

Directly and indirectly proportional

1. A ball falls vertically after being dropped.

The ball falls a distance d metres in a time of t seconds.

d is directly proportional to the square of t .

The ball falls 20 metres in a time of 2 seconds.

(a) Find a formula for d in terms of t .

(b) Calculate the distance the ball falls in 3 seconds.

(c) Calculate the time the ball takes to fall 605 m.

2. Gwen bought a new car.

Each year, the value of her car depreciated by 9%.

Calculate the number of years after which the value of her car was 47% of its value when new.

3. Bob lays 200 bricks in 1 hour.

He always works at the same speed.

Work out how long it will take Bob to lay 960 bricks.

Give your answer in hours and minutes.

4. The time, T seconds, it takes a water heater to boil some water is directly proportional to the mass of water, m kg, in the water heater.

When $m = 250$, $T = 600$

(a) Find T when $m = 400$

The time, T seconds, it takes a water heater to boil a constant mass of water is inversely

proportional to the power, P watts, of the water heater.

When $P = 1400$, $T = 360$

(b) Find the value of T when $P = 900$

5. The time, t seconds, that a ball takes to roll from rest down a slope is proportional to the **square root** of the distance, d metres, that it rolls.

It takes 4 seconds for the ball to roll 25 metres down the slope.

(a) Find an expression for t in terms of d .

(b) Find the time it takes for the ball to roll 64 metres down the slope.

(c) Find how far down the slope the ball will roll in 8 seconds.

6. When a stone is dropped, its speed, v , is proportional to the **square root** of the distance, d , it has fallen.

$v = 14 \text{ ms}^{-1}$ when $d = 10 \text{ m}$.

(a) Find the formula for v in terms of d .

(b) Calculate the distance the stone has fallen when its speed is 28 ms^{-1} .

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7. y is directly proportional to the cube of x .

y is inversely proportional to z .

When $y = 2$, $x = 2$ and $z = 16$

Find the value of z when $x = 4$

Show your working.

8. Amir uses his mobile phone for 'Talk' and 'Text'.

'Talk' costs 2p per minute.

Each 'Text' costs 1p.

(a) In January Amir paid £18

He used 700 minutes of 'Talk'.

How many 'Texts' did he send?

(b) In February Amir paid £24.60

He sent 1200 'Texts'.

How many minutes of 'Talk' did he use?

9. (a) P is inversely proportional to Q .

When $P = 100$, $Q = 32$

Express P in terms of Q .

b. Calculate the value of Q when P is twice as big as Q .

10. The cost of circular mirrors is directly proportional to the square of the diameter.

A circular mirror with a diameter of 60 cm costs £50.

What is the cost of a circular mirror with a diameter of 90cm?