

## Exercise Set 1.1

Graph.

1.  $y = -4$

2.  $y = -3.5$

3.  $x = -4.5$

4.  $x = 10$

Graph. Find the slope and the y-intercept.

5.  $y = -3x$

6.  $y = -0.5x$

7.  $y = 0.5x$

8.  $y = 3x$

9.  $y = -2x + 3$

10.  $y = -x + 4$

11.  $y = -x - 2$

12.  $y = -3x + 2$

Find the slope and the y-intercept.

13.  $2x + y - 2 = 0$

14.  $2x - y + 3 = 0$

15.  $2x + 2y + 5 = 0$

16.  $3x - 3y + 6 = 0$

17.  $x = 2y + 8$

18.  $x = -4y + 3$

Find an equation of the line:

19. with  $m = -5$ , containing  $(1, -5)$ .

20. with  $m = 7$ , containing  $(1, 7)$ .

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

22. with  $m = -3$ , containing  $(5, -2)$ .

23. with slope 2, containing  $(3, 0)$ .

24. with slope  $-5$ , containing  $(5, 0)$ .

25. with y-intercept  $(0, -6)$  and slope  $\frac{1}{2}$ .

26. with y-intercept  $(0, 7)$  and slope  $\frac{4}{3}$ .

27. with slope 0, containing  $(2, 3)$ .

28. with slope 0, containing  $(4, 8)$ .

Find the slope of the line containing the given pair of points, if it exists.

29.  $(-4, -2)$  and  $(-2, 1)$

30.  $(-2, 1)$  and  $(6, 3)$

31.  $(\frac{2}{3}, \frac{1}{2})$  and  $(-3, \frac{4}{5})$

32.  $(-\frac{3}{4}, \frac{5}{8})$  and  $(-\frac{1}{2}, -\frac{3}{16})$

33.  $(3, -7)$  and  $(3, -9)$

34.  $(-4, 2)$  and  $(-4, 10)$

35.  $(2, 3)$  and  $(-1, 3)$

36.  $(-6, \frac{1}{2})$  and  $(-7, \frac{1}{2})$

37.  $(x, 3x)$  and  $(x + h, 3(x + h))$

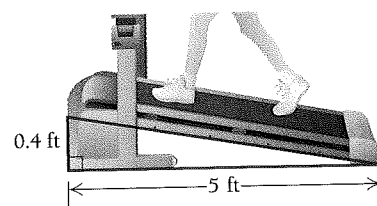
38.  $(x, 4x)$  and  $(x + h, 4(x + h))$

39.  $(x, 2x + 3)$  and  $(x + h, 2(x + h) + 3)$

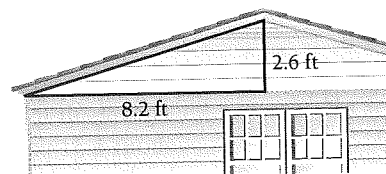
40.  $(x, 3x - 1)$  and  $(x + h, 3(x + h) - 1)$

41.–52. Find an equation of the line containing the pair of points in each of Exercises 29–40.

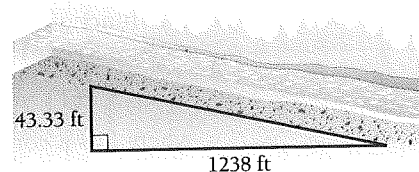
53. Find the slope (or grade) of the treadmill.



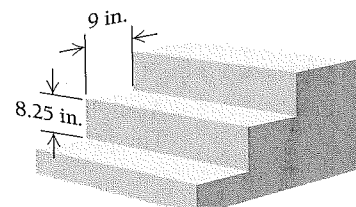
54. Find the slope (or pitch) of the roof.



55. Find the slope (or head) of the river.

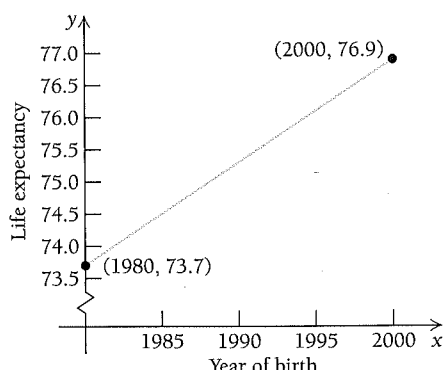


56. North Carolina state law requires that stairs have minimum treads (or width) of 9 in. and maximum risers (or height) of 8.25 in.<sup>4</sup> According to North Carolina law, what is the maximum grade of stairs in North Carolina?



<sup>4</sup>North Carolina Office of the State Fire Marshall.

57. Find the average rate of change of life expectancy at birth.<sup>5</sup>



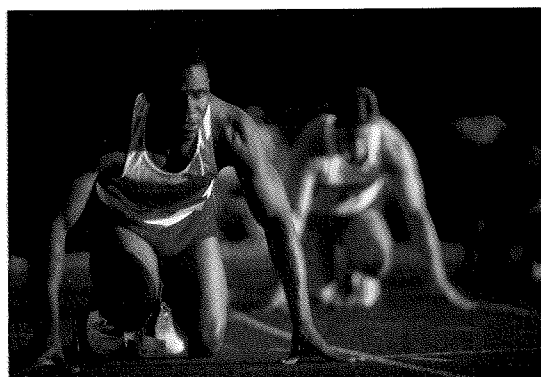
58. *Celsius and Fahrenheit.* If the temperature is  $C$  degrees Celsius, then the temperature is also  $F$  degrees Fahrenheit, where

$$F(C) = \frac{9}{5}C + 32.$$

- Find  $F(-10)$ ,  $F(0)$ ,  $F(10)$ , and  $F(40)$ .
  - Suppose the outside temperature is 30 degrees Celsius. What is the temperature in degrees Fahrenheit?
  - What temperature is the same in both degrees Fahrenheit and in degrees Celsius?
59. *Energy Conservation.* The R-factor of home insulation is directly proportional to its thickness  $T$ .
- Find an equation of variation if  $R = 12.51$  when  $T = 3$  in.
  - What is the R-factor for insulation that is 6 in. thick?
60. *Nerve Impulse Speed.* Impulses in nerve fibers travel at a speed of 293 ft/sec. The distance  $D$  traveled in  $t$  seconds is given by  $D = 293t$ . How long would it take an impulse to travel from the brain to the toes of a person who is 6 ft tall?
61. *Brain Weight.* The weight  $B$  of a human's brain is directly proportional to his or her body weight  $W$ .
- It is known that a person who weighs 200 lb has a brain that weighs 5 lb. Find an equation of variation expressing  $B$  as a function of  $W$ .
  - Express the variation constant as a percent and interpret the resulting equation.
  - What is the weight of the brain of a person who weighs 120 lb?

62. *Muscle Weight.* The weight  $M$  of the muscles in a human is directly proportional to his or her body weight  $W$ .

- It is known that a person who weighs 200 lb has 80 lb of muscles. Find an equation of variation expressing  $M$  as a function of  $W$ .
- Express the variation constant as a percent and interpret the resulting equation.
- What is the muscle weight of a person who weighs 120 lb?

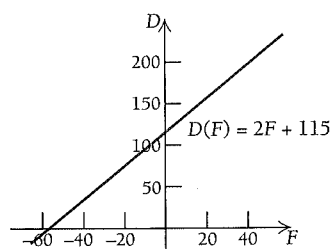


Muscle weight is directly proportional to body weight.

63. *Stopping Distance on Glare Ice.* The stopping distance (at some fixed speed) of regular tires on glare ice is given by

$$D(F) = 2F + 115,$$

where  $D(F)$  is the stopping distance, in feet, when the air temperature is  $F$ , in degrees Fahrenheit.



- Find  $D(0^\circ)$ ,  $D(-20^\circ)$ ,  $D(10^\circ)$ , and  $D(32^\circ)$ .
- tw b) Explain why the domain should be restricted to the interval  $[-57.5^\circ, 32^\circ]$ .
64. *Reaction Time.* While driving a car, you see a person suddenly cross the street unattended. Your brain registers the emergency and sends a signal to your foot to hit the brake. The car travels a distance  $D$ , in feet, during this time, where  $D$  is a function of

<sup>5</sup>National Center for Health Statistics.

## Exercise Set 1.2

Using the same set of axes, graph the pair of equations.

1.  $y = \frac{1}{2}x^2$  and  $y = -\frac{1}{2}x^2$
2.  $y = \frac{1}{4}x^2$  and  $y = -\frac{1}{4}x^2$
3.  $y = x^2$  and  $y = (x - 1)^2$
4.  $y = x^2$  and  $y = (x - 3)^2$
5.  $y = x^2$  and  $y = (x + 1)^2$
6.  $y = x^2$  and  $y = (x + 3)^2$
7.  $y = x^3$  and  $y = x^3 + 1$
8.  $y = x^3$  and  $y = x^3 - 1$

For each of the following, state whether the graph of the function is a parabola. If the graph is a parabola, then find the parabola's vertex.

9.  $y = x^2 + 4x - 7$
10.  $y = x^3 - 2x + 3$
11.  $y = 2x^4 - 4x^2 - 3$
12.  $y = 3x^2 - 6x$

Graph.

13.  $y = x^2 - 4x + 3$
14.  $y = x^2 - 6x + 5$
15.  $y = -x^2 + 2x - 1$
16.  $y = -x^2 - x + 6$
17.  $y = 2x^2 + 4x - 7$
18.  $y = 3x^2 - 9x + 2$
19.  $y = \frac{1}{2}x^2 + 3x - 5$
20.  $y = \frac{1}{3}x^2 + 4x - 2$

Solve.

21.  $x^2 - 2x = 2$
22.  $x^2 - 2x + 1 = 5$
23.  $3y^2 + 8y + 2 = 0$
24.  $2p^2 - 5p = 1$

Solve. Some of your answers may involve  $i$ .

25.  $x^2 - 2x + 10 = 0$
26.  $x^2 + 6x + 10 = 0$
27.  $x^2 + 6x = 1$
28.  $x^2 + 4x = 3$
29.  $x^2 + 4x + 8 = 0$
30.  $x^2 + 10x + 27 = 0$
31.  $4x^2 = 4x + 1$
32.  $-4x^2 = 4x - 1$

### APPLICATIONS

33. *Fruit Stacking.* The number of oranges stacked in a pyramid is approximated by the function

$$f(x) = \frac{1}{6}x^3 + \frac{1}{2}x^2 + \frac{1}{3}x,$$

where  $f(x)$  is the number of oranges and  $x$  is the number of layers. Find the number of oranges when the number of layers is 7, 10, and 12.

34. *NBA Payrolls.* The average payroll  $P$  (in millions of dollars) for teams in the National Basketball Association (NBA) can be approximated by

$$P = 4.8565 + 0.2841x + 0.1784x^2,$$

where  $x$  is the number of years since the 1985–86 season.

- a) Estimate the average payroll for the 2009–10 season.
  - b) Use the quadratic formula to predict when the average NBA payroll will be \$100 million.
35. *Baseball Ticket Prices.* The average ticket price for a major league baseball game can be modeled by the function

$$p(x) = 9.41 - 0.19x + 0.09x^2,$$

where  $x$  is the number of years after 1990.<sup>6</sup> Use the quadratic formula to predict when the average price of a ticket will be \$50.

36. *Target Weight.* The target weight  $w$  for an adult man of medium build is

$$w(h) = 0.0728h^2 - 6.986h + 289,$$

where  $h$  is in inches (for  $62 \leq h \leq 76$ ) and  $w$  is in pounds.<sup>7</sup>

- a) Find the target weight of an adult man of medium build who is 6 ft (72 in.) tall.
- b) If a man of medium build has achieved his target weight of 170 lb, how tall is he?

### SYNTHESIS

37. Let  $f(x) = x^3 - x^2$ .

- tW a) For very large values of  $x$ , is  $x^3$  or  $x^2$  larger? Explain.
- tW b) Use (a) to describe what  $f(x)$  looks like when  $x$  is very large.
- c) Use a grapher to plot the graph of  $f(x)$  for  $100 \leq x \leq 200$ . Does the graph confirm (b)?

38. Let  $f(x) = x^4 - 10x^3 + 3x^2 - 2x + 7$ .

- tW a) For very large values of  $x$ , is  $x^4$  or  $|-10x^3 + 3x^2 - 2x + 7|$  larger? Explain.
- tW b) Use (a) to describe what  $f(x)$  looks like when  $x$  is very large.

<sup>6</sup>Major League Baseball.

<sup>7</sup>Metropolitan Life Insurance Company.