Function Notation

Ex: $y = 2x + 3$

dom(x): all reals

ran (y): all reals

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

dom(x): $x \neq 2$ $(-\infty, 2) \cup (2, +\infty)$

ran (y): $y \neq 0$

$y = \sqrt{x+3}$ $x+3 \geq 0$

dom(x): $x \geq -3$ $[-3, +\infty)$

ran (y): $y \geq 0$ ✓

Notation

Instead of writing

$$y = 2x + 3$$

I could write

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

"f of x"

$$f(4) = 2(4) + 3 = 11$$

$$f(0) = 2(0) + 3 = 3$$

$$f(-3) = 2(-3) + 3 = -3$$

$$f(w) = 2w + 3$$

$$h(x) = x^2 - 3x + 5$$

$$h(0) = 0^2 - 3(0) + 5 = 5$$

$$h(2) = (2)^2 - 3(2) + 5 = 4 - 6 + 5 = 3$$

$$h(q) = q^2 - 3q + 5$$

$$h(x+1) = (x+1)^2 - 3(x+1) + 5$$

$$= x^2 + 2x + 1 - 3x - 3 + 5$$

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

Ex: (p 76)

In Exercises 3–14, evaluate $f(3)$, $f(-1)$, and $f(0)$.

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

$f(3) = -13$

$f(-1) = 3$

$f(0) = -1$

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

$f(3) = -13$

$f(-1) = -5$

$f(0) = -4$

$f(3) = -(3)^2 - 4$

$= -9 - 4$

$f(-1) = -(-1)^2 - 4$

$= -1 - 4$

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

14. $f(t) = \dfrac{t^2+1}{t-2}$

$f(3) = 10$

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

$f(0) = -\dfrac{1}{2}$

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

In Exercises 23–32, evaluate $g(-x)$, $g(2x)$, and $g(a+h)$.

24. $g(x) = \sqrt{5}$

$g(-x) = \sqrt{5}$ $g(2x) = \sqrt{5}$ $g(a+h) = \sqrt{5}$

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

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

$g(2x) = (2x)^2 + 6(2x) - 1 = 4x^2 + 12x - 1$

$g(a+h) = (a+h)^2 + 6(a+h) - 1$

In Exercises 43–56, find the domain of each function. Write your answer in interval notation.

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

46. $h(y) = \dfrac{1}{y + 2}$

50. $f(x) = \dfrac{2}{x^2 - 9}$

52. $F(w) = \sqrt{-4 - w}$

54. $h(s) = \dfrac{3}{s^2 + 3}$

56. $g(x) = \dfrac{3}{\sqrt{8 - x}}$

1.2: Graphs of Functions

origin
x-axis
y-axis
quadrant

Ex: (p 87)

Are the following functions:

8. $S = \{(-4, -1), (1, -1), (2, 0), (3, -1)\}$

12. $S = \{(-3, -3), (-2, 2), (0, 0), (1, 1)\}$

Fill in the tables below:

14.

x	-6	-3	0	3	6
$f(x) = \frac{1}{3}x + 2$					

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Graph the following:

18. $g(x) = -3x + 4$

22. $f(x) = \frac{3}{2}x + 3$

26. $H(x) = 7$

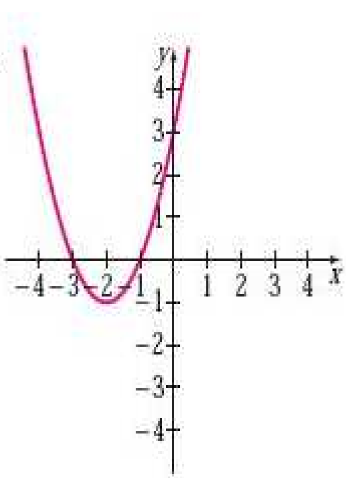
28. $h(x) = -x^2 + 1$

32. $g(t) = \sqrt{t - 3}$

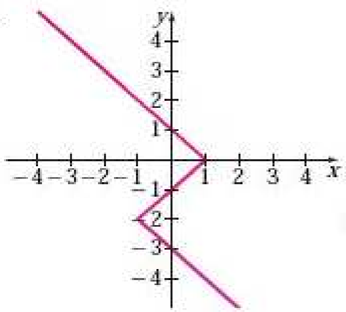
46. $f(x) = x^3 - 3$

Are the following functions:

48.

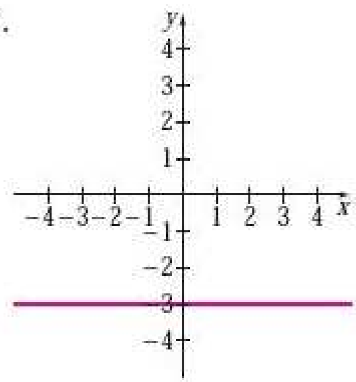


50.

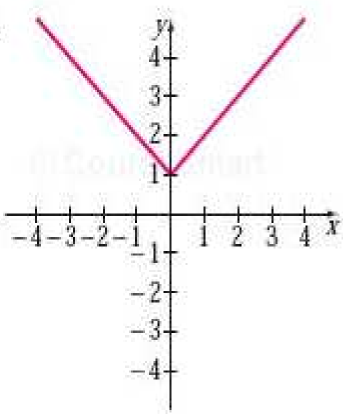


Find the domain and range:

52.

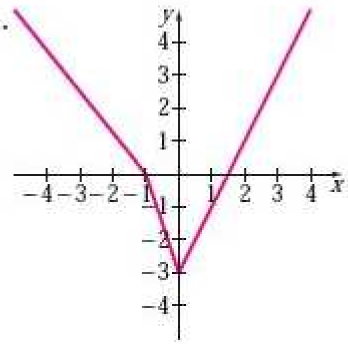


54.

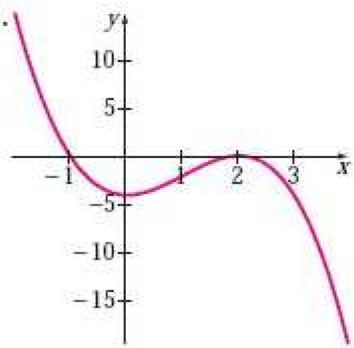


In Exercises 61–68, for each function f given by the graph, find an approximate value of (a) $f(-1)$, $f(0)$, and $f(2)$; (b) the domain of f; and (c) the x- and y-intercepts of the graph of f.

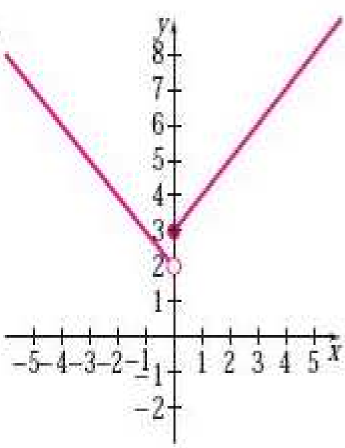
64.



66.



68.



1.3: Linear Functions

Definition of a Linear Function

A **linear function** $f(x)$ is defined as $f(x) = mx + b$, where m and b are constants.

Definition of Slope

The **slope** of a line containing the points (x_1, y_1) and (x_2, y_2) is given by $m = \frac{y_2 - y_1}{x_2 - x_1}$, where $x_1 \neq x_2$.

Definition of x- and y-intercepts

- The point where the graph of the line $y = mx + b$ crosses the y-axis, $(0, b)$, is called the **y-intercept.** Notice that the x-coordinate of the y-intercept is 0.
- The point where the graph of a nonhorizontal line $y = mx + b$ crosses the x-axis is called the **x-intercept.** Since the y-coordinate of the x-intercept is 0, the x-intercept is found by setting the expression $mx + b$ equal to 0 and solving for x.

Slope-Intercept Form of the Equation of a Line

The **slope-intercept form** of the equation of a line with slope m and y-intercept $(0, b)$ is given by

$$y = mx + b.$$

Equation of a Horizontal Line

The **equation of the horizontal line** passing through (x_1, y_1) is

$$y = y_1.$$

Equation of a Vertical Line

The **equation of the vertical line** passing through (x_1, y_1) is

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$$x = x_1.$$

Slopes of Parallel Lines

Two different nonvertical lines are parallel if and only if they have the same slope. Vertical lines are always parallel.

Slopes of Perpendicular Lines

Two lines with slopes m_1 and m_2 are perpendicular if and only if

$$m_1 m_2 = -1 \quad \text{or, equivalently,} \quad m_2 = -\frac{1}{m_1}.$$

Ex: (p 102)

6. $\frac{3}{4}(y + 4) = 12$

8. Which of the following are linear functions? Explain your answers.

(a) $h(s) = \frac{1}{3}s + 1$

(b) $H(x) = \frac{2}{x^2} + 1$

(c) $g(x) = 3$

(d) $f(t) = -3\sqrt{t}$

Find the slope of the line through the given points:

10. $(-1, 2)$ and $(0, -2)$

12. $(4, -1)$ and $(4, 2)$

14. $(3, 0)$ and $(0, -4)$

16. $(4, 1)$ and $(2, 4)$

Solve for y

38. $y - 1 = \frac{3}{5}(x - 10)$

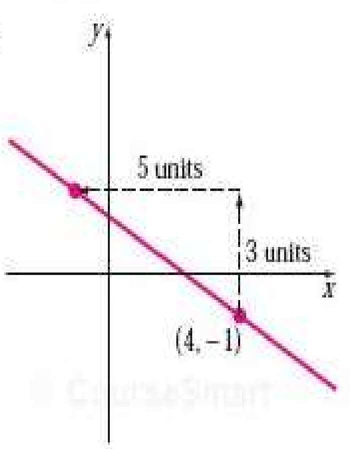
42. $4x + 3y + 8 = 0$

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

Find an equation of the line, given:

54. $(-3, 2)$ and $(5, 0)$

62.



74. Slope: 3; y-intercept: (0, 5)

78. Slope: $\frac{2}{3}$; passes through (2, −3)

84. x-intercept: (−3, 0); y-intercept: $\left(0, -\frac{3}{2}\right)$

90. Vertical line through (−2, 0)

92. Parallel to the line $y = 2x + 5$ and passing through (0, 3)

98. Perpendicular to the line $y = -\frac{1}{4}x$ and passing through (0, −2)

106. Parallel to the line $y = 3$ and passing through (1, −2)