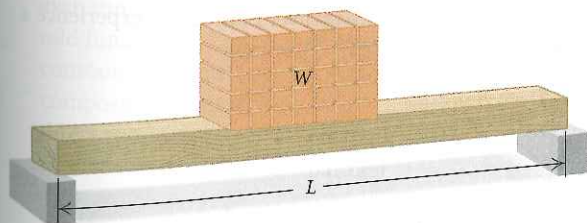


2.5

Exercise Set

Find the variation constant and an equation of variation for the given situation.

- y varies directly as x , and $y = 54$ when $x = 12$
4.5; $y = 4.5x$
- y varies directly as x , and $y = 0.1$ when $x = 0.2$
0.5; $y = 0.5x$
- y varies inversely as x , and $y = 3$ when $x = 12$
36; $y = 36/x$
- y varies inversely as x , and $y = 12$ when $x = 5$
60; $y = 60/x$
- y varies directly as x , and $y = 1$ when $x = \frac{1}{4}$
4; $y = 4x$
- y varies inversely as x , and $y = 0.1$ when $x = 0.5$
0.05; $y = 0.05/x$
- y varies inversely as x , and $y = 32$ when $x = \frac{1}{8}$
4; $y = 4/x$
- y varies directly as x , and $y = 3$ when $x = \frac{33}{11}$; $y = \frac{1}{11}x$
- y varies directly as x , and $y = \frac{3}{4}$ when $x = \frac{2}{3}$; $y = \frac{3}{8}x$
- y varies inversely as x , and $y = \frac{1}{5}$ when $x = 35$
7; $y = 7/x$
- y varies inversely as x , and $y = 1.8$ when $x = 0.3$
0.54; $y = 0.54/x$
- y varies directly as x , and $y = 0.9$ when $x = 0.4$
2.25; $y = 2.25x$
- Sales Tax.** The amount of sales tax paid on a product is directly proportional to its purchase price. In Indiana, the sales tax on a Sony Reader that sells for \$260 is \$17.50. What is the sales tax on an e-book that sells for \$21? **\$1.41**
- Child's Allowance.** The Gemmers decide to give their children a weekly allowance that is directly proportional to each child's age. Their 6-year-old daughter receives an allowance of \$4.50. What is their 11-year-old son's allowance? **\$8.25**
- Beam Weight.** The weight W that a horizontal beam can support varies inversely as the length L of the beam. Suppose an 8-m beam can support 1200 kg. How many kilograms can a 14-m beam support? **About 686 kg**

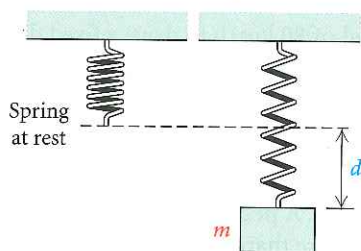


- Rate of Travel.** The time t required to drive a fixed distance varies inversely as the speed r . It takes 5 hr at a speed of 80 km/h to drive a fixed distance. How long will it take to drive the same distance at a speed of 70 km/h? **$5\frac{5}{7}$ hr**
- Fat Intake.** The maximum number of grams of fat that should be in a diet varies directly as a person's weight. A person weighing 120 lb should have no more than 60 g of fat per day. What is the maximum daily fat intake for a person weighing 180 lb? **90 g**
- House of Representatives.** The number of representatives N that each state has varies directly as the number of people P living in the state. If New York, with 19,254,630 residents, has 29 representatives, how many representatives does Colorado, with a population of 4,665,177, have? **7 representatives**



- Work Rate.** The time T required to do a job varies inversely as the number of people P working. It takes 5 hr for 7 bricklayers to build a park wall. How long will it take 10 bricklayers to complete the job? **3.5 hr**
- Pumping Rate.** The time t required to empty a tank varies inversely as the rate r of pumping. If a pump can empty a tank in 45 min at the rate of 600 kL/min, how long will it take the pump to empty the same tank at the rate of 1000 kL/min? **27 min**

21. **Hooke's Law.** Hooke's law states that the distance d that a spring will stretch varies directly as the mass m of an object hanging from the spring. If a 3-kg mass stretches a spring 40 cm, how far will a 5-kg mass stretch the spring? $66\frac{2}{3}$ cm



22. **Relative Aperture.** The relative aperture, or f-stop, of a 23.5-mm diameter lens is directly proportional to the focal length F of the lens. If a 150-mm focal length has an f-stop of 6.3, find the f-stop of a 23.5-mm diameter lens with a focal length of 80 mm. 3.36
23. **Musical Pitch.** The pitch P of a musical tone varies inversely as its wavelength W . One tone has a pitch of 330 vibrations per second and a wavelength of 3.2 ft. Find the wavelength of another tone that has a pitch of 550 vibrations per second. 1.92 ft

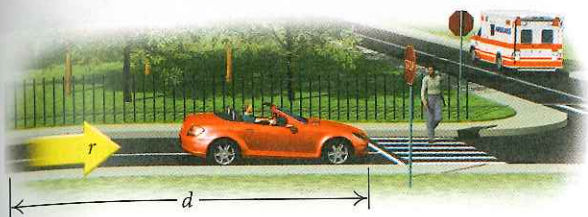


24. **Weight on Mars.** The weight M of an object on Mars varies directly as its weight E on Earth. A person who weighs 95 lb on Earth weighs 38 lb on Mars. How much would a 100-lb person weigh on Mars? 40 lb

Find an equation of variation for the given situation.

25. y varies inversely as the square of x , and $y = 0.15$ when $x = 0.1$ $y = 0.0015/x^2$
26. y varies inversely as the square of x , and $y = 6$ when $x = 3$ $y = 54/x^2$
27. y varies directly as the square of x , and $y = 0.15$ when $x = 0.1$ $y = 15x^2$
28. y varies directly as the square of x , and $y = 6$ when $x = 3$ $y = \frac{2}{3}x^2$
29. y varies jointly as x and z , and $y = 56$ when $x = 7$ and $z = 8$ $y = xz$
30. y varies directly as x and inversely as z , and $y = 4$ when $x = 12$ and $z = 15$ $y = 5x/z$
31. y varies jointly as x and the square of z , and $y = 105$ when $x = 14$ and $z = 5$ $y = \frac{3}{10}xz^2$
32. y varies jointly as x and z and inversely as w , and $y = \frac{3}{2}$ when $x = 2$, $z = 3$, and $w = 4$ $y = xz/w$
33. y varies jointly as x and z and inversely as the product of w and p , and $y = \frac{3}{28}$ when $x = 3$, $z = 10$, $w = 7$, and $p = 8$ $y = \frac{1}{5}xz/(wp)$, or $xz/(5wp)$
34. y varies jointly as x and z and inversely as the square of w , and $y = \frac{12}{5}$ when $x = 16$, $z = 3$, and $w = 5$ $y = \frac{3}{4}xz/w^2$
35. **Intensity of Light.** The intensity I of light from a light bulb varies inversely as the square of the distance d from the bulb. Suppose that I is 90 W/m^2 (watts per square meter) when the distance is 5 m. How much farther would it be to a point where the intensity is 40 W/m^2 ? 2.5 m
36. **Atmospheric Drag.** Wind resistance, or atmospheric drag, tends to slow down moving objects. Atmospheric drag varies jointly as an object's surface area A and velocity v . If a car traveling at a speed of 40 mph with a surface area of 37.8 ft^2 experiences a drag of 222 N (Newtons), how fast must a car with 51 ft^2 of surface area travel in order to experience a drag force of 430 N? 57.4 mph

37. **Stopping Distance of a Car.** The stopping distance d of a car after the brakes have been applied varies directly as the square of the speed r . If a car traveling 60 mph can stop in 200 ft, how fast can a car travel and still stop in 72 ft? **36 mph**



38. **Weight of an Astronaut.** The weight W of an object varies inversely as the square of the distance d from the center of the earth. At sea level (3978 mi from the center of the earth), an astronaut weighs 220 lb. Find his weight when he is 200 mi above the surface of the earth. **199 lb**
39. **Earned-Run Average.** A pitcher's earned-run average E varies directly as the number R of earned runs allowed and inversely as the number I of innings pitched. In 2009, Zack Greinke of the Kansas City Royals had an earned-run average of 2.16. He gave up 55 earned runs in 229.1 innings. How many earned runs would he have given up had he pitched 245 innings with the same average? Round to the nearest whole number. **59 earned runs**
40. **Boyle's Law.** The volume V of a given mass of a gas varies directly as the temperature T and inversely as the pressure P . If $V = 231 \text{ cm}^3$ when $T = 42^\circ$ and $P = 20 \text{ kg/cm}^2$, what is the volume when $T = 30^\circ$ and $P = 15 \text{ kg/cm}^2$? **220 cm³**

Skill Maintenance

In each of Exercises 41–45, fill in the blank with the correct term. Some of the given choices will not be used.

even function	relative maximum
odd function	relative minimum
constant function	solution
composite function	zero
direct variation	perpendicular
inverse variation	parallel

41. Nonvertical lines are [1.4] parallel if and only if they have the same slope and different y -intercepts.
42. An input c of a function f is a [1.5] zero of the function if $f(c) = 0$.
43. For a function f for which $f(c)$ exists, $f(c)$ is a [2.1] relative minimum if $f(c)$ is the lowest point in some open interval.
44. If the graph of a function is symmetric with respect to the origin, then f is an [2.4] odd function.
45. An equation $y = k/x$ is an equation of [2.5] inverse variation.

Synthesis

46. In each of the following equations, state whether y varies directly as x , inversely as x , or neither directly nor inversely as x .
- $7xy = 14$ **Inversely**
 - $x - 2y = 12$ **Neither**
 - $-2x + 3y = 0$ **Directly**
 - $x = \frac{3}{4}y$ **Directly**
 - $\frac{x}{y} = 2$ **Directly**
47. **Volume and Cost.** An 18-oz jar of peanut butter in the shape of a right circular cylinder is 5 in. high and 3 in. in diameter and sells for \$1.80. In the same store, a 28-oz jar of the same brand is $5\frac{1}{2}$ in. high and $3\frac{1}{4}$ in. in diameter. If the cost is directly proportional to volume, what should the price of the larger jar be? If the cost is directly proportional to weight, what should the price of the larger jar be? **\$2.32; \$2.80**
48. Describe in words the variation given by the equation
 Q varies directly as the square of p and inversely as the cube of q .

$$Q = \frac{kp^2}{q^3}$$
49. **Area of a Circle.** The area of a circle varies directly as the square of the length of a diameter. What is the variation constant? **$\pi/4$**