

average distance a gas
 molecules between collisions
 varies inversely as the square of
 the number of atoms
 per volume. 5. The strength
 of a muscle varies directly as (or
 proportional to) the cube of its
 length. The centripetal force
 on an object varies directly as (or
 proportional to) its mass and the
 square of its velocity and
 inversely as the radius of the
 circle it moves along. 7. C 8.

10. D
 12. 12 13. $\frac{220}{7}$
 15. $\frac{5}{2}$ 16. $\frac{1}{4}$ 17. $\frac{32}{15}$
 18. $\frac{18}{125}$ 20. $\frac{45}{16}$
 22. 75 psi

5. $s = kx^3$, where s is the strength of a muscle that has length x

6. $f = \frac{mv^2}{r}$, where f is the centripetal force of an object of mass m moving along a circle of radius r at velocity v

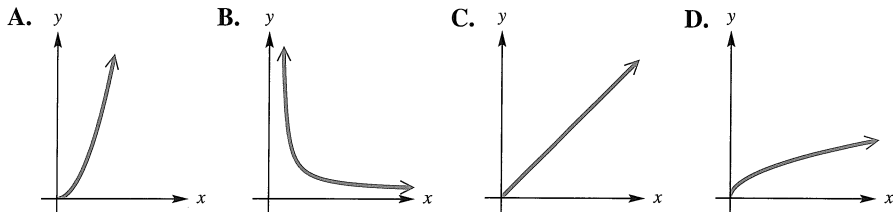
Concept Check Match each statement with its corresponding graph. In each case, $k > 0$.

7. y varies directly as x . ($y = kx$)

8. y varies inversely as x . ($y = \frac{k}{x}$)

9. y varies directly as the second power of x . ($y = kx^2$)

10. x varies directly as the second power of y . ($x = ky^2$)



Solve each variation problem. See Examples 1–4.

11. If y varies directly as x , and $y = 10$ when $x = 2$, find y when $x = -6$.
12. If y varies directly as x , and $y = 3$ when $x = 10$, find y when $x = 40$.
13. If m varies jointly as x and y , and $m = 10$ when $x = 4$ and $y = 7$, find m when $x = 11$ and $y = 8$.
14. If m varies jointly as z and p , and $m = 10$ when $z = 3$ and $p = 5$, find m when $z = 5$ and $p = 7$.
15. If y varies inversely as x , and $y = 10$ when $x = 3$, find y when $x = 12$.
16. If y varies inversely as x , and $y = 20$ when $x = \frac{1}{4}$, find y when $x = 20$.
17. Suppose r varies directly as the square of m , and inversely as s . If $r = 12$ when $m = 6$ and $s = 4$, find r when $m = 4$ and $s = 10$.
18. Suppose p varies directly as the square of z , and inversely as r . If $p = \frac{32}{5}$ when $z = 4$ and $r = 10$, find p when $z = 2$ and $r = 16$.
19. Let a be directly proportional to m and n^2 , and inversely proportional to y^3 . If $a = 9$ when $m = 4$, $n = 9$, and $y = 3$, find a when $m = 6$, $n = 2$, and $y = 5$.
20. If y varies directly as x , and inversely as m^2 and r^2 , and $y = \frac{5}{3}$ when $x = 1$, $m = 2$, and $r = 3$, find y when $x = 3$, $m = 1$, and $r = 8$.

Solve each problem. See Examples 1–4.

21. **Circumference of a Circle** The circumference of a circle varies directly as the radius. A circle with radius 7 in. has circumference 43.96 in. Find the circumference of the circle if the radius changes to 11 in.
22. **Pressure Exerted by a Liquid** The pressure exerted by a certain liquid at a given point varies directly as the depth of the point beneath the surface of the liquid. The pressure at 10 ft is 50 pounds per square inch (psi). What is the pressure at 15 ft?
23. **Resistance of a Wire** The resistance in ohms of a platinum wire temperature sensor varies directly as the temperature in degrees Kelvin (K). If the resistance is 646 ohms at a temperature of 190 K, find the resistance at a temperature of 250 K.