

1. Rewrite the statement connecting each pair of variables using a constant k instead of ' \propto '.

(a) $S \propto e$

(b) $v \propto t$

(c) $x \propto z^2$

(d) $y \propto \sqrt{x}$

(e) $T \propto \sqrt{L}$

(f) $C \propto r$

(g) $A \propto r^2$

(h) $V \propto r^3$

2. y varies as t . If $y = 6$ when $t = 4$, calculate:

(a) the value of y , when $t = 6$

(b) the value of t , when $y = 4$.

3. z is proportional to m . If $z = 20$ when $m = 4$, calculate:

(a) the value of z , when $m = 7$

(b) the value of m , when $z = 55$.

4. A varies directly as r^2 . If $A = 12$, when $r = 2$, calculate:

(a) the value of A , when $r = 5$

(b) the value of r , when $A = 48$.

5. Given that $z \propto x$, copy and complete the table.

x	1	3		$5\frac{1}{2}$
z	4		16	

6. Given that $V \propto r^3$, copy and complete the table.

r	1	2		$1\frac{1}{2}$
V	4		256	

7. Given that $w \propto \sqrt{h}$, copy and complete the table.

h	4	9		$2\frac{1}{4}$
w	6		15	

8. s is proportional to $(v - 1)^2$. If $s = 8$, when $v = 3$, calculate:

(a) the value of s , when $v = 4$

(b) the value of v , when $s = 2$.

9. m varies as $(d + 3)$. If $m = 28$ when $d = 1$, calculate:
- the value of m , when $d = 3$
 - the value of d , when $m = 49$.
10. The pressure of the water P at any point below the surface of the sea varies as the depth of the point below the surface d . If the pressure is 200 newtons/cm^2 at a depth of 3 m , calculate the pressure at a depth of 5 m .
11. The distance d through which a stone falls from rest is proportional to the square of the time taken t . If the stone falls 45 m in 3 seconds, how far will it fall in 6 seconds?
How long will it take to fall 20 m ?
12. The energy E stored in an elastic band varies as the square of the extension x . When the elastic is extended by 3 cm , the energy stored is 243 joules . What is the energy stored when the extension is 5 cm ?
What is the extension when the stored energy is 36 joules ?
13. In the first few days of its life, the length of an earthworm l is thought to be proportional to the square root of the number of hours n which have elapsed since its birth. If a worm is 2 cm long after 1 hour , how long will it be after 4 hours ?
How long will it take to grow to a length of 14 cm ?
14. It is well known that the number of golden eggs which a goose lays in a week varies as the cube root of the average number of hours of sleep she has. When she has 8 hours sleep, she lays 4 golden eggs.
How long does she sleep when she lays 5 golden eggs?
15. The resistance to motion of a car is proportional to the square of the speed of the car. If the resistance is 4000 newtons at a speed of 20 m/s , what is the resistance at a speed of 30 m/s ?
At what speed is the resistance 6250 newtons ?
16. A road research organisation recently claimed that the damage to road surfaces was proportional to the fourth power of the axle load. The axle load of a 44 ton HGV is about 15 times that of a car.
Calculate the ratio of the damage to road surfaces made by a 44-ton HGV and a car.

1. Rewrite the statements connecting the variables using a constant of variation, k .

(a) $x \propto \frac{1}{y}$

(b) $s \propto \frac{1}{t^2}$

(c) $t \propto \frac{1}{\sqrt{q}}$

(d) m varies inversely as w

(e) z is inversely proportional to t^2 .

2. b varies inversely as e . If $b = 6$ when $e = 2$, calculate:

(a) the value of b when $e = 12$

(b) the value of e when $b = 3$.

3. q varies inversely as r . If $q = 5$ when $r = 2$, calculate:

(a) the value of q when $r = 4$

(b) the value of r when $q = 20$.

4. x is inversely proportional to y^2 . If $x = 4$ when $y = 3$, calculate:

(a) the value of x when $y = 1$

(b) the value of y when $x = 2\frac{1}{4}$.

5. R varies inversely as v^2 . If $R = 120$ when $v = 1$, calculate:

(a) the value of R when $v = 10$

(b) the value of v when $R = 30$.

6. T is inversely proportional to x^2 . If $T = 36$ when $x = 2$, calculate:

(a) the value of T when $x = 3$

(b) the value of x when $T = 1.44$.

7. p is inversely proportional to \sqrt{y} . If $p = 1.2$ when $y = 100$, calculate:
- the value of p when $y = 4$
 - the value of y when $p = 3$.

- 8.** y varies inversely as z . If $y = \frac{1}{8}$ when $z = 4$, calculate:
 (a) the value of y when $z = 1$
 (b) the value of z when $y = 10$.

9. Given that $z \propto \frac{1}{v}$, copy and complete the table:

y	2	4		$\frac{1}{4}$
z	8		16	

- 10.** Given that $v \propto \frac{1}{t^2}$, copy and complete the table:

t	2	5		10
v	25		$\frac{1}{4}$	

- 11.** Given that $r \propto \frac{1}{\sqrt{x}}$, copy and complete the table:

x	1	4		
r	12		$\frac{3}{4}$	2

- 12.** e varies inversely as $(y - 2)$. If $e = 12$ when $y = 4$, find
 (a) e when $y = 6$ (b) y when $e = \frac{1}{2}$.

- 13.** M is inversely proportional to the square of l .
If $M = 9$ when $l = 2$, find:
(a) M when $l = 10$ (b) l when $M = 1$.

- 14.** Given $z = \frac{k}{x^n}$, find k and n , then copy and complete the table.

x	1	2	4	
z	100	$12\frac{1}{2}$		$\frac{1}{10}$

15. Given $y = \frac{k}{\sqrt[n]{y}}$, find k and n , then copy and complete the table.

v	1	4	36	
y	12	6		$\frac{3}{25}$

16. The volume V of a given mass of gas varies inversely as the pressure P . When $V = 2 \text{ m}^3$, $P = 500 \text{ N/m}^2$. Find the volume when the pressure is 400 N/m^2 . Find the pressure when the volume is 5 m^3 .

17. The number of hours N required to dig a certain hole is inversely proportional to the number of men available x . When 6 men are digging, the hole takes 4 hours. Find the time taken when 8 men are available. If it takes $\frac{1}{2}$ hour to dig the hole, how many men are there?

18. The life expectancy L of a rat varies inversely as the square of the density d of poison distributed around his home. When the density of poison is 1 g/m^2 the life expectancy is 50 days. How long will he survive if the density of poison is:

(a) 5 g/m^2 ?

(b) $\frac{1}{2} \text{ g/m}^2$?

19. The force of attraction F between two magnets varies inversely as the square of the distance d between them. When the magnets are 2 cm apart, the force of attraction is 18 newtons. How far apart are they if the attractive force is 2 newtons?