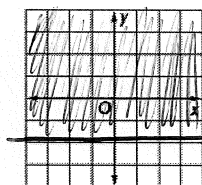
8. $9x + 3y - 6 \leq 0 \rightarrow y \leq -3x + 2$



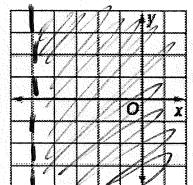
9. $y + 1 \geq 2x \rightarrow y \geq 2x - 1$



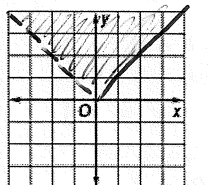
10. $y - 7 \leq -9 \rightarrow y \leq -2$



11. $x > -5$



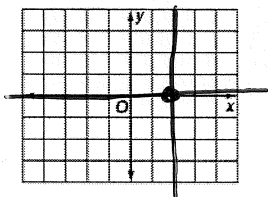
12. $y > |x|$



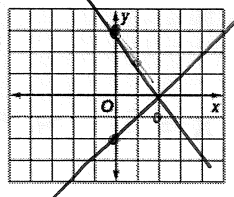
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Solve each system of equations by graphing.

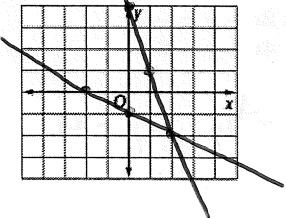
1. $x = 2$
 $y = 0$ (2, 0)



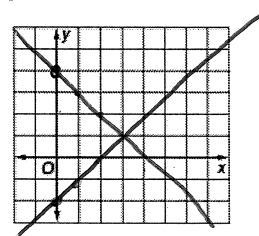
2. $y = -3x + 6$
 $y = 2x - 4$ (2, 0)



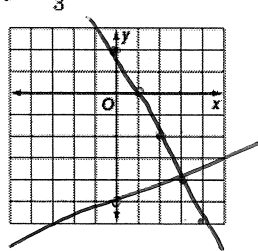
3. $y = 4 - 3x$
 $y = -\frac{1}{2}x - 1$ (2, 2)



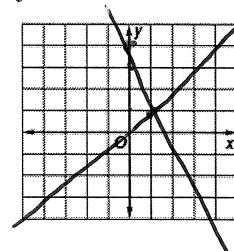
4. $y = 4 - x$
 $y = x - 2$ (3, 1)



5. $y = -2x + 2$
 $y = \frac{1}{3}x - 5$ (3, 4)



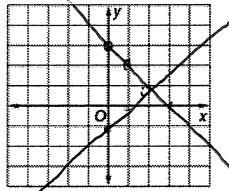
6. $y = x$
 $y = -3x + 4$ (1, 1)



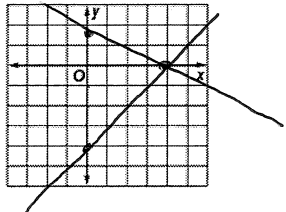
(2, 1)

(4, 0)

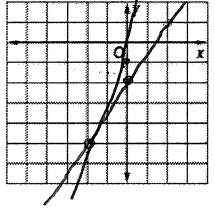
7. $x + y = 3$ $y = -x + 3$
 $x - y = 1$ $y = x - 1$



8. $x - y = 4$ $y = x - 4$
 $2x - 5y = 8$ $y = 2/5x - 8/5$



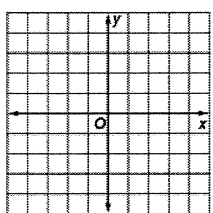
9. $3x - 2y = 4$ $y = 3/2x - 2$
 $2x - y = 1$ $y = 2x - 1$



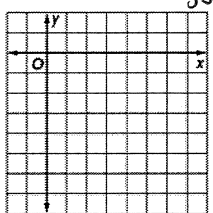
(-2, -5)

Graph each system of equations and describe it as *consistent and independent*, *consistent and dependent*, or *inconsistent*.

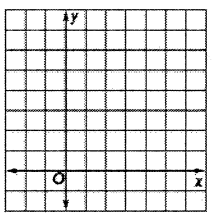
10. $y = -3x$ no solution
 $y = -3x + 2$ solution



11. $y = x - 5$ infinitely many solutions
 $-2x + 2y = -10$ solution



12. $2x - 5y = 10$
 $3x + y = 15$ one solution



one solution
 (5, 0)

Solve each system of equations by using substitution.

1. $a + b = 20$
 $a - b = -4$

$a = 8$ $b = 12$

2. $x + 3y = -3$
 $4x + 3y = 6$

$x = 3$ $y = -2$

3. $w - z = 1$
 $2w + 3z = 12$

$w = 3$, $z = 2$

4. $3r + t = 5$
 $2r - t = 5$

$r = 2$ $t = -1$

5. $2b + 3c = -4$
 $b + c = 3$

$b = 13$, $c = -10$

6. $x - y = -5$
 $3x + 4y = 13$

$x = -1$, $y = 4$

Solve each system of equations by using elimination.

7. $2t - u = 17$
 $3t + u = 8$

$t = 5$ $u = -7$

8. $2j - k = 3$
 $3j + k = 2$

$j = 1$ $k = -1$

9. $3c - 2d = 2$
 $3c + 4d = 50$

$d = 8$ $c = 6$

10. $2f + 3g = 9$
 $f - g = 2$

$f = 3$, $g = 1$

11. $-2x + y = -1$
 $x + 2y = 3$

$x = 1$, $y = 1$

12. $2x - y = 12$
 $2x - y = 6$

no solution

Solve each system of equations.

13. $-r + t = 5$
 $-2r + t = 4$

$r = 1$, $t = 6$

14. $2x - y = -5$
 $4x + y = 2$

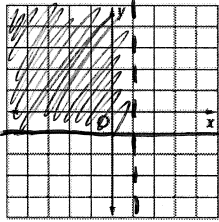
$x = 1/2$, $y = 4$

15. $x - 3y = -12$
 $2x + y = 11$

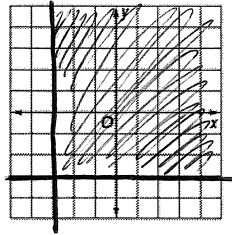
$x = 3$ $y = 5$

Solve each system of inequalities by graphing.

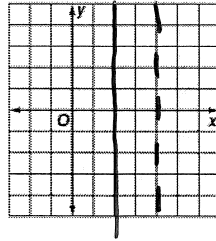
1. $x < 1$
 $y \geq -1$



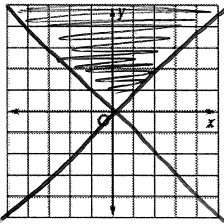
2. $x \geq -3$
 $y \geq -3$



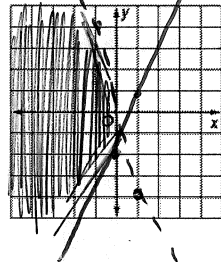
3. $x \leq 2$ *no solutions*
 $x > 4$



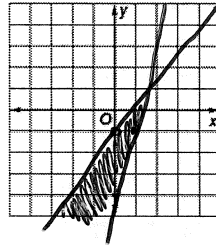
4. $y \geq x$
 $y \geq -x$



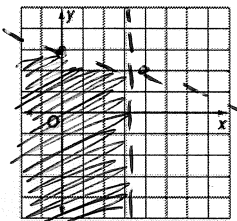
5. $y < -4x$
 $y \geq 3x - 2$



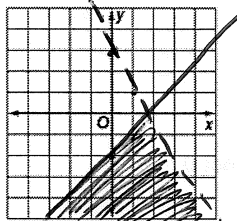
6. $x - y \geq -1$ $y \leq x - 1$
 $3x - y \leq 4$ $y \geq 3x - 4$



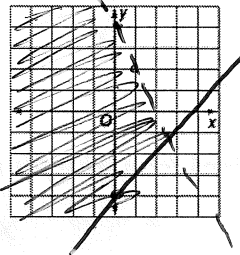
7. $y < 3$
 $x + 2y < 12$ $y < -\frac{1}{2}x + 6$



8. $y < -2x + 3$
 $y \leq x - 2$



9. $x - y \leq 4$ $y \geq x - 4$
 $2x + y < 4$ $y < -2x + 4$



Complete parts a-c for each quadratic function.

a. Find the y-intercept, the equation of the axis of symmetry, and the x-coordinate of the vertex.

~~b.~~ Make a table of values that includes the vertex.

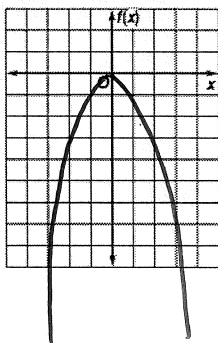
c. Use this information to graph the function.

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

y-int: (0, 0)

axis of symm: $x = 0$

x coord of vertex: 0

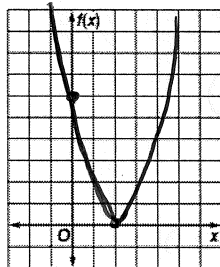


2. $f(x) = x^2 - 4x + 4$

y-int: (0, 4)

axis: $x = 2$

x coord of vertex: 2

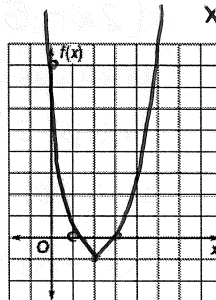


3. $f(x) = x^2 - 6x + 8$

y-int: (0, 8)

axis of symmetry: $x = 2$

x coord of vertex: 2



Determine whether each function has a maximum or a minimum value, and find that value. Then state the domain and range of the function.

4. $f(x) = 6x^2$ minimum at 0

D: \mathbb{R}
R: $y \geq 0$

5. $f(x) = -8x^2$ maximum at 0

D: \mathbb{R}
R: $y \leq 0$

6. $f(x) = x^2 + 2x$ minimum at -1

D: \mathbb{R} , R: $y \geq -1$

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

maximum at -1
D: \mathbb{R} , R: $y \leq -1$

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

minimum at -9
D: \mathbb{R} , R: $y \geq 9$

9. $f(x) = 2x^2 + 4x + 1$

minimum at -1
D: \mathbb{R} , R: $y \geq -1$

10. $f(x) = 3x^2$

minimum at 0
D: \mathbb{R} , R: $y \geq 0$

11. $f(x) = x^2 + 1$

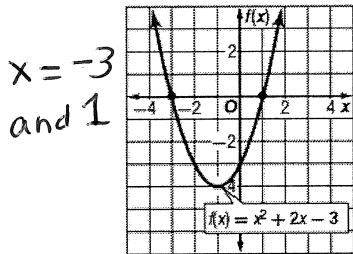
minimum at 1
D: \mathbb{R} , R: $y \geq 1$

12. $f(x) = -x^2 + 6x - 15$

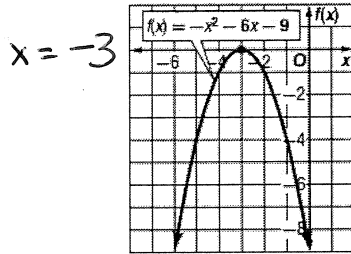
maximum at -6
D: \mathbb{R} , R: $y \leq -6$

Use the related graph of each equation to determine its solutions.

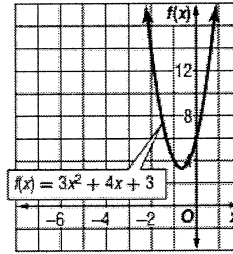
1. $x^2 + 2x - 3 = 0$



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



3. $3x^2 + 4x + 3 = 0$



no real solutions

Write a quadratic equation in standard form with the given root(s).

1. 1, 4 $x^2 - 5x + 4 = 0$

2. 6, -9 $x^2 + 3x - 54 = 0$

3. -2, -5 $x^2 + 7x + 10 = 0$

4. 0, 7 $x^2 - 7x = 0$

5. $-\frac{1}{3}, -3$ $3x^2 + 10x + 3 = 0$

6. $-\frac{1}{2}, \frac{3}{4}$ $8x^2 - 2x - 3 = 0$

Factor each polynomial.

7. $m^2 + 7m - 18$

$(m + 9)(m - 2)$

8. $2x^2 - 3x - 5$

$(2x - 5)(x + 1)$

9. $4z^2 + 4z - 15$

$(2z - 3)(2z + 5)$

10. $4p^2 + 4p - 24$

$4(p - 2)(p + 3)$

11. $3y^2 + 21y + 36$

$3(y + 3)(y + 4)$

12. $c^2 - 100$

$(c - 10)(c + 10)$

Solve each equation by factoring.

13. $x^2 = 64$ $x = 8, -8$

14. $x^2 - 100 = 0$ $x = 10, -10$

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

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

17. $x^2 + 2x - 3 = 0$ $x = -3, 1$

18. $x^2 - 3x - 10 = 0$ $x = 5, -2$

19. $x^2 - 6x + 5 = 0$ $x = 5, 1$

20. $x^2 - 9x = 0$ $x = 0, 9$

21. $x^2 - 4x = 21$ $x = -3, 7$

22. $2x^2 + 5x - 3 = 0$ $x = -3, \frac{1}{2}$

23. $4x^2 + 5x - 6 = 0$ $x = -2, \frac{3}{4}$

24. $3x^2 - 13x - 10 = 0$ $x = -\frac{2}{3}, 5$

Simplify.

1. $\sqrt{-36} = 6i$

2. $\sqrt{-8} \cdot \sqrt{-32} = -16$

3. $\sqrt{-15} \cdot \sqrt{-25} = -\sqrt{375}$

4. $(-3i)(4i)(-5i) = -60i$

5. $(7i)^2(6i) = -294i$

6. $i^{42} = -1$

7. $i^{55} = -i$

8. $i^{89} = i$

9. $(5 - 2i) + (-13 - 8i) = -8 - 10i$

10. $(7 - 6i) + (9 + 11i)$
 $= 16 + 5i$

11. $(-12 + 48i) + (15 + 21i)$
 $= 3 + 69i$

12. $(10 + 15i) - (48 - 30i)$
 $= -38 + 45i$

13. $(28 - 4i) - (10 - 30i)$
 $= 18 + 26i$

14. $(6 - 4i)(6 + 4i)$
 $= 52$

15. $(8 - 11i)(8 - 11i) = -57 - 176i$

16. $(4 + 3i)(2 - 5i)$
 $= 23 - 14i$

17. $(7 + 2i)(9 - 6i)$
 $= 75 - 24i$

~~18. $\frac{6 + 5i}{-2i}$~~

Solve each equation.

17. $3x^2 + 3 = 0$ $x = \pm i$

18. $5x^2 + 125 = 0$ $x = \pm 5i$

19. $4x^2 + 20 = 0$ $x = \pm i\frac{\sqrt{20}}{2} = \pm i\sqrt{5}$

20. $-x^2 - 16 = 0$ $x = \pm 4i$

21. $x^2 + 18 = 0$ $x = \pm i\frac{\sqrt{18}}{2} = \pm i\sqrt{18}$

22. $8x^2 + 96 = 0$ $x = \pm i\frac{\sqrt{48}}{2} = \pm i\sqrt{12}$

Find the value of c that makes each trinomial a perfect square. Then write the trinomial as a perfect square.

9. $x^2 + 10x + c$ 25

10. $x^2 - 14x + c$ 49

11. $x^2 + 24x + c$ 144

12. $x^2 + 5x + c$ $\frac{25}{4}$

13. $x^2 - 9x + c$ $\frac{81}{4}$

14. $x^2 - x + c$ $\frac{1}{4}$

Complete parts a-c for each quadratic equation.

- a. Find the value of the discriminant.
- b. Describe the number and type of roots.
- c. Find the exact solutions by using the Quadratic Formula.

1. $x^2 - 8x + 16 = 0$
 a.) 0
 b.) one real
 c.) $x = 4$

2. $x^2 - 11x - 26 = 0$
 a.) 225
 b.) two real
 c.) $x = -2, 13$

3. $3x^2 - 2x = 0$
 a.) 4 b.) 2 real c.) $x = 0, 2/3$

4. $20x^2 + 7x - 3 = 0$
 a.) 289 b.) two real c.) $x = -3/5, 1/4$

5. $5x^2 - 6 = 0$
 a.) 120 b.) 2 real c.) $x = \pm \frac{\sqrt{120}}{5} = \pm \frac{\sqrt{30}}{5}$

6. $x^2 - 6 = 0$
 a.) 24 b.) two real c.) $x = \pm \frac{\sqrt{24}}{2}$

7. $x^2 + 8x + 13 = 0$
 a.) 12 b.) 2 real c.) $x = \frac{-8 \pm \sqrt{12}}{2}$

8. $5x^2 - x - 1 = 0$
 a.) 21 b.) two real c.) $x = \frac{1 \pm \sqrt{21}}{10}$

9. $x^2 - 2x - 17 = 0$
 a.) 72 b.) two real c.) $x = \frac{2 \pm \sqrt{72}}{2}$

10. $x^2 + 49 = 0$
 a.) -196 b.) zero real / two imag. c.) $x = \pm 7i$

11. $x^2 - x + 1 = 0$
 a.) -3 b.) two imaginary c.) $x = \frac{1 \pm i\sqrt{3}}{2}$

12. $2x^2 - 3x = -2$
 a.) -7 b.) two imaginary c.) $x = \frac{3 \pm i\sqrt{7}}{4}$

Solve each equation by using the Quadratic Formula.

13. $x^2 = 64$ $x = \pm 8$

14. $x^2 - 30 = 0$ $x = \pm \frac{\sqrt{120}}{2}$

15. $x^2 - x = 30$ $x = -5, 6$

16. $16x^2 - 24x - 27 = 0$ $x = -3/4, 9/4$

17. $x^2 - 4x - 11 = 0$ $x = \frac{4 \pm \sqrt{60}}{2}$

18. $x^2 - 8x - 17 = 0$ $x = \frac{8 \pm \sqrt{132}}{2}$

19. $x^2 + 25 = 0$ $x = \pm 5i$

20. $3x^2 + 36 = 0$ $x = \pm 12i$

21. $2x^2 + 10x + 11 = 0$ $x = \frac{-10 \pm \sqrt{12}}{4}$

22. $2x^2 - 7x + 4 = 0$ $x = \frac{7 \pm \sqrt{17}}{4}$

23. $8x^2 + 1 = 4x$ $x = \frac{4 \pm 4i}{16}$

24. $2x^2 + 2x + 3 = 0$ $x = \frac{-2 \pm i\sqrt{20}}{4}$

Write each quadratic function in vertex form. Then identify the vertex, axis of symmetry, and direction of opening.

1. $y = (x-2)^2$
 vertex form: $y = (x-2)^2$
 vertex: (2, 0) AOS: $x = 2$
 opening up

2. $y = -x^2 + 4$
 vertex form: $y = -x^2 + 4$
 vertex: (0, 4) AOS: $x = 0$
 opening down

3. $y = x^2 - 6$
 vertex form: $y = x^2 - 6$
 vertex: (0, -6) AOS: $x = 0$
 opening down

4. $y = -3(x+5)^2$
 vertex form: $y = -3(x+5)^2$
 vertex: (-5, 0) AOS: $x = -5$
 opening down

5. $y = -5x^2 + 9$
 vertex form: $y = -5x^2 + 9$
 vertex: (0, 9) AOS: $x = 0$
 opening down

6. $y = (x-2)^2 - 18$
 vertex form: $y = (x-2)^2 - 18$
 vertex: (2, -18) AOS: $x = 2$
 opening up

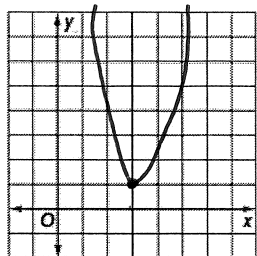
7. $y = x^2 - 2x - 5$
 vertex form: $y = (x-1)^2 - 6$
 vertex: (1, -6) AOS: $x = 1$
 opening up

8. $y = x^2 + 6x + 2$
 vertex form: $y = (x+3)^2 - 7$
 vertex: (-3, -7) AOS: $x = -3$
 opening up

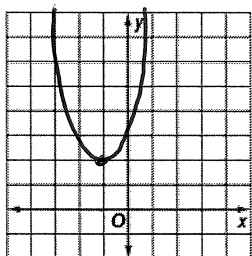
9. $y = -3x^2 + 24x$
 $y = -3(x-4)^2 + 48$ vertex form
 vertex: (4, 48) AOS: $x = 4$
 opening down

Graph each function.

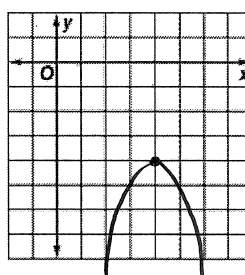
10. $y = (x - 3)^2 - 1$



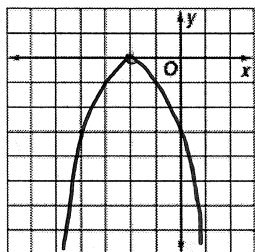
11. $y = (x + 1)^2 + 2$



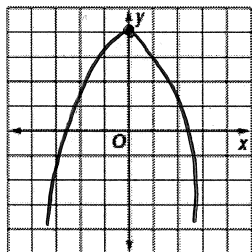
12. $y = -(x - 4)^2 - 4$



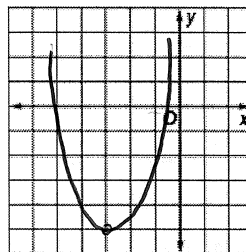
13. $y = -\frac{1}{2}(x + 2)^2$



14. $y = -3x^2 + 4$



15. $y = x^2 + 6x + 4$



Simplify

11. $(g + 5) + (2g + 7)$

$3g + 12$

12. $(5d + 5) - (d + 1)$

$4d + 4$

13. $(x^2 - 3x - 3) + (2x^2 + 7x - 2)$

$3x^2 + 4x - 5$

14. $(-2f^2 - 3f - 5) + (-2f^2 - 3f + 8)$

$-4f^2 - 6f + 3$

15. $-5(2c^2 - d^2)$

$-10c^2 + 5d^2$

16. $x^2(2x + 9)$

$2x^3 + 9x^2$

17. $(a - 5)^2$

$a^2 - 10a + 25$

18. $(2x - 3)(3x - 5)$

$6x^2 - 19x + 15$

19. $(r - 2t)(r + 2t)$

$r^2 - 4t^2$

20. $(3y + 4)(2y - 3)$

$6y^2 - y - 12$

21. $(3 - 2b)(3 + 2b)$

$9 - 4b^2$

22. $(3w + 1)^2$ $9w^2 + 6w + 1$

2. How many terms does the polynomial have? $2x^2y - 3xy + 5y^2 - 6$

4 terms

For Exercises 3-8, write the polynomial in descending order. Then identify the leading coefficient and the degree.

3. $a^2 - 6a^3 - a = -6a^3 + a^2 - a$
leading: -6 degree: 3

4. $2b - b^4 + 5b^2 = -b^4 + 5b^2 + 2b$
leading: -1 degree: 4

5. $6x^2 - x + 3x^4 - 1 = 3x^4 + 6x^2 - x - 1$
leading: 3 degree: 4

6. $8 - 4y + y^5 - y^2$
 $y^5 - y^2 - 4y + 8$
leading: 1 degree: 5

7. $100 - t^2$
 $-t^2 + 100$
leading: -1 degree: 2

8. $-51 + s^2$
 $s^2 + 51$
leading: 1 degree: 2

For Exercises 43–62, add or subtract as indicated. Write the answers in descending order, if possible.

43. $(8y^2 - 4y^3) - (3y^2 - 8y^3)$
 $4y^2 + 5y^2$
44. $(-9y^2 - 8) - (4y^2 + 3)$
 $-13y^2 - 11$
45. $(-2r - 6r^4) + (-r^4 - 9r)$
 $-7r^4 - 11r$
46. $(-8s^9 + 7s^2) + (7s^9 - s^2)$
 $-s^9 + 6s^2$
47. $(5xy + 13x^2 + 3y) - (4x^2 - 8y)$
 $9x^2 + 5xy + 11y$
48. $(6p^2q - 2q) - (-2p^2q + 13)$
 $8p^2q - 2q - 13$
49. $(11ab - 23b^2) + (7ab - 19b^2)$
 $-42b^2 + 18ab$
50. $(-4x^2y + 9) + (8x^2y - 12)$
 $4x^2y - 3$
51. $[2p - (3p + 5)] + (4p - 6) + 2$
 $3p + 1$
52. $-(q - 2) - [4 - (2q - 3) + 5]$
 $q - 10$
53. $5 - [2m^2 - (4m^2 + 1)]$
 $-6m^2 + 6$
54. $[4n^3 - (n^3 + 4)] + 3n^3$
 $6n^3 - 4$
55. $(6x^3 - 5) - (-3x^3 + 2x) - (2x^3 - 6x)$
 $7x^3 + 4x - 5$
56. $(9p^4 - 2) + (7p^4 + 1) - (8p^4 - 10)$
 $8p^4 + 9$
57. $(-ab + 5a^2b) + [7ab^2 - 2ab - (7a^2b + 2ab^2)]$
 $-2a^2b + 5ab^2 - 3ab$
58. $(m^3n^2 + 4m^2n) - [-5m^3n^2 - 4mn - (7m^2n - 6mn)]$
 $6m^3n^2 + 11m^2n + 10mn$

For Exercises 9–46, multiply the polynomials by using the distributive property and the special product formulas.

9. $(7x^4y)(-6xy^5) = -42x^5y^6$
10. $(-4a^3b^7)(-2ab^3) = 8a^4b^{10}$
11. $\left(\frac{1}{4}tu^2\right)(8uv) = 2tu^3v$
12. $\left(-\frac{1}{5}mn^5\right)(-20np^3) = 4mnp^3$
13. $(2.2a^6b^4c^7)(5ab^4c^3) = 11a^7b^8c^{10}$
14. $(8.5c^4d^5e)(6cd^2e) = 51.6c^5d^7e^2$
15. $3ab(a + b) = 3a^2b + 3ab^2$
16. $2a(3 - a) = 6a - 2a^2$
17. $\frac{1}{5}(2a - 3) = \frac{2}{5}a - \frac{3}{5}$
18. $\frac{1}{3}(6b + 4) = 2b + \frac{4}{3}$
19. $2m^3n^2(m^2n^3 - 3mn^2 + 4n)$
 $= 2m^5n^5 - 6m^4n^4 + 8m^3n^3$
20. $3p^2q(p^3q^3 - pq^2 - 4p)$
 $= 3p^5q^4 - 3p^3q^3 - 12p^3q$
21. $(x + y)(x - 2y) = x^2 - xy - 2y^2$
22. $(3a + 5)(a - 2) = 3a^2 - a$
23. $(6x - 1)(5 + 2x) = 12x^2 + 28x - 5$
24. $(7 + 3x)(x - 8) = 3x^2 - 17x - 56$
25. $(4a - 9)(2a - 1) = 8a^2 - 22a + 9$
26. $(3b + 5)(b - 5) = 3b^2 - 10b - 25$
27. $(y^2 - 12)(2y^2 + 3) = 2y^4 - 21y^2 - 36$
28. $(4p^2 - 1)(2p^2 + 5) = 8p^4 + 18p^2 - 5$
29. $(5s + 3t)(5s - 2t) = 25s^2 + 5st - 6t^2$
30. $(4a + 3b)(4a - b) = 16a^2 + 8ab - 3b^2$
31. $(n^2 + 10)(5n + 3) = 5n^3 + 3n^2 + 50n + 30$
32. $(m^2 + 8)(3m + 7) = m^3 + 7m^2 + 24m + 56$
33. $(1.3a - 4b)(2.5a + 7b)$
 $3.25a^2 + 9ab - 28b^2$
34. $(2.1x - 3.5y)(4.7x + 2y)$
 $= 9.87x^2 - 12.25xy - 7y^2$
35. $(2x + y)(3x^2 + 2xy + y^2)$
 $= 6x^3 + 7x^2y + 4xy^2 + y^3$
36. $(h - 5k)(h^2 - 2hk + 3k^2)$
 $h^3 - 7h^2k + 15hk^2 - 15k^3$
37. $(x - 7)(x^2 + 7x + 49)$
 $x^3 - 343$
38. $(x + 3)(x^2 - 3x + 9)$
 $x^3 + 27$
39. $(4a - b)(a^3 - 4a^2b + ab^2 - b^3)$
 $4a^4 - 17a^3b + 8a^2b^2 - 5ab^3 + b^4$
40. $(3m + 2n)(m^3 + 2m^2n - mn^2 + 2n^3)$
 $3m^4 + 4m^3n + 3m^2n^2 - 2mn^3 + 2n^4$

For Exercises 47–66, multiply by using the special case products.

47. $(a - 8)(a + 8) = a^2 - 64$
48. $(b + 2)(b - 2) = b^2 - 4$
49. $(3p + 1)(3p - 1) = 9p^2 - 1$
50. $(5q - 3)(5q + 3) = 25q^2 - 9$
51. $\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right) = x^2 - \frac{1}{9}$
52. $\left(\frac{1}{2}x + \frac{1}{3}\right)\left(\frac{1}{2}x - \frac{1}{3}\right) = \frac{1}{4}x^2 - \frac{1}{9}$
53. $(3h - k)(3h + k) = 9h^2 - k^2$
54. $(x - 7y)(x + 7y) = x^2 - 49y^2$
55. $(3h - k)^2 = 9h^2 - 6hk + k^2$
56. $(x - 7y)^2 = x^2 - 14xy + 49y^2$
57. $(t - 7)^2 = t^2 - 14t + 49$
58. $(w + 9)^2 = w^2 + 18w + 81$
59. $(u + 3v)^2 = u^2 + 6uv + 9v^2$
60. $(a - 4b)^2 = a^2 - 8ab + 16b^2$
61. $\left(h + \frac{1}{6}k\right)^2 = h^2 + \frac{hk}{3} + \frac{k^2}{36}$
62. $\left(\frac{2}{5}x + 1\right)^2 = \frac{4x^2}{25} + \frac{4x}{5} + 1$
63. $(2z^2 - w^3)(2z^2 + w^3) = 4z^4 - w^6$
64. $(a^4 - 2b^3)(a^4 + 2b^3) = a^8 - 4b^6$
65. $(5x^2 - 3y)^2 = 25x^4 - 30x^2y + 9y^2$
66. $(4p^3 - 2m)^2 = 16p^6 - 816p^3m + 4m^2$

For Exercises 27-42, divide the polynomials by using long division. Check your answer by multiplication.

- 27. $(x^2 + 11x + 19) \div (x + 4) = x + 7 \text{ R } -9$
- 28. $(x^3 - 7x^2 + 13x + 3) \div (x - 2) = x^2 - 5x + 3 \text{ R } 9$
- 29. $(3y^3 - 7y^2 - 4y + 3) \div (y - 3) = 3y^2 + 2y + 2 \text{ R } 9$
- 30. $(z^3 - 2z^2 + 2z - 5) \div (z - 4) = z^2 + 2z + 10 \text{ R } 35$
- 31. $(-12a^2 + 77a - 121) \div (3a - 11) = -4a + 11 \text{ R } 0$
- 32. $(28x^2 - 29x + 6) \div (4x - 3) = 7x - 2 \text{ R } 0$
- 33. $(18y^2 + 9y - 20) \div (3y + 4) = 6y - 5 \text{ R } 0$
- 34. $(-3y^2 + 2y + 1) \div (-y + 1) = 3y + 1 \text{ R } 0$
- 35. $(8a^3 + 1) \div (2a + 1) = 4a^2 - 2a + 1 \text{ R } 0$
- 36. $(81x^4 - 1) \div (3x + 1) = 27x^3 - 9x^2 + 3x - 1 \text{ R } 0$
- 37. $(x^4 - x^3 - x^2 + 4x - 2) \div (x^2 + x - 1) = x^2 - 2x + 2 \text{ R } 0$
- 38. $(2a^5 - 7a^4 + 11a^3 - 22a^2 + 29a - 10) \div (2a^2 - 5a + 2) = a^3 - a^2 + 2a + 5 \text{ R } 0$
- 39. $(x^4 - 3x^2 + 10) \div (x^2 - 2) = x^2 - 1 \text{ R } 8$
- 40. $(3y^4 - 25y^2 - 18) \div (y^2 - 3) = 3y^2 - 16 \text{ R } -66$
- 41. $(n^4 - 16) \div (n - 2) = n^3 + 2n^2 + 4n + 8 \text{ R } 0$
- 42. $(m^3 + 27) \div (m + 3) = m^2 - 3m + 9 \text{ R } 0$

48. The following table represents the result of a synthetic division.

$$\begin{array}{r|rrrr} 5 & 1 & -2 & -4 & 3 \\ & & 5 & 15 & 55 \\ \hline & 1 & 3 & 11 & \underline{58} \end{array}$$

Use x as the variable.

- a. Identify the divisor. $x - 5$
- b. Identify the quotient. $x^2 + 3x + 11$
- c. Identify the remainder. 58

49. The following table represents the result of a synthetic division.

$$\begin{array}{r|rrrrr} -2 & 2 & 3 & 0 & -1 & 6 \\ & & -4 & 2 & -4 & 10 \\ \hline & 2 & -1 & 2 & -5 & \underline{16} \end{array}$$

Use x as the variable.

- a. Identify the divisor. $x + 2$
- b. Identify the quotient. $2x^3 - x^2 + 2x - 5$
- c. Identify the remainder. 16

For Exercises 50-61, divide by using synthetic division. Check your answer by multiplication.

- 50. $(x^2 - 2x - 48) \div (x - 8) = x + 6 \text{ R } 0$
- 51. $(x^2 - 4x - 12) \div (x - 6) = x + 2 \text{ R } 0$
- 52. $(t^2 - 3t - 4) \div (t + 1) = t - 4 \text{ R } 0$
- 53. $(h^2 + 7h + 12) \div (h + 3) = h + 4 \text{ R } 0$
- 54. $(5y^2 + 5y + 1) \div (y - 1) = 5y + 10 \text{ R } 11$
- 55. $(3w^2 + w - 5) \div (w + 2) = 3w - 5 \text{ R } 5$
- 56. $(3 + 7y^2 - 4y + 3y^3) \div (y + 3) = 3y^2 - 2y + 2 \text{ R } -3$
- 57. $(2z - 2z^2 + z^3 - 5) \div (z + 3) = z^2 - 5z + 17 \text{ R } -56$
- 58. $(x^3 - 3x^2 + 4) \div (x - 2) = x^2 - x - 2 \text{ R } 0$

74. Given $P(x) = 4x^3 + 10x^2 - 8x - 20$,

- a. Evaluate $P(-4)$. $= -84$
- b. Divide. $(4x^3 + 10x^2 - 8x - 20) \div (x + 4) = 4x^2 - 6x + 16 \text{ R } -84$
- c. Compare the value found in part (a) to the remainder found in part (b).

they are the same.

In Exercises 9–46, factor the trinomial completely by using any method. Remember to look for a common factor first.

9. $b^2 - 12b + 32$ $(b-4)(b+8)$ 10. $a^2 - 12a + 27$ $(a-3)(a-9)$ 11. $y^2 + 10y - 24$ $(y+12)(y-2)$
 12. $w^2 + 3w - 54$ $(w-6)(w+9)$ 13. $x^2 + 13x + 30$ $(x+3)(x+10)$ 14. $t^2 + 9t + 8$ $(t+1)(t+8)$
 15. $c^2 - 6c - 16$ $(c-8)(c+2)$ 16. $z^2 - 3z - 28$ $(z-7)(z+4)$ 17. $2x^2 - 7x - 15$ $(2x+3)(x-5)$
 18. $2y^2 - 13y + 15$ $(2y-3)(y-5)$ 19. $a + 6a^2 - 5$ $(a+1)(6a-5)$ 20. $10b^2 - 3 - 29b$ $(b-3)(10b+1)$
 21. $s^2 + st - 6t^2$ $(s-2t)(s+3t)$ 22. $p^2 - pq - 20q^2$ $(p-5q)(p+4q)$ 23. $3x^2 - 60x + 108$ $3(x-18)(x-2)$
 24. $4c^2 + 12c - 72$ $4(c-3)(c+6)$ 25. $2c^2 - 2c - 24$ $2(c-4)(c+3)$ 26. $3x^2 + 12x - 15$ $3(x-1)(x+5)$

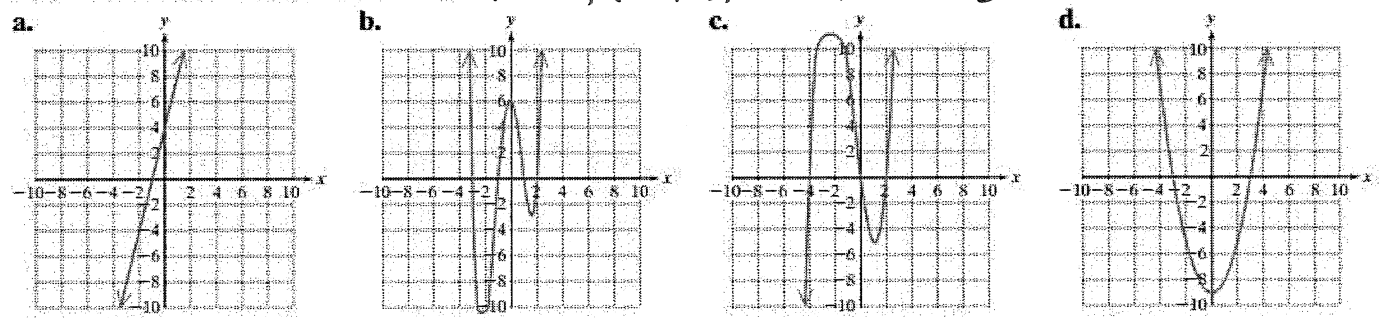
For Exercises 33–42, factor the sum or difference of cubes.

33. $8x^3 - 1$ (Check by multiplying.) $(2x-1)(4x^2+2x+1)$ 34. $y^3 + 64$ (Check by multiplying.) $(y+4)(y^2-4y+16)$
 35. $125c^3 + 27$ $(5c+3)(25c^2-15c+9)$ 36. $216u^3 - v^3$ $(6u-v)(36u^2+6uv+v^2)$ 37. $x^3 - 1000$ $(x-10)(x^2+10x+100)$ 38. $8y^3 - 27$ $(2y-3)(4y^2+6y+9)$
 39. $64t^3 + 1$ $(4t+1)(16t^2-4t+1)$ 40. $125r^3 + 1$ $(5r+1)(25r^2-5r+1)$ 41. $2000y^6 + 2x^3$ $2(x+10y^2)(x^2-10xy^2+100y^4)$ 42. $16z^4 - 54z$ $2z(2z-3)(4z^2+6z+9)$

For Exercises 81–84, find the x -intercepts of each function and use that information to match the function with its graph.

81. $g(x) = (x+3)(x-3)$ $(-3, 0), (0, 3)$ d
 82. $h(x) = x(x-2)(x+4)$ $(0, 0), (2, 0), (-4, 0)$ c
 83. $f(x) = 4(x+1)$ $(-1, 0), a$

84. $k(x) = (x+1)(x+3)(x-2)(x-1)$ $(-1, 0), (-3, 0), (2, 0), (1, 0)$ b



Solve each equation.

21. $a^3 - 9a^2 + 14a = 0$ $a = 0, 2, 7$ 22. $x^3 = 3x^2$ $x = 0, 3$
 23. $t^4 - 3t^3 - 40t^2 = 0$ $t = 0, \frac{3 \pm \sqrt{89}}{2}$ 24. $b^3 - 8b^2 + 16b = 0$ $b = 0, 4$

Given a polynomial and one of its factors, find the remaining factors of the polynomial.

13. $x^3 + 2x^2 - x - 2; x + 1$

$(x-1)(x+1)(x+2)$

14. $x^3 + x^2 - 5x + 3; x - 1$

$(x-1)^2(x+3)$

15. $x^3 + 3x^2 - 4x - 12; x + 3$

$(x-2)(x+2)(x+3)$

16. $x^3 - 6x^2 + 11x - 6; x - 3$

$(x-3)(x-2)(x-1)$

17. $x^3 + 2x^2 - 33x - 90; x + 5$

$(x-6)(x+3)(x+5)$

18. $x^3 - 6x^2 + 32; x - 4$

$(x-4)^2(x+2)$

19. $x^3 - x^2 - 10x - 8; x + 2$

$(x-4)(x+1)(x+2)$

20. $x^3 - 19x + 30; x - 2$

$(x-3)(x-2)(x+5)$

21. $2x^3 + x^2 - 2x - 1; x + 1$

$(x-1)(x+1)(2x+1)$

22. $2x^3 + x^2 - 5x + 2; x + 2$

$(x-1)(x+2)(2x-1)$

23. $3x^3 + 4x^2 - 5x - 2; 3x + 1$

$(x-1)(x+2)(3x+1)$

24. $3x^3 + x^2 + x - 2; 3x - 2$ $(3x-2)(x^2+x+1)$

List all of the possible rational zeros of each function.

1. $n(x) = x^2 + 5x + 3$
 $3, -3, 1, -1,$

2. $h(x) = x^2 - 2x - 5$
 $5, -5, -1, 1$

3. $w(x) = x^2 - 5x + 12$
 $12, -12,$
 $6, -6, 3, -3, 4, -4,$
 $2, -2, 1, -1$

4. $f(x) = 2x^2 + 5x + 3$
 $3, -3, 1, -1, 3/2, -3/2, 1/2, -1/2$

5. $g(x) = 6x^3 + x^2 - x + 2$
 $2, -2, 1, -1, 2/3, -2/3, 1/3, -1/3, 1/6, -1/6$

6. $g(x) = 9x^4 + 3x^3 + 3x^2 - x + 27$
 $\pm 1, \pm 3, \pm 9, \pm 27, \pm 1/3,$

Find all of the zeros of each function.

21. $f(x) = x^3 + 5x^2 + 11x + 15$

$x = -3, -1 \pm 2i$

22. $q(x) = x^3 - 10x^2 + 18x - 4$

$x = 2, \frac{-8 \pm \sqrt{56}}{2}$

23. $m(x) = 6x^4 - 17x^3 + 8x^2 + 8x - 3$

$x = 1/3, 3/2, \frac{1 \pm \sqrt{5}}{2}$

24. $g(x) = x^4 + 4x^3 + 5x^2 + 4x + 4$

$x = -2, \pm i$

Write a polynomial in standard form with the given zeros.

1. 2, 4, 5

$x^3 - 11x^2 + 38x - 40$

2. -3, 6, -1, 0

$x^4 - 2x^3 - 21x^2 - 18x$

3. -1, -2, -3

$x^3 + 6x^2 + 11x + 6$

Given the polynomials, determine the zeros and state the multiplicity.

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

Zeros:	multiplicity:
0	1
2	3
-5	2

5. $g(x) = (x-1)^6(x+2)^4$

Zeros:	multiplicity:
-1	6
2	4

Find the domain and range of the following functions.

6. $y = x^2 - 5$

D: \mathbb{R} R: $y \geq -5$

7. $y = (x-2)^2 - 1$

D: \mathbb{R} R: $y \geq -1$

Use a graphing calculator to find the zeros of the following polynomials. (Solve the equation by graphing).

8. $x^3 + 6x^2 + 3x - 10 = 0$

$x = 1, -2, -5$

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

no real solutions

Determine if the binomial is a factor of the polynomial.

10. $x^3 + 5x^2 + 2x - 8; (x - 1)$ yes

11. $x^4 + 2x^3 - 13x^2 - 14x + 24; (x - 2)$

no

Find the rational roots of each polynomial.

12. $x^3 + 5x^2 + 2x - 8 = 0$

$x = -4, -2, 1$

13. $x^4 + 2x^3 - 13x^2 - 14x + 24 = 0$

$x = -4, -2, 1, 3$