



- 1 y is inversely proportional to x . Here are some values of x and y .

x	2	5	?	12
y	30	12	4	?

- Find a formula for y in terms of x .
- Find the two missing values in the table.

(3 marks)

a)

$$y = \frac{k}{x}$$

$$30 = \frac{k}{2}$$

$$k = 60$$

$$y = \frac{60}{x}$$

b) missing x ($y = 4$)

$$4 = \frac{60}{x}$$

$$x = 60 \div 4$$

$$x = 15$$

missing y ($x = 12$)

$$y = \frac{60}{12}$$

$$y = 5$$

2

The graph of $y = \frac{12}{x}$ is drawn for positive values of x . Here is a table of values for the graph.

x	1	2	3	4	6	12
y	12	?	4	?	2	?

- a. Complete the table.
 b. As x gets larger, what happens to the value of y and to the graph? Does the graph ever touch the x -axis? Give a reason.

(3 marks)

a)

$$x = 2: y = \frac{12}{2} = 6$$

$$x = 4: y = \frac{12}{4} = 3$$

$$x = 12: y = \frac{12}{12} = 1$$

b)

x gets bigger, y gets smaller

curve falls and flattens out towards the x -axis

$12 \div x$ is never 0, so it never touches the axis

y gets closer to 0 but never reaches it

3

The time, t days, taken to build a wall is inversely proportional to the number of workers, w .

6 workers take 15 days to build the wall.

a. Find a formula for t in terms of w .

b. How many workers are needed to build the wall in 4.5 days?

(4 marks)

a)

$$t = \frac{k}{w}$$

$$15 = \frac{k}{6}$$

$$k = 15 \times 6 = 90$$

$$t = \frac{90}{w}$$

b)

$$4.5 = \frac{90}{w}$$

$$w = 90 \div 4.5$$

$$w = 20$$

20 workers

4

p is inversely proportional to q .

When $q = 5$, $p = 12$.

a. Find a formula for p in terms of q .

b. Find the value of p when $q = 8$.

(3 marks)

Inversely proportional means that the product pq is constant

$$pq = k. \text{ Dividing by } q \text{ gives } p = k/q$$

Substitute

$$12 = \frac{k}{5}, \text{ so } k = 60 \text{ and } p = \frac{60}{q}$$

$$\text{When } q = 8, p = 60 \div 8 = 7.5$$

- 5 y is inversely proportional to the square of x .

When $x = 3$, $y = 4$.

Find the negative value of x when $y = 9$.

(3 marks)

$$\text{Write } y = \frac{k}{x^2}$$

Substitute

$$4 = \frac{k}{9}, \text{ so } k = 36 \text{ and } y = \frac{36}{x^2}$$

$$\text{When } y = 9: 9 = \frac{36}{x^2}, \text{ so } x^2 = 4$$

$$x = 2 \text{ or } x = -2, \text{ so the negative value is } x = -2$$

$$\boxed{x = -2}$$

- 6 The force F newtons between two magnets is inversely proportional to the square of the distance d cm between them.

When $d = 2$, $F = 60$.

- Find a formula for F in terms of d .
- Find the positive value of d when $F = 15$.

(4 marks)

$$\text{Write } F = \frac{k}{d^2}$$

Substitute

$$60 = \frac{k}{4}, \text{ so } k = 240 \text{ and } F = \frac{240}{d^2}$$

$$\text{When } F = 15: 15 = \frac{240}{d^2}, \text{ so } d^2 = 16$$

$$\text{The positive value is } d = 4$$

7 y is inversely proportional to the cube of x .

When $x = 2$, $y = 5$.

a. Find a formula for y in terms of x .

b. Show that when $x = 5$, $y = \frac{8}{25}$.

c. Find the value of x when $y = 135$.

(5 marks)

a)

$$y = \frac{k}{x^3}$$

$$5 = \frac{k}{8}$$

$$k = 40$$

$$y = \frac{40}{x^3}$$

b)

$$y = \frac{40}{5^3}$$

$$y = \frac{40}{125}$$

$$y = \frac{8}{25}$$

c)

$$135 = \frac{40}{x^3}$$

$$x^3 = \frac{40}{135}$$

$$x^3 = \frac{8}{27}$$

$$x = \frac{2}{3}$$

$$x = \frac{2}{3}$$

8

x and y are positive quantities.

y is inversely proportional to the square of x .

x is increased by 25%.

Work out the percentage change in y .

(4 marks)

$$\text{Write } y = \frac{k}{x^2}$$

The new value of x is $1.25x$, so the new y is $\frac{k}{(1.25x)^2} =$

$$\frac{k}{1.5625x^2}$$

$1 \div 1.5625 = 0.64$, so the new y is 0.64 times the old y

This is a 36% decrease

36% decrease

9

y is directly proportional to the square of x .

When $x = 5$, $y = 50$.

x is inversely proportional to z .

When $z = 2$, $x = 6$.

Find the value of y when $z = 4$.

(5 marks)

From the first relation

$$y = kx^2 \text{ and } 50 = k \times 25, \text{ so } k = 2 \text{ and } y = 2x^2$$

From the second relation

$$x = \frac{m}{z} \text{ and } 6 = \frac{m}{2}, \text{ so } m = 12 \text{ and } x = \frac{12}{z}$$

$$\text{So } y = 2\left(\frac{12}{z}\right)^2 = \frac{288}{z^2}$$

$$\text{When } z = 4, y = 288 \div 16 = 18$$

$$y = 18$$

10 t is directly proportional to the square root of m .

When $m = 9$, $t = 6$.

m is inversely proportional to w .

When $w = 4$, $m = 9$.

Find the value of w when $t = 3$.

(5 marks)

From the first relation

$$t = k\sqrt{m} \text{ and } 6 = k \times 3, \text{ so } k = 2 \text{ and } t = 2\sqrt{m}$$

From the second relation

$$m = \frac{c}{w} \text{ and } 9 = \frac{c}{4}, \text{ so } c = 36 \text{ and } m = \frac{36}{w}$$

$$\text{So } t = 2\sqrt{\left(\frac{36}{w}\right)} = \frac{12}{\sqrt{w}}$$

$$\text{When } t = 3: \sqrt{w} = 12 \div 3 = 4, \text{ so } w = 16$$

Check

$$m = 36 \div 16 = 2.25 \text{ and } t = 2 \times 1.5 = 3$$

$$\boxed{w = 16}$$