

Direct and inverse proportion equations

Topic cliff notes / objectives, key ideas and examples

Learning objectives

- Write direct or inverse proportion as an equation.
- Find the constant from a known pair and use it for a new input.

Key ideas

- Direct proportion to a positive integer power includes that power in the model.

$$y \propto x^n \Rightarrow y = kx^n, \quad n \in \mathbb{Z}_{>0}$$

- Inverse proportion to a positive integer power places that power in the denominator.

$$y = \frac{k}{x^n}, \quad x \neq 0, \quad n \in \mathbb{Z}_{>0}$$

- Use a known pair to find the constant before substituting a new input.
- For positive inputs in this inverse-root model, quadrupling the input halves the output.

$$y = \frac{k}{\sqrt{x}}, \quad x > 0$$

Worked example

The output is directly proportional to the square of the input. The known pair is three and eighteen. Find the output at five.

$$y = kx^2, \quad x = 3, y = 18 \Rightarrow 18 = 9k$$

$$k = 2 \Rightarrow y = 2x^2$$

$$x = 5 \Rightarrow y = 2(5^2)$$

Answer

$$y = 50$$

Quick example

For inverse proportion, use the known pair two and twelve to find the output at six.

$$y = \frac{k}{x}, \quad x = 2, y = 12 \Rightarrow k = 24$$

Answer

$$y = \frac{24}{6} = 4$$

Watch out

Do not omit the specified power or root. Doubling an input does not always double its output.

