Inverse Proportion Equations (Harder)

Starter

1. **(Review of previous material)** The quantity y is ***directly*** proportional to the ***square root*** of x. When $x = 16$, $y = 48$.

   (a) Find a formula for y in terms of x, having calculated the constant of proportionality.

   (b) Find x when $y = 95$. Give your answer to 3 s.f.

Working:

(a) $y \propto \sqrt{x} \quad \Rightarrow \quad y = k\sqrt{x}$

$x = 16, y = 48 \quad 48 = k\sqrt{16}$

$k = 12$

$y = 12\sqrt{x}$

(b) ***When*** $y = 95$***:***

$95 = 12\sqrt{x}$

$\frac{95}{12} = \sqrt{x}$

$\left(\frac{95}{12}\right)^2 = x$

$x = 62.7$ (3 s.f.)

2. **(Review of last lesson)**

The quantity A is ***inversely*** proportional to B. When $A = 15$, $B = 5$.

(a) Find a formula for A in terms of B, having calculated the constant of proportionality.

(b) Find B when $A = 25$.

Working:

(a) $A \propto \frac{1}{B} \quad \Rightarrow \quad A = \frac{k}{B}$

When $A = 15, B = 5$***:*** $15 = \frac{k}{5}$

$k = 75$

$A = \frac{75}{B}$

(b) ***When*** $A = 25$***:*** $25 = \frac{75}{B}$

$25B = 75$

$B = \frac{75}{25}$

$B = 3$

E.g. 1 A quantity y is ***inversely*** proportional to the ***cube*** of x. When $y = 12.5, x = 2$.

(a) Find a formula for y in terms of x, having calculated the constant of proportionality.

(b) What is the value of y when $x = 5$?

Working:

(a) $y \propto \frac{1}{x^3} \quad \Rightarrow \quad y = \frac{k}{x^3}$

When $y = 12.5, x = 2$**:**

$$12.5 = \frac{k}{2^3}$$
$$12.5 \times 2^3 = k$$
$$k = 100$$
$$y = \frac{100}{x^3}$$

(b) ***When*** $x = 5$**:**

$$y = \frac{100}{5^3}$$
$$y = \frac{100}{125}$$
$$y = \frac{4}{5} = 0.8$$

E.g. 2 A quantity m is ***inversely*** proportional to the ***square root*** of t. When $t = 4, m = 4$. The constant of proportionality is a positive integer. What is the value of t when $m = 2$?

Hint: you need to find the formula involving m and t.

Working:

$m \propto \frac{1}{\sqrt{t}} \quad \Rightarrow \quad m = \frac{k}{\sqrt{t}}$

When $t = 4, m = 4$**:**

$$4 = \frac{k}{\sqrt{4}}$$
$$k = 8$$
$$m = \frac{8}{\sqrt{t}}$$

When $m = 2$**:**

$$2 = \frac{8}{\sqrt{t}}$$
$$\sqrt{t} = \frac{8}{2}$$
$$\sqrt{t} = 4$$

Square both sides

$$t = 16$$

E.g. 3 The air pressure, P, from an electric pump is ***inversely*** proportional to the ***square*** of the radius, r, of the tube to the pump. A tube of radius 10 mm creates 20 units of air pressure.

(a) How much pressure will a tube of radius 15 mm create?

(b) If an air-bed is to be pumped up using a maximum of 30 units of air pressure, what radius of tube should be used?

Working:

(a) $P \propto \frac{1}{r^2} \quad \Rightarrow \quad P = \frac{k}{r^2}$

When $P = 20, r = 10$***:*** $20 = \frac{k}{10^2}$

$20 \times 10^2 = k$

$k = 2000$

$P = \frac{2000}{r^2}$

When $r = 15$***:*** $P = \frac{2000}{15^2}$

$P = \frac{80}{9} = 8.89$ (3 s.f.)

(b) ***When*** $P = 30$***:*** $30 = \frac{2000}{r^2}$

$30r^2 = 2000$

$r^2 = \frac{200}{3}$

$r = \sqrt{\frac{200}{3}} = \frac{10\sqrt{6}}{3}$

$r = 8.16$ mm (3 s.f.)

Video: Inverse proportion

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p149 E5.3 Qu 1, 3-10
A*-G class textbook:	p138 E5.4 Qu 2, 4-11
9-1 homework book:	p53 E5.3 Qu 1-6
A*-G homework book:	p39 E5.4 Qu 4-7

Homework book answers (only available during a lockdown)