Matching In Exercises 1–4, match the equation with its graph. [The graphs are labeled (a), (b), (c), and (d).]

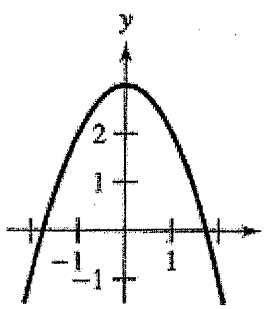
1. $y = -\frac{3}{2}x + 3$

2. $y = \sqrt{9 - x^2}$

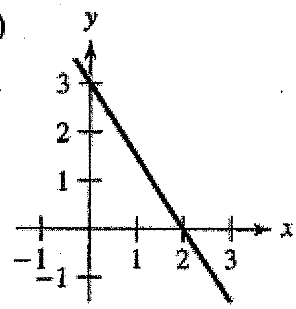
3. $y = 3 - x^2$

4. $y = x^3 - x$

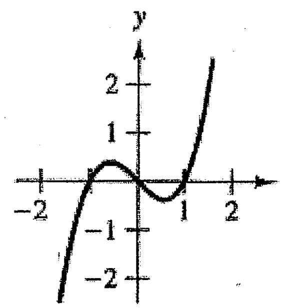
(a)



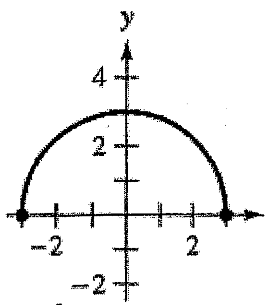
(b)



(c)



(d)



Sketching a Graph by Point Plotting In Exercises 5–14, sketch the graph of the equation by point plotting.

5. $y = \frac{1}{2}x + 2$

6. $y = 5 - 2x$

7. $y = 4 - x^2$

8. $y = (x - 3)^2$

11. $y = \sqrt{x} - 6$

12. $y = \sqrt{x + 2}$

13. $y = \dfrac{3}{x}$

14. $y = \dfrac{1}{x + 2}$

Finding Intercepts **In Exercises 17–26, find any intercepts.**

*Finding x-intercepts: Set y = 0, solve for x

*Finding y-intercepts: replace all x's with 0, solve for y.

17. $y = 2x - 5$

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

19. $y = x^2 + x - 2$

20. $y^2 = x^3 - 4x$

21. $y = x\sqrt{16 - x^2}$

22. $y = (x - 1)\sqrt{x^2 + 1}$

23. $y = \dfrac{2 - \sqrt{x}}{5x + 1}$

24. $y = \dfrac{x^2 + 3x}{(3x + 1)^2}$

Finding Points of Intersection **In Exercises 57–62, find the points of intersection of the graphs of the equations.**

*Steps: 1) Solve both equations for <u>same</u> variable (y or x, whichever easier)

2) Set equations equal, solve for variable.

57. $x + y = 8$
$4x - y = 7$

58. $3x - 2y = -4$
$4x + 2y = -10$

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

60. $x = 3 - y^2$
$y = x - 1$

61. $x^2 + y^2 = 5$
$x - y = 1$

62. $x^2 + y^2 = 25$
$-3x + y = 15$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $y = mx + b$ or $y - y_1 = m(x - x_1)$

Finding an Equation of a Line In Exercises 17–22, find an equation of the line that passes through the point and has the indicated slope. Then sketch the line.

	Point	Slope
13.	$(6, 2)$	$m = 0$
14.	$(-4, 3)$	m is undefined.
15.	$(1, 7)$	$m = -3$
16.	$(-2, -2)$	$m = 2$
21.	$(3, -2)$	$m = 3$
22.	$(-2, 4)$	$m = -\frac{3}{5}$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $\mathbf{y = mx + b}$ or $y - y_1 = m(x - x_1)$

Finding the Slope and *y*-Intercept **In Exercises 25–30, find the slope and the *y*-intercept (if possible) of the line.**

25. $y = 4x - 3$

26. $-x + y = 1$

27. $x + 5y = 20$

28. $6x - 5y = 15$

29. $x = 4$

30. $y = -1$

Finding an Equation of a Line **In Exercises 39–46, find an equation of the line that passes through the points. Then sketch the line.**

40. $(-2, -2), (1, 7)$

42. $(-3, 6), (1, 2)$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $y = mx + b$ or $y - y_1 = m(x - x_1)$

Finding Parallel and Perpendicular Lines **In Exercises 55–62, write the general forms of the equations of the lines through the point (a) parallel to the given line and (b) perpendicular to the given line.**

Parallel Lines: #57-58 Perpendicular Lines: #59,62

Both Parallel and Perpendicular Lines: #55-56

Parallel means same slope

Perpendicular means opposite reciprocal to given slope

$$m_2 = -\frac{1}{m_1}$$

57. $(2, 5)$ $x - y = -2$

58. $(-3, 2)$ $x + y = 7$

59. $(2, 1)$ $4x - 2y = 3$

62. $(4, -5)$ $3x + 4y = 7$

55. $(-7, -2)$ $x = 1$

56. $(-1, 0)$ $y = -3$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $y = mx + b$ or $y - y_1 = m(x - x_1)$

Evaluating a Function **In Exercises 1–10, evaluate the function at the given value(s) of the independent variable. Simplify the results.**

1. $f(x) = 7x - 4$

(a) $f(0)$ (b) $f(-3)$

(c) $f(b)$ (d) $f(x - 1)$

2. $f(x) = \sqrt{x + 5}$

(a) $f(-4)$ (b) $f(11)$

(c) $f(4)$ (d) $f(x + \Delta x)$

3. $g(x) = 5 - x^2$

(a) $g(0)$ (b) $g(\sqrt{5})$

(c) $g(-2)$ (d) $g(t - 1)$

4. $g(x) = x^2(x - 4)$

(a) $g(4)$ (b) $g\left(\frac{3}{2}\right)$

(c) $g(c)$ (d) $g(t + 4)$

Evaluating a Function In Exercises 1–10, evaluate the function at the given value(s) of the independent variable. Simplify the results.

7. $f(x) = x^3$

$$\frac{f(x + \Delta x) - f(x)}{\Delta x}$$

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

$$\frac{f(x) - f(1)}{x - 1}$$

9. $f(x) = \dfrac{1}{\sqrt{x - 1}}$

$$\frac{f(x) - f(2)}{x - 2}$$

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

$$\frac{f(x) - f(1)}{x - 1}$$

<u>**Evaluate the Function as indicated (#29 – #31)**</u>

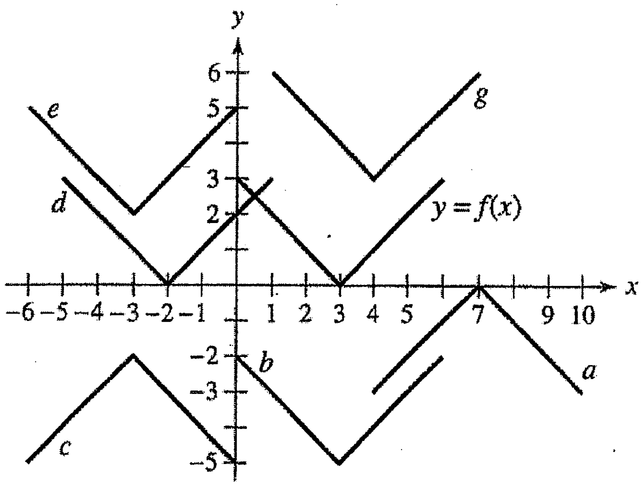
29. $f(x) = \begin{cases} 2x + 1, & x < 0 \\ 2x + 2, & x \geq 0 \end{cases}$

(a) $f(-1)$ (b) $f(0)$ (c) $f(2)$ (d) $f(t^2 + 1)$

30. $f(x) = \begin{cases} x^2 + 2, & x \le 1 \\ 2x^2 + 2, & x > 1 \end{cases}$

(a) $f(-2)$ (b) $f(0)$ (c) $f(1)$ (d) $f(s^2 + 2)$

Matching **In Exercises 55–60, use the graph of $y = f(x)$ to match the function with its graph.**



55. $y = f(x + 5)$

56. $y = f(x) - 5$

57. $y = -f(-x) - 2$

58. $y = -f(x - 4)$

59. $y = f(x + 6) + 2$

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

General Function

$y = f(x)$

Transformed Function

$y = af(x \pm h) \pm k$

vertical reflections, vertical stretches and compressions

horizontal shift h units, opposite direction of sign

vertical shift k units, same direction as sign

Vertical stretch by a factor of 3

Horizontal translation 4 units left

$f(x) = -3\sqrt{2(x+4)} - 1$

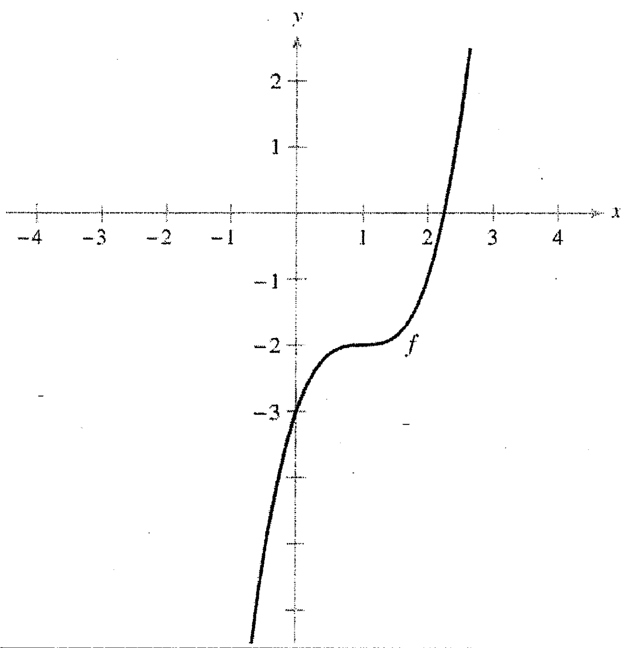
Vertical translation 1 unit down

Reflection in the x-axis

Horizontal compression by a factor of $\frac{1}{2}$

Sketching Transformations Use the graph of f shown in the figure to sketch the graph of each function. To print an enlarged copy of the graph, go to *MathGraphs.com.*

Use the graph of f shown in the figure to sketch the graph of each function.



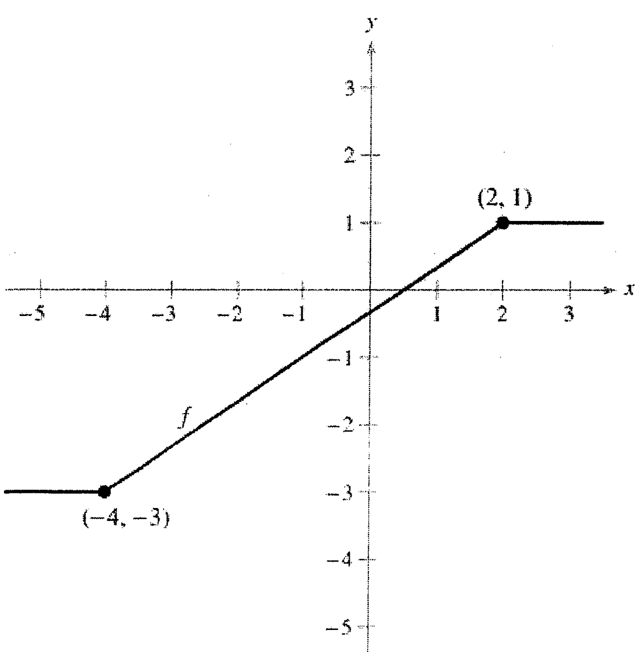
61)

(b) $f(x-1)$

(d) $f(x) - 4$

(f) $\frac{1}{4}f(x)$

(g) $-f(x)$



62)

(a) $f(x-4)$

(c) $f(x) + 4$

(e) $2f(x)$

(g) $f(-x)$

Matching **In Exercises 1–4, match the equation with its graph. [The graphs are labeled (a), (b), (c), and (d).]**

1. $y = -\frac{3}{2}x + 3$ ← y-intercept

↳ negative slope

linear graph $\boxed{B}$

2. $y = \sqrt{9 - x^2}$

↳ semi-circle

$y^2 = 9 - x^2$

$x^2 + y^2 = 9$ $\boxed{D}$

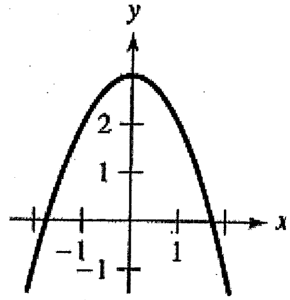
3. $y = 3 - x^2$

$\boxed{A}$ * quadratic, opens down, y-intercept 3

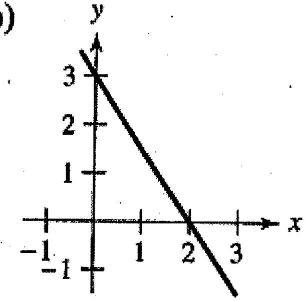
4. $y = x^3 - x$ $\boxed{C}$

* cubic function

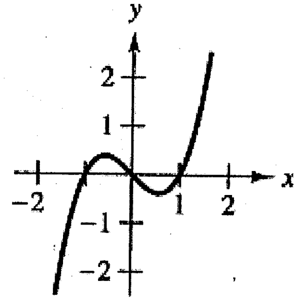
(a)



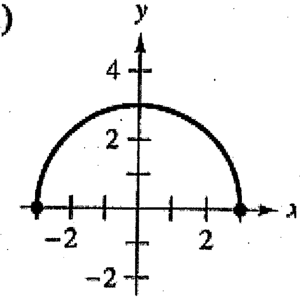
(b)



(c)



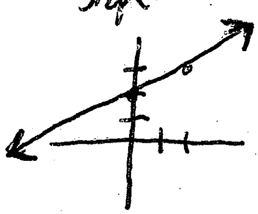
(d)



Sketching a Graph by Point Plotting **In Exercises 5–14, sketch the graph of the equation by point plotting.**

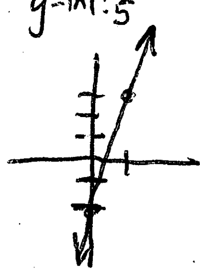
5. $y = \frac{1}{2}x + 2$ ↳ y-int: 2

slope: $m = 1/2$

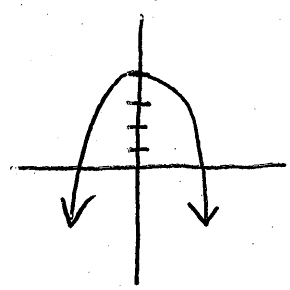


6. $y = 5 - 2x$

y-int: 5 slope: $m = -2$

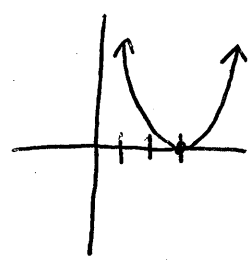


7. $y = 4 - x^2$



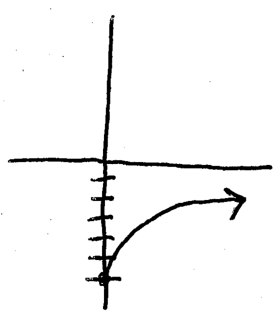
shift right 3 units

8. $y = (x - 3)^2$



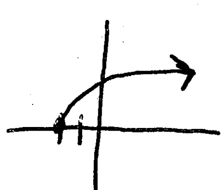
11. $y = \sqrt{x} - 6$

* shift down 6 units



12. $y = \sqrt{x + 2}$

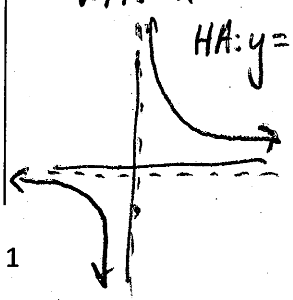
* shift left 2 units



13. $y = \frac{3}{x}$

V.A: $x = 0$

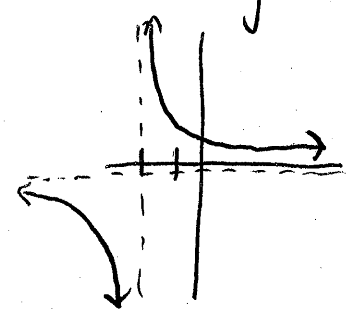
HA: $y = 0$



14. $y = \frac{1}{x + 2}$

VA: $x = -2$

H.A: $y = 0$



Finding Intercepts In Exercises 17–26, find any intercepts.

*<u>Finding x-intercepts:</u> Set y = 0, solve for x

*<u>Finding y-intercepts:</u> replace all x's with 0, solve for y.

17. $y = 2x - 5$

$0 = 2x - 5$

$5 = 2x$

$x = 5/2$

x-int: $(5/2, 0)$

$y = 2(0) - 5$

$y = -5$

y-int: $(0, -5)$

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

$0 = 4x^2 + 3$

$-3 = 4x^2$

$-\sqrt{-3} = \sqrt{4x^2}$

No x-int:

$y = 4(0)^2 + 3 = 3$

y-int: $(0, 3)$

19. $y = x^2 + x - 2$

$0 = x^2 + x - 2$

$0 = (x+2)(x-1)$

$x = -2,\ x = 1$

x-int: $\boxed{(-2, 0), (1, 0)}$

$y = (0)^2 + (0) - 2$

$y = -2$

$\boxed{\text{y-int: } (0, -2)}$

20. $y^2 = x^3 - 4x$

$0 = x^3 - 4x$

$0 = x(x^2 - 4)$

$0 = x(x+2)(x-2)$

$x = 0,\ 2,\ -2$

x-ints: $(0,0)\ (2,0),\ (-2,0)$

$y^2 = 0^3 - 4(0)$

$y = 0$

$\boxed{\text{y-int: } (0, 0)}$

21. $y = x\sqrt{16 - x^2}$

$y = x(16 - x^2)^{1/2}$

$0 = x(16 - x^2)^{1/2}$

$x = 0,\quad 16 - x^2 = 0$

$(4 - x)(4 + x) = 0$

$\boxed{x = 0 \quad x = 4, -4}$

$y = 0(16 - 0^2)^{1/2}$

$y = 0$

$\boxed{\text{y-int: } (0, 0)}$

22. $y = (x - 1)\sqrt{x^2 + 1}$

$0 = (x-1)(x^2+1)^{1/2}$

$x = 1$

$x^2 + 1 = 0$

$x^2 \neq -1$

$\boxed{x = 1}$

$y = (0-1)\sqrt{0^2 + 1}$

$= -\sqrt{1} = -1$

$\boxed{\text{y-int: } (0, -1)}$

23. $y = \dfrac{2 - \sqrt{x}}{5x + 1}$

x-int:

$0 = 2 - \sqrt{x}$

$\sqrt{x} = 2$

$x = 2^2 = 4$

$\boxed{\text{x-int: } (4, 0)}$

y-int: $y = \dfrac{2 - \sqrt{0}}{5(0) + 1} = \dfrac{2}{1}$

$y = 2$

$\boxed{\text{y-int: } (0, 2)}$

24. $y = \dfrac{x^2 + 3x}{(3x + 1)^2}$

x-int:

$0 = x^2 + 3x$

$0 = x(x + 3)$

$x = 0,\ x = -3$

$\boxed{\text{x-int: } (0,0),\ (-3,0)}$

y-int:

$y = \dfrac{0^2 + 0}{(3(0) + 1)^2} = \dfrac{0}{1}$

$\boxed{\text{y-int: } (0, 0)}$

Finding Points of Intersection **In Exercises 57–62, find the points of intersection of the graphs of the equations.**

*Steps: 1) Solve both equations for <u>same</u> variable (y or x, whichever easier) (*substitution method or elimination method)

2) Set equations equal, solve for variable.

57. $x + y = 8$

$+ \quad 4x - y = 7$

$5x + 0 = 15$

$x = 3$

intersection: $(3) + y = 8$

$y = 5$

$\boxed{(3,5)}$

58. $3x - 2y = -4$

$+ \quad 4x + 2y = -10$

$7x + 0 = -14$

$x = -2$

$3(-2) - 2y = -4$

$-6 - 2y = -4$

$-2y = 2$

$y = -1$

$\boxed{(-2,-1)}$

59. $x^2 + y = 6$

$x + y = 4 \rightarrow y = 4 - x$

$x^2 + y = 6$

$x^2 + (4 - x) = 6$

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

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

$x = 2$	$x = -1$
$2 + y = 4$	$-1 + y = 4$
$y = 2$	$y = 5$

$\boxed{(2,2), (-1,5)}$

60. $x = 3 - y^2$

$y = x - 1$

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

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

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

$x^2 - 1x - 2 = 0$

$(x-2)(x+1) = 0$

$x = 2, \; x = -1$

$y = x - 1$

$y = 2 - 1 = 1$	$y = -1 - 1 = -2$
$(2,1)$	$(-1,-2)$

61. $x^2 + y^2 = 5$

$x - y = 1 \rightarrow x = y + 1$

$x^2 + y^2 = 5$

$(y+1)^2 + y^2 = 5$

$y^2 + 2y + 1 + y^2 = 5$

$2y^2 + 2y - 4 = 0$

$2(y^2 + y - 2) = 0$

$2(y+2)(y-1) = 0$

$y = -2, \; y = 1$

$x = y + 1$	$x = y + 1$
$x = -2 + 1 = -1$	$x = 1 + 1 = 2$
$(-1,-2)$	$(2,1)$

62. $x^2 + y^2 = 25$

$-3x + y = 15 \rightarrow y = 3x + 15$

$x^2 + (3x+15)^2 = 25$

$x^2 + 9x^2 + 90x + 225 - 25 = 0$

$10x^2 + 90x + 200 = 0$

$10(x^2 + 9x + 20) = 0$

$10(x+4)(x+5) = 0$

$x = -4, \; x = -5$

$y = 3x + 15$

$y = 3(-4) + 15$

$y = -12 + 15 = 3$

$y = 3(-5) + 15 = 0$

$\boxed{(-4,3) \text{ and } (-5,0)}$

Slope Formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $y = mx + b$ or $y - y_1 = m(x - x_1)$

Finding an Equation of a Line **In Exercises 17–22, find an equation of the line that passes through the point and has the indicated slope. Then sketch the line.**

Point Slope

13. $(6, 2)$ $m = 0$

x y

$y = mx + b$

$2 = 0(6) + b$

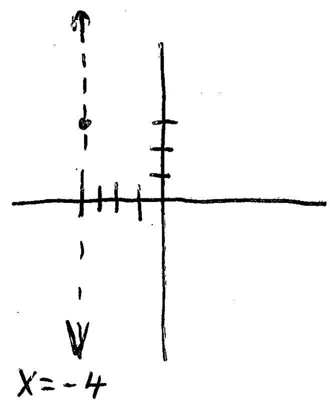
$2 = b$

$y = 0x + 2$

$\boxed{y = 2}$

Point Slope

14. $(-4, 3)$ m is undefined. (vertical line)



$\boxed{x = -4}$

Point Slope

15. $(1, 7)$ $m = -3$

$y = mx + b$

$7 = -3(1) + b$

$10 = b$

$\boxed{y = -3x + 10}$

Point Slope

16. $(-2, -2)$ $m = 2$

$y = mx + b$

$-2 = 2(-2) + b$

$-2 = -4 + b$

$2 = b$

$\boxed{y = 2x + 2}$

Point Slope

21. $(3, -2)$ $m = 3$

$y = mx + b$

$-2 = 3(3) + b$

$-2 = 9 + b$

$-11 = b$

$\boxed{y = 3x - 11}$

Point Slope

22. $(-2, 4)$ $m = -\frac{3}{5}$

$y = mx + b$

$4 = \frac{-3}{5}(-2) + b$

$4 = \frac{6}{5} + b$

$4 - \frac{6}{5} = b$

$\frac{20}{5} - \frac{6}{5} = \frac{14}{5} = b$

$\boxed{y = \frac{-3}{5}x + \frac{14}{5}}$

Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $\mathbf{y = mx + b}$ or $y - y_1 = m(x - x_1)$

Finding the Slope and *y*-Intercept **In Exercises 25–30, find the slope and the *y*-intercept (if possible) of the line.**

25. $y = \overset{m}{4}x - \overset{b}{3}$

$y = mx + b$

$$\boxed{\begin{array}{l}\text{slope: } m = 4 \\ \text{y-int: } b = -3\end{array}}$$

26. $-x + y = 1$

$y = x + 1 \rightarrow y = \overset{m}{1}x + \overset{b}{1}$

$$\boxed{\begin{array}{l}m = 1 \\ b = 1\end{array}}$$

27. $x + 5y = 20$

$5y = -1x + 20$

$y = \frac{-1}{5}x + \frac{20}{5}$

$y = \frac{-1}{5}x + 4$

$$\boxed{\begin{array}{l}m = \frac{-1}{5} \\ b = 4\end{array}}$$

28. $6x - 5y = 15$

$6x - 15 = 5y$

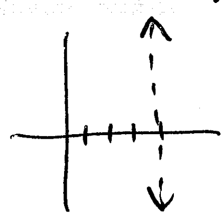
$5y = 6x - 15$

$y = \frac{6}{5}x - \frac{15}{5}$

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

$$\boxed{\begin{array}{l}m = 6/5 \\ b = -3\end{array}}$$

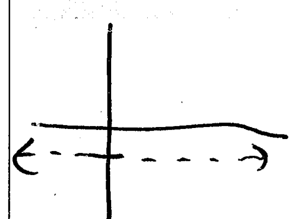
29. $x = 4$ vertical line



$m = \text{undefined}$

no y-intercept

30. $y = -1$



$$\boxed{\begin{array}{l}\text{slope: } m = 0 \\ \text{y-int: } b = -1\end{array}}$$

Finding an Equation of a Line **In Exercises 39–46, find an equation of the line that passes through the points. Then sketch the line.**

40. $(\overset{x_1}{-2}, \overset{y_1}{-2}), (\overset{x_2}{1}, \overset{y_2}{7})$

$m = \frac{7 - -2}{1 - -2} = \frac{9}{3} = 3$

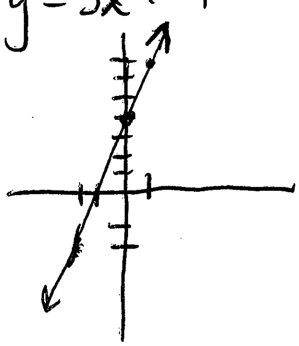
$y = mx + b$

$7 = 3(1) + b$

$7 = 3 + b$

$b = 4$

$y = 3x + 4$



42. $(-3, 6), (1, 2)$

$m = \frac{2-6}{1--3} = \frac{-4}{4} = -1$

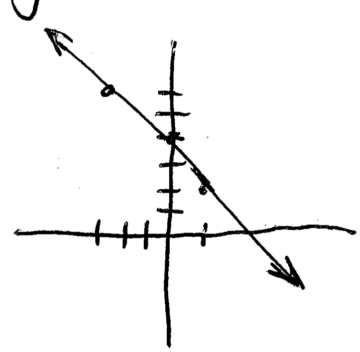
$y = mx + b$

$2 = -1(1) + b$

$2 = -2 + b$

$4 = b$

$y = -1x + 4$



Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $\mathbf{y = mx + b}$ or $\boldsymbol{y - y_1 = m(x - x_1)}$

Finding Parallel and Perpendicular Lines **In Exercises 55–62, write the general forms of the equations of the lines through the point (a) parallel to the given line and (b) perpendicular to the given line.**

Parallel Lines: #57-58 Perpendicular Lines: #59,62
Both Parallel and Perpendicular Lines: #55-56

Parallel means same slope

Perpendicular means opposite reciprocal to given slope

$$m_2 = -\frac{1}{m_1}$$

57. (2, 5) $x - y = -2$

*parallel

$x + 2 = y$
$y = x + 2$
$m = 1$

$y = mx + b$
$5 = 1(2) + b$
$5 = 2 + b$
$3 = b$

$\boxed{y = 1x + 3}$

58. (−3, 2) $x + y = 7$

*parallel

$y = -1x + 7$
$m = -1$

$y = mx + b$
$2 = -1(-3) + b$
$2 = 3 + b$
$-1 = b$

$\boxed{y = -1x - 1}$

59. (2, 1) $4x - 2y = 3$

* perpendicular

$4x - 3 = 2y$
$2y = 4x - 3$
$y = \frac{4}{2}x - \frac{3}{2}$
$y = 2x - 3/2$
$m = 2$
$m_2 = -\frac{1}{2}$

$y = mx + b$
$1 = -\frac{1}{2}(2) + b$
$1 = -1 + b$
$2 = b$

$\boxed{y = -\frac{1}{2}x + 2}$

62. (4, −5) $3x + 4y = 7$

*perpendicular

$4y = -3x + 7$
$y = \frac{-3}{4}x + \frac{7}{4}$
$m_1 = \frac{-3}{4}$
$m_2 = \frac{4}{3}$

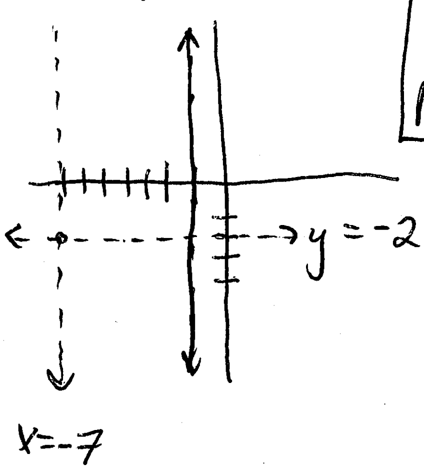
$y = mx + b$
$-5 = \frac{4}{3}(4) + b$
$-5 = \frac{16}{3} + b$
$-5 - \frac{16}{3} = b \rightarrow -\frac{31}{3} = b$

$\boxed{y = \frac{4}{3}x - \frac{31}{3}}$

55. (−7, −2) $x = 1$

* both

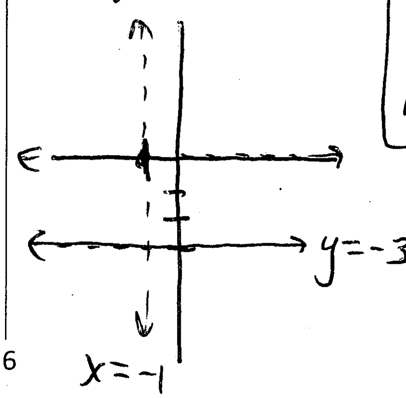
parallel: $x = -7$
perpendicular: $y = -2$



56. (−1, 0) $y = -3$

*both

parallel: $y = 0$
perpendicular: $x = -1$



Slope Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$ Equation of line: $y = mx + b$ or $y - y_1 = m(x - x_1)$

Evaluating a Function In Exercises 1–10, evaluate the function at the given value(s) of the independent variable. Simplify the results.

1. $f(x) = 7x - 4$

(a) $f(0)$ (b) $f(-3)$

(c) $f(b)$ (d) $f(x - 1)$

a) $f(0) = 7(0) - 4 = \boxed{-4}$

b) $f(-3) = 7(-3) - 4 = -21 - 4 = \boxed{-25}$

c) $f(b) = 7(b) - 4 = \boxed{7b - 4}$

d) $f(x-1) = 7(x-1) - 4$

$= 7x - 7 - 4$

$= \boxed{7x - 11}$

2. $f(x) = \sqrt{x + 5}$

(a) $f(-4)$ (b) $f(11)$

(c) $f(4)$ (d) $f(x + \Delta x)$

a) $f(-4) = \sqrt{-4+5} = \sqrt{1} = \boxed{1}$

b) $f(11) = \sqrt{11+5} = \sqrt{16} = \boxed{4}$

c) $f(4) = \sqrt{4+5} = \sqrt{9} = \boxed{3}$

d) $f(x+\Delta x) = \boxed{\sqrt{x+\Delta x+5}}$

3. $g(x) = 5 - x^2$

(a) $g(0)$ (b) $g(\sqrt{5})$

(c) $g(-2)$ (d) $g(t - 1)$

a) $g(0) = 5 - 0^2 = \boxed{5}$

b) $g(\sqrt{5}) = 5 - \sqrt{5}^2 = 5 - 5 = \boxed{0}$

c) $g(-2) = 5 - (-2)^2 = 5 - 4 = \boxed{1}$

d) $g(t-1) = 5 - (t-1)^2$

$= 5 - (t^2 - 2t + 1)$

$= 5 - t^2 + 2t - 1$

$= \boxed{4 - t^2 + 2t}$

4. $g(x) = x^2(x - 4)$

(a) $g(4)$ (b) $g(\frac{3}{2})$

(c) $g(c)$ (d) $g(t + 4)$

a) $g(4) = 4^2(4-4) = 16(0) = \boxed{0}$

b) $g(\frac{3}{2}) = (\frac{3}{2})^2(\frac{3}{2} - 4) = (\frac{9}{4})(\frac{-5}{2}) = \boxed{\frac{-45}{8}}$

c) $g(c) = c^2(c-4) = \boxed{c^3 - 4c^2}$

d) $g(t+4) = (t+4)^2(t+4-4)$

$= \boxed{t(t+4)^2}$

Evaluating a Function In Exercises 1–10, evaluate the function at the given value(s) of the independent variable. Simplify the results.

$f(x+\Delta x) = (x+\Delta x)^3$

7. $f(x) = x^3$

$\dfrac{f(x + \Delta x) - f(x)}{\Delta x}$

$\dfrac{(x+\Delta x)^3 - x^3}{\Delta x}$

8. $f(x) = 3x - 1$ $\quad f(1) = 3(1) - 1 = 2$

$\dfrac{f(x) - f(1)}{x - 1}$

$\dfrac{3x-1-2}{x-1} = \dfrac{3x-3}{x-1} = \dfrac{3\cancel{(x-1)}}{\cancel{(x-1)}}$

$= \boxed{3}$

9. $f(x) = \dfrac{1}{\sqrt{x-1}}$ $\quad f(2) = \dfrac{1}{\sqrt{2-1}} = 1$

$\dfrac{f(x) - f(2)}{x - 2}$

$\dfrac{\frac{1}{\sqrt{x-1}} - 1}{x-2} = \dfrac{\frac{1-\sqrt{x-1}}{\sqrt{x-1}}}{x-2}$

10. $f(x) = x^3 - x$ $\quad f(1) = 1^3 - 1 = 0$

$\dfrac{f(x) - f(1)}{x - 1}$

$\dfrac{x^3 - x - 0}{x-1} = \dfrac{x(x^2-1)}{x-1}$

$= \dfrac{x(x+1)\cancel{(x-1)}}{\cancel{(x-1)}} = \boxed{x(x+1)}$

Evaluate the Function as indicated (#29 – #31)

29. $f(x) = \begin{cases} 2x + 1, & x < 0 \\ 2x + 2, & x \ge 0 \end{cases}$

(a) $f(-1)$ (b) $f(0)$ (c) $f(2)$ (d) $f(t^2 + 1)$

$f(-1) = 2(-1) + 1 = -1$

$f(0) = 2(0) + 2 = 2$

$f(2) = 2(2) + 2 = 6$

$f(t^2+1) = 2(t^2+1) + 2$

$= 2t^2 + 2 + 2 = \boxed{2t^2 + 4}$

30. $f(x) = \begin{cases} x^2 + 2, & x \le 1 \\ 2x^2 + 2, & x > 1 \end{cases}$

(a) $f(-2)$ (b) $f(0)$ (c) $f(1)$ (d) $f(s^2 + 2)$

$f(-2) = (-2)^2 + 2 = \boxed{6}$

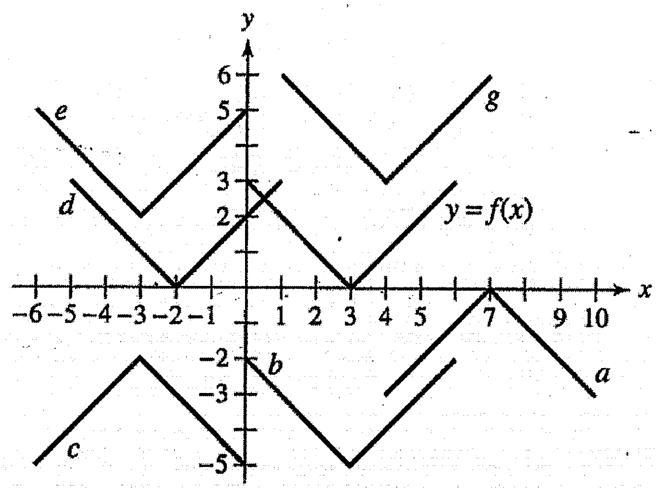
$f(0) = 0^2 + 2 = \boxed{2}$

$f(1) = 1^2 + 2 = \boxed{3}$

$f(s^2+2) = 2(s^2+2) + 2$

$= 2s^2 + 4 + 2 = \boxed{2s^2+6}$

Matching **In Exercises 55–60, use the graph of $y = f(x)$ to match the function with its graph.**



55. $y = f(x + 5)$

*shift graph of $f(x)$ left 5 units.

$\boxed{\text{graph } d}$

56. $y = f(x) - 5$

*shift graph $f(x)$ down 5 units

$\boxed{\text{graph } b}$

57. $y = -f(-x) - 2$

$f(x)$ graph is ① reflected over x-axis ② reflected over y-axis ③ shift down 2 units

$\boxed{\text{graph } c}$

58. $y = -f(x - 4)$

$f(x)$ graph is ① reflected over x-axis and ② shifted right 4 units

$\boxed{\text{graph } a}$

59. $y = f(x + 6) + 2$

$f(x)$ graph is ① shift left 6 units and ② shift 2 units up.

$\boxed{\text{graph } e}$

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

$f(x)$ is ① shifted right 1 unit and ② shifted up 3 units

$\boxed{\text{graph } g}$

General Function

$y = f(x)$

Transformed Function

$y = af(x \pm h) \pm k$

vertical reflections, vertical stretches and compressions

horizontal shift h units, opposite direction of sign

vertical shift k units, same direction as sign

$f(x) = -3\sqrt{2(x+4)} - 1$

Vertical stretch by a factor of 3

Horizontal translation 4 units left

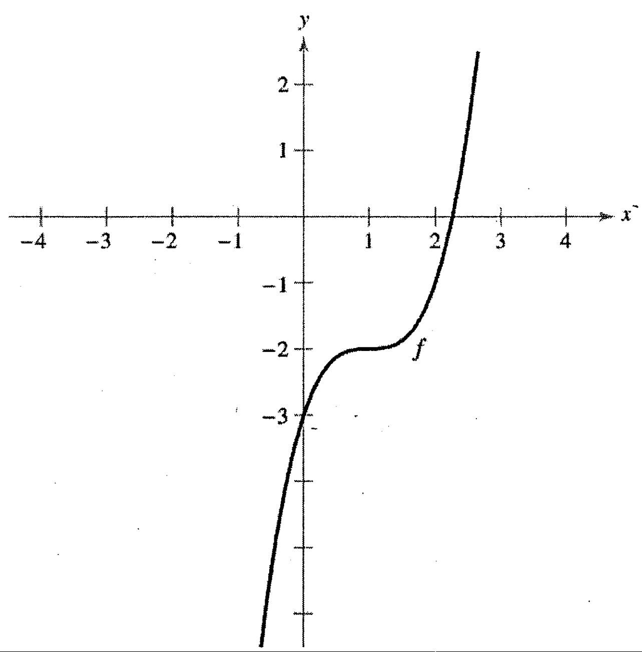
Vertical translation 1 unit down

Reflection in the x-axis

Horizontal compression by a factor of $\frac{1}{2}$

Sketching Transformations Use the graph of f shown in the figure to sketch the graph of each function. To print an enlarged copy of the graph, go to *MathGraphs.com.*

Use the graph of f shown in the figure to sketch the graph of each function.



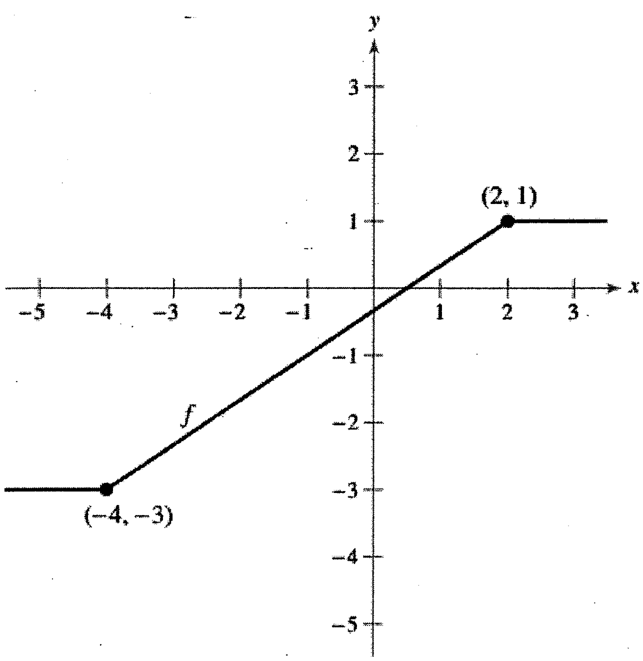
61)

(b) $f(x-1) \rightarrow f(x)$ shifted right 1 unit.

(d) $f(x) - 4 \rightarrow f(x)$ shifted down 4 units

(f) $\frac{1}{4}f(x) \rightarrow f(x)$ is compressed by (vertically) factor of $\frac{1}{4}$.

(g) $-f(x) \rightarrow f(x)$ is reflected over x-axis.



62)

(a) $f(x-4) \rightarrow f(x)$ shifts right 4 units

(c) $f(x) + 4 \rightarrow f(x)$ shifts up 4 units

(e) $2f(x) \rightarrow f(x)$ stretches by factor of 2.

(g) $f(-x) \rightarrow f(x)$ reflection over the y-axis.