

Inverse Proportion Equations

Starter

1. **(Review of last lesson)** The time taken, t , for a ball to drop d metres is directly proportional to the square root of d . Given that a ball takes 3 second to drop 44.1 m, find:
- the value of the constant of proportionality, k
 - the time taken for the ball to drop 15 m.

Working:

$$\begin{aligned} \text{(a)} \quad t &\propto \sqrt{d} &\Rightarrow & t = k\sqrt{d} \\ t = 3, d = 44.1 & & & 3 = k \times \sqrt{44.1} \\ & & & k = \frac{\sqrt{10}}{7} \approx 0.452 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad t &= \frac{\sqrt{10}}{7} \sqrt{d} \\ \text{When } d = 15, & & t &= \frac{\sqrt{10}}{7} \times \sqrt{15} \\ & & t &= 1.75 \text{ seconds (3 s.f.)} \end{aligned}$$

E.g. 1 A quantity M is inversely proportional to T . When $M = 8$, $T = 6$.

- Find the constant of proportionality.
- Find M when $T = 24$.
- Find T when M is 3.

Working:

$$\begin{aligned} \text{(a)} \quad M &\propto \frac{1}{T} &\Rightarrow & M = \frac{k}{T} \\ & & & \text{When } M = 8, T = 6: & 8 = \frac{k}{6} & \text{(substitute)} \\ & & & & k = 48 & \text{(find } k) \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \text{Write the formula:} & M = \frac{48}{T} \\ \text{When } T = 24: & M = \frac{48}{24} \\ & M = 2 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad \text{Write the formula:} & M = \frac{48}{T} \\ \text{When } M \text{ is } 3: & 3 = \frac{48}{T} \\ & 3T = 48 \\ & T = 16 \end{aligned}$$

E.g. 2 The quantity p is inversely proportional to q . When $p = 7$, $q = 4$. What is the value of p when $q = 56$?

Hints: find the constant of proportionality first and then write down the equation connecting p and q

Working: $p \propto \frac{1}{q} \Rightarrow p = \frac{k}{q}$

When $p = 7, q = 4:$ $7 = \frac{k}{4}$
 $k = 28$

Write the formula: $p = \frac{28}{q}$

When $q = 56:$ $p = \frac{28}{56}$
 $p = \frac{1}{2}$

E.g. 3 Complete the table given that x and y are inversely proportional to one another.

x	2		36	-6	
y	18	3			72

Hint: use the first column to find the constant of proportionality and then write down the equation connecting x and y

Working: $y \propto \frac{1}{x} \Rightarrow y = \frac{k}{x}$

When $x = 2, y = 18:$ $18 = \frac{k}{2}$
 $k = 36$

Write the formula: $y = \frac{36}{x}$

Substituting into the formula will give the values in the table.

x	2	12	36	-6	$\frac{1}{2}$
y	18	3	1	-6	72

N.B. When x and y are inversely proportional to one another, the product of x and y is constant i.e. xy is constant.

Video: [Inverse proportion](#)

[Solutions to Starter and E.g.s](#)

Exercise

Click on the blue link above to find the answers to the questions 2-5.

1. 9-1 class textbook: p149 M5.8 Qu 1-4, 6
A*-G class textbook: p138 E5.4 Qu 1, 3
9-1 homework book: p51 M5.8 Qu 1, 2, 4, 6, 7
A*-G homework book: p39 E5.4 Qu 1-3
2. The quantity y is inversely proportional to x . When $y = 16$, $x = 2$.
 - (a) Find an equation for y in terms of x .
 - (b) Find y when x is 10.
 - (c) Find x when y is 4.
3. The quantity w is inversely proportional to z . When $w = 15$, $z = 4$.
 - (a) What is the value of z when $w = 25$?
 - (b) Explain what happens to z when w 5 times bigger.
4. Complete the table given that a and b are inversely proportional to one another.

a	4	8		-10	
b	64		16		128

5. R is inversely proportional to I . When $I = 5$, $R = 3$.
 - (a) Find R when $I = 7.5$.
 - (b) Find I when $R = 30$.

Answers to the exercise

1. See textbook
2. (a) $y = \frac{32}{x}$ (b) 3.2 (c) 8
3. (a) 2.4 (b) z becomes 5 times smaller or z is divided by 5
- 4.

a	4	8	16	-10	2
b	64	32	16	-25.6	128

5. (a) 2 (b) $\frac{1}{2}$

[Homework book answers \(only available during a lockdown\)](#)