

Exercise walk-through

E2.8

Proportion

IGCSE Mathematics

You must be able to

- translate a proportion statement into an equation with a constant k
- find k from one pair of values, then use the equation for any other pair
- handle proportion to a square, a cube or a square root

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The method

Method — Write the equation, find k , then answer the question

statement	equation
y is directly proportional to x	$y = kx$
y is proportional to x^2	$y = kx^2$
y is inversely proportional to x	$y = \frac{k}{x}$
y is inversely proportional to x^2	$y = \frac{k}{x^2}$
y is proportional to $\sqrt{x}$	$y = k\sqrt{x}$

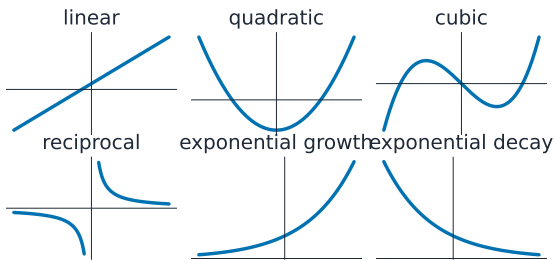
- **Three steps, always:** write the equation with k , substitute the given pair to find k , then substitute again.
- **Inverse means divide.** “Inversely proportional to x ” is $y = k/x$, so doubling x **halves** y .
- **Worked:** $y \propto x^2$ and $y = 45$ when $x = 3$, so $45 = 9k$ and $k = 5$. Then at $x = 5$, $y = 5 \times 25 = 125$.

Method — Write the equation, find k , then answer the question

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): the equation with k in it is the first method mark, and the value of k is the second.

Method — Write the equation, find \$k\$, then answer the question

center Answer shapes (marked by method marks — M1 for a correct method, A1 for the correct answer): the...



recognise $y = x^2$, $y = 1/x$, $y = 2^x$ from shape

The standard graph shapes: linear, quadratic, cubic, reciprocal and exponential

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Practice

Practice 2.1 ■ 3 marks

y is directly proportional to x . When $x = 4$, $y = 18$. Find y when $x = 10$.

Solution 2.1

Method: Write the equation, find k , then answer the question — p.4

Worked steps

■ $y = kx$, and $18 = 4k$ so $k = 4.5$ M1 A1

$$y = 4.5 \times 10 = 45$$

A1

Practice 2.2 ■ 3 marks

y is inversely proportional to x . When $x = 5$, $y = 12$. Find y when $x = 4$.

Solution 2.2

Method: Write the equation, find k , then answer the question — p.4

Worked steps

■ $y = \frac{k}{x}$, and $12 = \frac{k}{5}$ so $k = 60$ M1 A1

$$y = \frac{60}{4} = 15$$
 A1

Practice 2.3 ■ 3 marks

y is proportional to x^2 . When $x = 3$, $y = 45$. Find y when $x = 5$.

Solution 2.3

Worked steps

■ $y = kx^2$, and $45 = 9k$ so $k = 5$ M1 A1

$$y = 5 \times 25 = \mathbf{125}$$

A1

3

Exam-style

Exam-style 3.1 ■ 5 marks

y is inversely proportional to the square of x . When $x = 2$, $y = 9$.

Exam-style 3.1 (a) ■ 2 marks

Find an expression for y in terms of x .

Solution 3.1 (a)

Method: Write the equation, find k , then answer the question — p.4

Worked steps

■ $y = \frac{k}{x^2}$, and $9 = \frac{k}{4}$ so $k = 36$ M1

$$y = \frac{36}{x^2}$$

A1

Exam-style 3.1 (b) ■ 1 mark

Find y when $x = 6$.

Solution 3.1 (b)

Worked steps

$$\blacksquare y = \frac{36}{36}$$

$$= 1$$

B1

Exam-style 3.1 (c) ■ 2 marks

Find the positive value of x when $y = 4$.

Solution 3.1 (c)

Worked steps

$$\blacksquare 4 = \frac{36}{x^2}, \text{ so } x^2 = 9 \quad \text{M1}$$

$$x = \mathbf{3}$$

A1

Exam-style 3.2 ■ 3 marks

The time T hours taken to complete a job is inversely proportional to the number of workers n . Six workers take 10 hours. Find the time taken by four workers.

Solution 3.2

Method: Write the equation, find \$k\$, then answer the question — p.4

Worked steps

■ $T = \frac{k}{n}$, and $10 = \frac{k}{6}$ so $k = 60$ **M1** **A1**

$$T = \frac{60}{4} = 15 \text{ hours} \quad \textbf{A1}$$

- fewer workers means MORE time, which is the check that the relationship was written as an inverse