



- 1 4 identical pumps can drain a flooded basement in 18 hours.
Work out how long it would take 6 of these pumps to drain the basement.

(2 marks)

$$\text{Total work} = 4 \times 18 = 72 \text{ pump-hours}$$

$$\text{Time for 6 pumps} = 72 \div 6 = 12 \text{ hours}$$

Check

$$6 \times 12 = 72, \text{ the same total work}$$

12 hours

- 2 3 identical machines take 10 hours to print an order of leaflets.
Work out how long 5 of these machines would take to print the same order.

(2 marks)

$$\text{Total work} = 3 \times 10 = 30 \text{ machine-hours}$$

$$\text{Time for 5 machines} = 30 \div 5 = 6 \text{ hours}$$

6 hours

- 3 8 friends hire a minibus and share the cost equally. Each friend pays £15.
4 more friends join the group and the cost is shared equally between everyone.
Work out how much each person now pays.

(2 marks)

$$\text{Total cost} = 8 \times 15 = £120$$

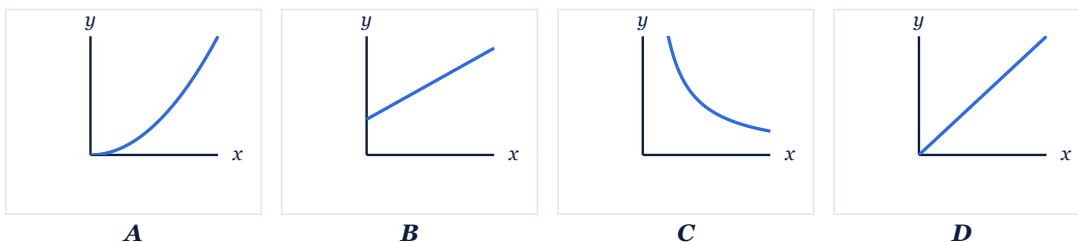
$$8 + 4 = 12 \text{ people}$$

$$= 120 \div 12$$

£10

4 Here are four graphs, *A*, *B*, *C* and *D*, each drawn for positive values of x and y .

- Which graph shows y directly proportional to x ?
- Which graph shows y inversely proportional to x ?
- Explain why graph *B* does not show direct proportion.



(3 marks)

a) direct proportion: straight line through $(0, 0)$

D

b) inverse: as x goes up, y comes down, never reaches 0

C

c) *B* misses the origin

***B* does not go through $(0, 0)$**

5 5 identical pipes can fill a storage tank in 4.8 hours.

Only 3 of the pipes are working.

Work out how long the 3 pipes will take to fill the tank.

(3 marks)

$$\text{Total work} = 5 \times 4.8 = 24 \text{ pipe-hours}$$

$$\text{Time for 3 pipes} = 24 \div 3 = 8 \text{ hours}$$

Check

$$3 \times 8 = 24, \text{ the same total work}$$

8 hours

6

Here are some values of x and y .

x	2	3	5	6
y	30	20	12	10

- Show that y is inversely proportional to x .
- Work out the value of y when $x = 12$.

(3 marks)

a) Multiply each pair

$$2 \times 30 = 60$$

$$3 \times 20 = 60$$

$$5 \times 12 = 60$$

$$6 \times 10 = 60$$

$x \times y$ is always 60, so inversely proportional

b)

$$12 \times y = 60$$

$$y = 60 \div 12$$

$$y = 5$$

7

It takes 8 bricklayers 15 days to build a wall.

- Work out how many days it would take 12 bricklayers to build the same wall.
- State one assumption you have made.

(3 marks)

$$a) \text{ Total work} = 8 \times 15 = 120 \text{ worker-days}$$

$$\text{Time for 12 bricklayers} = 120 \div 12 = 10 \text{ days}$$

b) Assumption: every bricklayer works at the same steady rate

8 y is inversely proportional to x .

When $x = 5$, $y = 8$.

- Find a formula for y in terms of x .
- Work out the value of y when $x = 16$.
- Work out the value of x when $y = 10$.

(4 marks)

$$a) y = k/x$$

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

$$k = 8 \times 5 = 40$$

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

$$b) x = 16$$

$$y = \frac{40}{16}$$

$$y = 2.5$$

$$c) y = 10$$

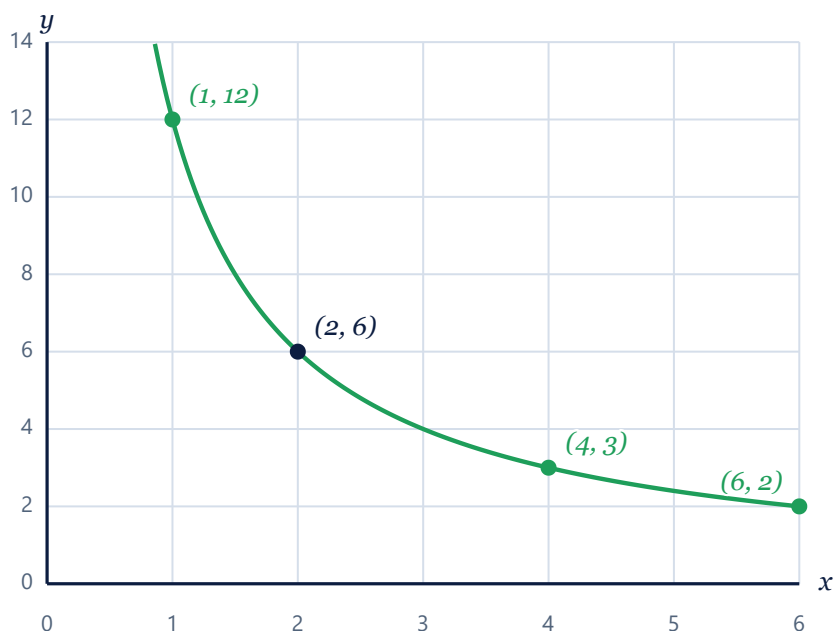
$$10 = \frac{40}{x}$$

$$x = \frac{40}{10}$$

$$x = 4$$

9 y is inversely proportional to x . The point $(2, 6)$ lies on the graph of y against x , as shown.

- Find a formula for y in terms of x .
- On the grid, sketch the graph of y against x for $1 \leq x \leq 6$. Mark the points where $x = 4$ and $x = 6$.



(4 marks)

a) $y = k/x$

$$6 = k \div 2$$

$$k = 12$$

$$y = 12/x$$

b) find some points

$$x = 1: y = 12$$

$$x = 4: y = 3$$

$$x = 6: y = 2$$

smooth curve through $(1, 12)$, $(2, 6)$, $(4, 3)$, $(6, 2)$

10 x is a positive quantity. For each relationship, write down what happens to y when x is doubled.

- y is directly proportional to x
- y is inversely proportional to x
- y is directly proportional to x^2

(2 marks)

a) $y = kx$, so doubling x doubles y

b) $y = \frac{k}{x}$, so doubling x halves y

c) $y = kx^2$, so doubling x multiplies y by $2^2 = 4$

- 11 The pressure, P , of a gas in a sealed container is inversely proportional to its volume, V .

When $V = 0.5 \text{ m}^3$, $P = 240$ units.

Work out the pressure when the volume is 0.8 m^3 .

(3 marks)

$$\begin{aligned}P &= \frac{k}{V} \\240 &= \frac{k}{0.5} \\k &= 240 \times 0.5 = 120 \\P &= \frac{120}{0.8} \\P &= 150\end{aligned}$$

- 12 y is inversely proportional to x .

When $x = 4$, $y = 9$.

- Find the value of y when $x = 6$.
- Find the value of y when $x = 12$.

(3 marks)

$$\begin{aligned}y &= \frac{k}{x} \text{ with } k = 4 \times 9 = 36 \\a) y &= 36 \div 6 = 6 \\b) y &= 36 \div 12 = 3 \\ \text{Check} \\6 \times 6 &= 36 \text{ and } 12 \times 3 = 36, \text{ so } k \text{ is constant both ways}\end{aligned}$$

- 13 t is inversely proportional to s .

When $s = 60$, $t = 2.5$.

Work out the value of s when $t = 4$.

(3 marks)

$$\begin{aligned}t &= \frac{k}{s} \\2.5 &= \frac{k}{60} \\k &= 2.5 \times 60 = 150 \\4 &= \frac{150}{s} \\s &= \frac{150}{4} \\s &= 37.5\end{aligned}$$

- 14 y is inversely proportional to x .

When $x = 3$, $y = 20$.

Work out the value of y when $x = 5$.

(2 marks)

$$k = 3 \times 20 = 60, \text{ so } y = \frac{60}{x}$$

$$\text{When } x = 5, y = 60 \div 5 = 12$$

12

- 15 6 identical machines can complete an order in 14 days.

The 6 machines work for 4 days. Then 2 more identical machines are added.

Work out how many more days are needed to complete the order.

(3 marks)

$$\text{Total work} = 6 \times 14 = 84 \text{ machine-days}$$

$$\text{Work done in the first 4 days} = 6 \times 4 = 24 \text{ machine-days}$$

$$\text{Work remaining} = 84 - 24 = 60 \text{ machine-days}$$

With 8 machines

$$60 \div 8 = 7.5 \text{ more days}$$

7.5 days

- 16 6 decorators can paint a hotel in 10 days. They all work at the same rate.

After 4 days, 2 of the decorators leave. The other decorators carry on at the same rate.

Work out how many more days it takes to finish painting the hotel.

(4 marks)

$$\text{Whole job} = 6 \times 10 = 60 \text{ decorator-days}$$

$$\text{Done in 4 days} = 6 \times 4 = 24$$

$$\text{Left} = 60 - 24 = 36$$

$$\text{Decorators left} = 6 - 2 = 4$$

$$= 36 \div 4$$

9 more days