1. Assume that *y* is directly proportional to *x*. Use the given *x*-value and *y*-value to find a linear model that relates *y* and *x*.

$x = 5, y = 24$

a. $y = -\frac{24}{5}x$

b. $y = 24x$

c. $y = -\frac{5}{24}x$

d. $y = \frac{24}{5}x$

e. $y = \frac{5}{24}x$

2. Assume that *y* is directly proportional to *x*. Use the given *x*-value and *y*-value to find a linear model that relates *y* and *x*.

$x = 2, y = 58$

a. $y = 29x$

b. $y = -29x$

c. $y = 58x$

d. $y = -58x$

e. $y = 29$

3. Assume that *y* is directly proportional to *x*. Use the given *x*-value and *y*-value to find a linear model that relates *y* and *x*.

$x = 38, y = 2400$

a. $y = \frac{1200}{19}x$

b. $y = -2400x$

c. $y = \frac{19}{1200}x$

d. $y = -\frac{19}{1200}x$

e. $y = -\frac{1200}{19}x$

4. The simple interest on an investment is directly proportional to the amount of the investment. By investing $2400 in a certain bond issue, you obtained an interest payment of $111.75 after 1 year. Find a mathematical model that gives the interest I for this bond issue after 1 year in terms of the amount invested P. (Round your answer to three decimal places.)

a. $I = 0.047P$
b. $I = 268{,}200P$
c. $I = 21.477P$
d. $I = 2400P$
e. $I = 111.75P$

5. The simple interest on an investment is directly proportional to the amount of the investment. By investing $5800 in a municipal bond, you obtained an interest payment of $221.25 after 1 year. Find a mathematical model that gives the interest I for this municipal bond after 1 year in terms of the amount invested P. (Round your answer to three decimal places.)

a. $I = 26.215P$
b. $I = 221.25P$
c. $I = 0.038P$
d. $I = 1{,}283{,}250P$
e. $I = 5800P$

6. On a yardstick with scales in inches and centimeters, you notice that 31 inches is approximately the same length as 79 centimeters. Use this information to find a mathematical model that relates centimeters y to inches x. Then use the model to find the numbers of centimeters in 10 inches and 20 inches. (Round your answer to one decimal place.)

a. Model: $y = \frac{31}{79}x$; 3.9 cm, 7.8 cm
b. Model: $y = \frac{79}{31}x$; 25.5 cm, 7.8 cm
c. Model: $y = \frac{79}{31}x$; 3.9 cm, 51 cm
d. Model: $y = \frac{79}{31}x$; 25.5 cm, 51 cm
e. Model: $y = \frac{31}{79}x$; 25.5 cm, 51 cm

7. When buying gasoline, you notice that 22 gallons of gasoline is approximately the same amount of gasoline as 83 liters. Use this information to find a linear model that relates liters y to gallons x. Then use the model to find the numbers of liters in 5 gallons and 25 gallons. (Round your answer to one decimal place.)

a. Model: $y = \frac{22}{83}x$; 1.3 L, 6.6 L
b. Model: $y = \frac{83}{22}x$; 18.9 L, 6.6 L
c. Model: $y = \frac{83}{22}x$; 1.3 L, 94.3 L
d. Model: $y = \frac{83}{22}x$; 18.9 L, 94.3 L
e. Model: $y = \frac{22}{83}x$; 18.9 L, 94.3 L

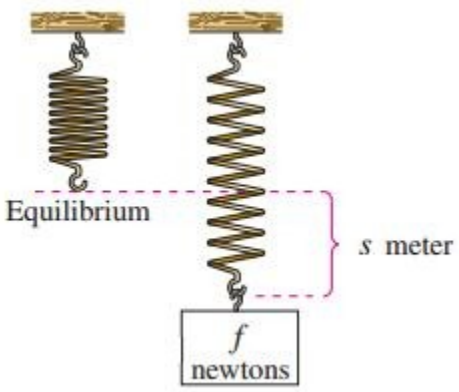
8. Property tax is based on the assessed value of a property. A house that has an assessed value of $100,000 has a property tax of $4,920. Find a mathematical model that gives the amount of property tax y in terms of the assessed value x of the property. Use the model to find the property tax on a house that has an assessed value of $230,000. (Round your answer to four decimal places.)

a. $y = 0.0492x;\ \$230{,}000$
b. $y = 0.0492x;\ \$11{,}316$
c. $y = 20.3252x;\ \$11{,}316$
d. $y = 20.3252x;\ \$4{,}674{,}797$
e. $y = 0.0492x;\ \$4{,}674{,}797$

9. State sales tax is based on retail price. An item that sells for $176.99 has a sales tax of $10.40. Find a mathematical model that gives the amount of sales tax y in terms of the retail price x. Use the model to find the sales tax on a $569.99 purchase. (Round your answer to four decimal places.)

a. $y = 17.0183x;\ \$33.52$
b. $y = 0.0588x;\ \$33.52$
c. $y = 0.0588x;\ \$569.99$
d. $y = 0.0588x;\ \$9{,}700$
e. $y = 17.0183x;\ \$9{,}700$

10. A force of $f = 245$ newtons stretches a spring $s = 0.5$ meter (see figure).



How far will a force of 90 newtons stretch the spring? What force is required to stretch the spring 0.3 meter? (Round your answer to two decimal places.)

a. 0.5 m; 147 N
b. 0.5 m; 245 N
c. 0.18 m; 147 N
d. 0.09 m; 285 N
e. 0.18 m; 245 N

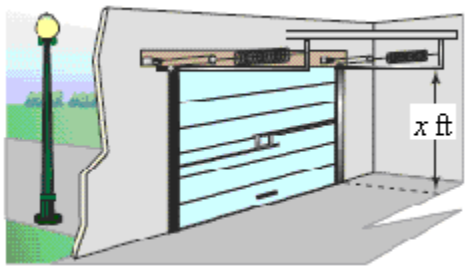
11. A force of 270 newtons stretches a spring 0.18 meter. What force is required to stretch the spring 0.19 meter?

a. 295 N
b. 290 N
c. 285 N
d. 280 N
e. 270 N

12. The coiled spring of a toy supports the weight of a child. The spring is compressed a distance of 1.6 inches by the weight of a 35-pound child. The toy will not work properly if its spring is compressed more than 6 inches. What is the weight of the heaviest child who should be allowed to use the toy? (Round your answer to two decimal places.)

a. 136.25 lb
b. 126.25 lb
c. 131.25 lb
d. 35 lb
e. 141.25 lb

13. An overhead garage door has two springs, one on each side of the door (see figure). A force of 20 pounds is required to stretch each spring 1 foot. Because of a pulley system, the springs stretch only one-half the distance the door travels. The door moves a total of $x = 18$ feet, and the springs are at their natural length when the door is open. Find the combined lifting force applied to the door by the springs when the door is closed.



a. Combined lifting force $= 2F = 356$ lb
b. Combined lifting force $= 2F = 360$ lb
c. Combined lifting force $= 2F = 362$ lb
d. Combined lifting force $= 2F = 358$ lb
e. Combined lifting force $= 2F = 364$ lb

14. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

y is inversely proportional to *x*. $(y = 7 \text{ when } x = 5.)$

a. $y = \frac{5}{x}$
b. $y = \frac{x}{35}$
c. $y = 35x$
d. $y = \frac{35}{x}$
e. $y = \frac{7}{x}$

15. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

y varies inversely as *x*. $(y = 9 \text{ when } x = 45.)$

a. $y = \frac{9}{x}$

b. $y = \frac{405}{x}$

c. $y = \frac{x}{405}$

d. $y = \frac{45}{x}$

e. $y = 405x$

16. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

z varies jointly as *x* and *y*. $(z = 128 \text{ when } x = 4 \text{ and } y = 8.)$

a. $z = \frac{4y}{x}$

b. $z = \frac{4}{xy}$

c. $z = \frac{xy}{4}$

d. $z = \frac{4x}{y}$

e. $z = 4xy$

17. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

F is jointly proportional to *r* and the third power of *s*. $(F = 24750 \text{ when } r = 18 \text{ and } s = 5.)$

a. $F = \frac{11r}{s^3}$

b. $F = \frac{rs^3}{11}$

c. $F = 11rs^3$

d. $F = \frac{11}{rs^3}$

e. $F = \dfrac{11s^3}{r}$

18. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

P varies directly as x and inversely as the square of y. ($P = \dfrac{3}{2}$ when $x = 25$ and $y = 10$.)

a. $P = \dfrac{xy^2}{6}$

b. $P = \dfrac{6x}{y}$

c. $P = \dfrac{6x}{y^2}$

d. $P = \dfrac{6y^2}{x}$

e. $P = 6xy^2$

19. The work W (in joules) done when lifting an object varies jointly with the mass m (in kilograms) of the object and the height h (in meters) that the object is lifted. The work done when a 120-kilogram object is lifted 1.8 meters is 2116.8 joules. How much work is done when lifting a 200-kilogram object 1.5 meters?

a. 2960 J
b. 2920 J
c. 2940 J
d. 2950 J
e. 2930 J

20. Assume that y is directly proportional to x. Use the given x-value and y-value to find a linear model that relates y and x.

$x = 5, y = 380$

a. $y = 76x$
b. $y = -76x$
c. $y = \dfrac{1}{76}x$
d. $y = -\dfrac{1}{76}x$
e. $y = -380x$

21. Determine whether the variation model is of the form $y = kx$ or $y = \frac{k}{x}$ and find *k*. Then write a model that relates *y* and *x*.

x	4	8	12	16	20
y	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$

a. $y = 4x$

b. $y = \frac{1}{x}$

c. $y = \frac{4}{x}$

d. $y = x$

e. $y = \frac{x}{4}$

22. Determine whether the variation model is of the form $y = kx$ or $y = \frac{k}{x}$ and find *k*. Then write a model that relates *y* and *x*.

x	9	18	27	36	45
y	2	4	6	8	10

a. $y = \frac{2}{9}x$

b. $y = \frac{9}{x}$

c. $y = \frac{2}{9x}$

d. $y = \frac{9}{2x}$

e. $y = \frac{9}{2}x$

23. Determine whether the variation model is of the form $y = kx$ or $y = \frac{k}{x}$ and find *k*. Then write a model that relates *y* and *x*.

x	5	10	15	20	25
y	–1.5	–3	–4.5	–6	–7.5

a. $y = -\frac{3}{10x}$

b. $y = \frac{10}{3}x$

c. $y = -\frac{3}{10}x$

d. $y = \frac{3}{10}x$

e. $y = -\frac{10}{3}x$

24. Determine whether the variation model is of the form $y = kx$ or $y = \frac{k}{x}$ and find *k*. Then write a model that relates *y* and *x*.

x	5	10	15	20	25
y	26	13	$\frac{26}{3}$	$\frac{13}{2}$	$\frac{26}{5}$

a. $y = \frac{130}{x}$

b. $y = \frac{x}{130}$

c. $y = \frac{1}{x}$

d. $y = 130x$

e. $y = x$

25. Use the given value of k to complete the table for the direct variation model $y = kx^2$.

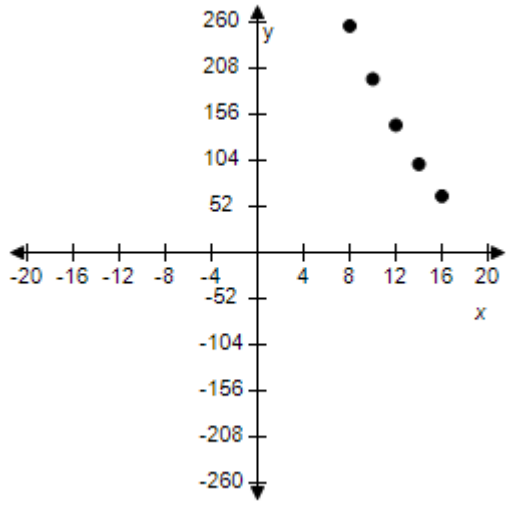
Plot the points on a rectangular coordinate system.

x	8	10	12	14	16
$y = kx^2$					

$k = 1$

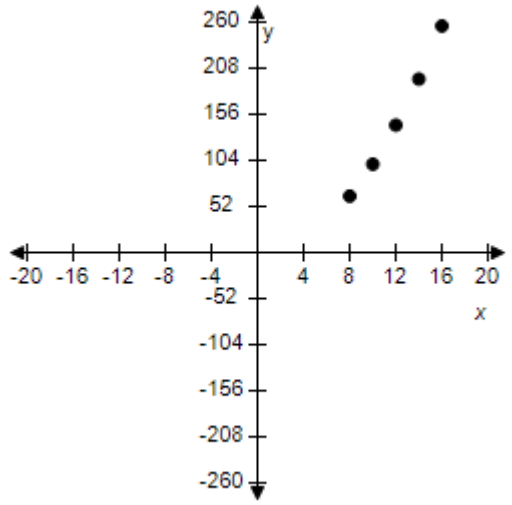
a.

x	8	10	12	14	16
$y = kx^2$	256	196	144	100	64



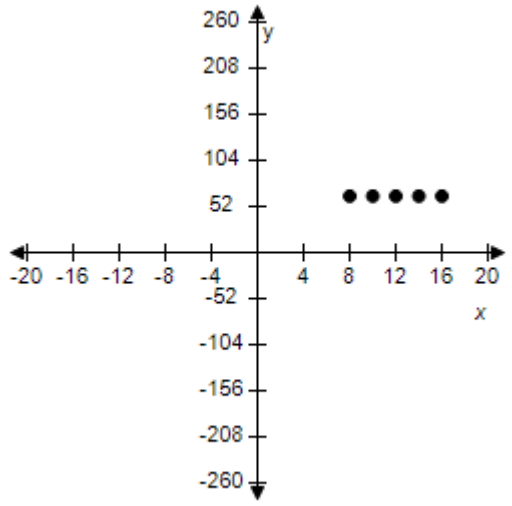
b.

x	8	10	12	14	16
$y = kx^2$	64	100	144	196	256



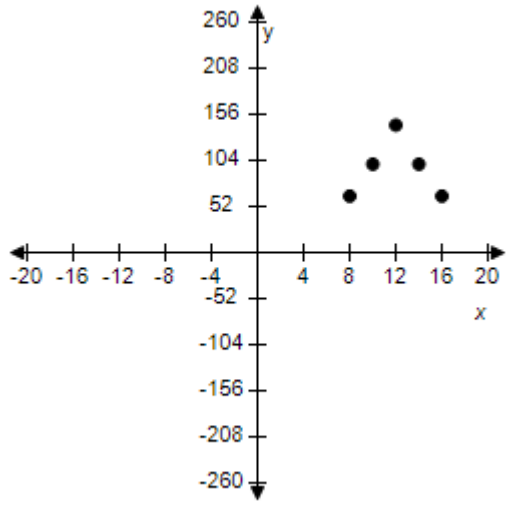
c.

x	8	10	12	14	16
$y = kx^2$	64	64	64	64	64



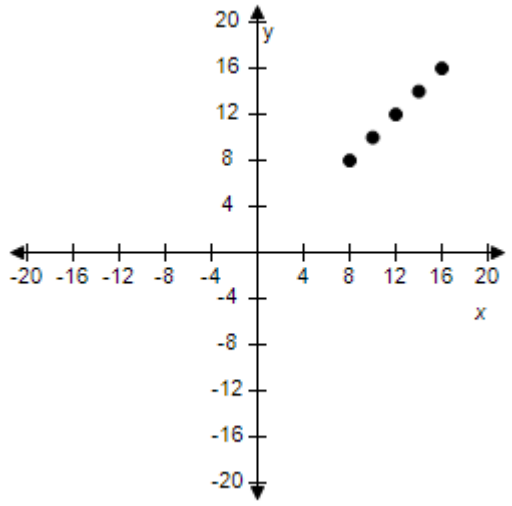
d.

x	8	10	12	14	16
$y = kx^2$	64	100	144	100	64



e.

x	8	10	12	14	16
$y = kx^2$	8	10	12	14	16



26. Find a mathematical model representing the statement. (Determine the constant of proportionality.)

z varies directly as the square of x and inversely as y. ($z = 36$ when $x = 9$ and $y = 3$.)

a. $z = \dfrac{3x^2}{4y}$

b. $z = \dfrac{4x}{3y}$

c. $z = \frac{4x^2}{3y}$

d. $z = -\frac{3x^2}{4y}$

e. $z = -\frac{4x^2}{3y}$

27. Find a mathematical model representing the statement. (Determine the constant of proportionality. Round your answer to three decimal places.)

v varies jointly as *p* and *q* and inversely as the square of *s*. (*v* = 1.1 when *p* = 5.5, *q* = 6.9 and *s* = 1.8.)

a. $v = \frac{0.094p}{qs^2}$

b. $v = -\frac{pq}{0.094s^2}$

c. $v = \frac{0.094pq}{s^2}$

d. $v = \frac{pq}{0.094s^2}$

e. $v = -\frac{0.094pq}{s^2}$

27. Use the fact that the diameter of the largest particle that can be moved by a stream varies approximately directly as the square of the velocity of the stream.

A stream with a velocity of $\frac{1}{5}$ mile per hour can move coarse sand particles about 0.07 inch in diameter. Approximate the velocity required to carry particles 0.2 inch in diameter. (Round your answer to two decimal places.)

a. About 0.84 mi/h
b. About 0.19 mi/h
c. About –0.16 mi/h
d. About 0.49 mi/h
e. About 0.34 mi/h

28. Use the fact that the resistance of a wire carrying an electrical current is directly proportional to its length and inversely proportional to its cross-sectional area.

If #28 copper wire (which has a diameter of 0.0126 inch) has a resistance of 68.17 ohms per thousand feet, what length of #28 copper wire will produce a resistance of 30.5 ohms?

a. About 447 ft
b. About 442 ft
c. About 432 ft
d. About 452 ft
e. About 462 ft

29. The frequency of vibrations of a piano string varies directly as the square root of the tension on the string and inversely as the length of the string. The middle A string has a frequency of 430 vibrations per second. Find the frequency of a string that has 1.25 times as much tension and is 1.4 times as long. (Round the answer to two decimal places.)

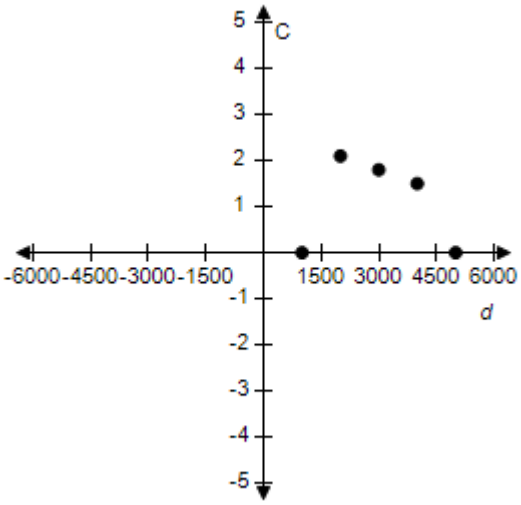
a. 373.4 vibrations / sec
b. 343.4 vibrations / sec
c. 353.4 vibrations / sec
d. 383.4 vibrations / sec
e. 363.4 vibrations / sec

30. An oceanographer took readings of the water temperatures C (in degrees Celsius) at several depths d (in meters). The data collected are shown in the table.

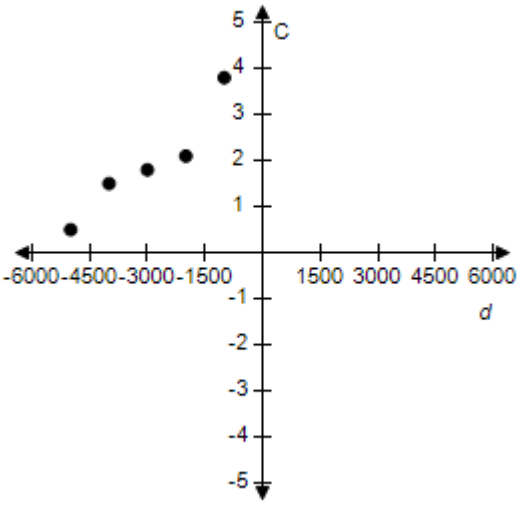
Depth, d	Temperature, C
1000	3.8°
2000	2.1°
3000	1.8°
4000	1.5°
5000	0.5°

Sketch a scatter plot of the data.

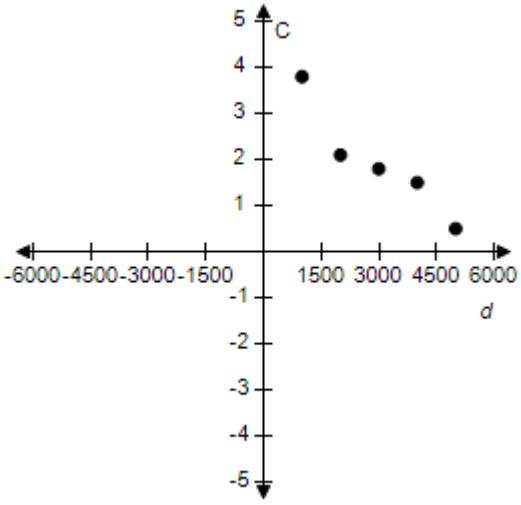
a.



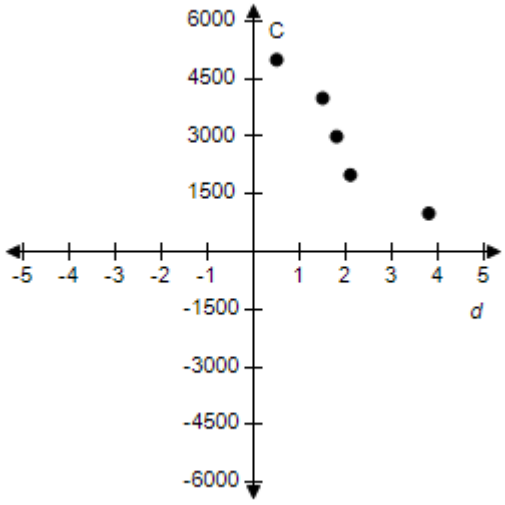
b.



c.



d.



e.