

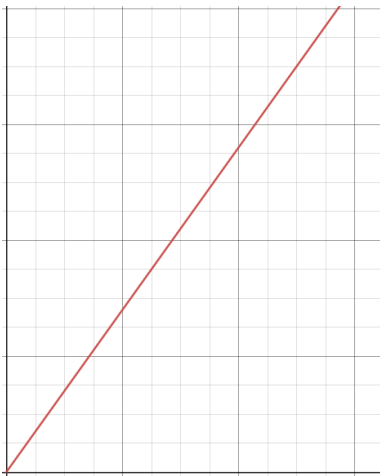
Y10 Maths Knowledge Organiser Higher Tier: Variation

| What must I be able to do? | Key vocabulary | |
|--|------------------------------------|---|
| New content: <ul style="list-style-type: none"> □ Solve problems where two variables have a direct proportional relationship <ul style="list-style-type: none"> ➤ Mathswatch 199 (GCSE) □ Solve problems where two variables have an inversely proportional relationship <ul style="list-style-type: none"> ➤ Mathswatch 199 (GCSE) | Constant of proportionality | The <u>constant ratio</u> between two proportional variables. Often represented with the letter k . |
| | Direct proportion | As <u>one variable increases</u> , the <u>other increases at the same rate</u> |
| | Inverse proportion | As <u>one variable increases</u> , the <u>other decreases</u> . |

Direct Proportion

Examples of direct proportionality and their respective graphs

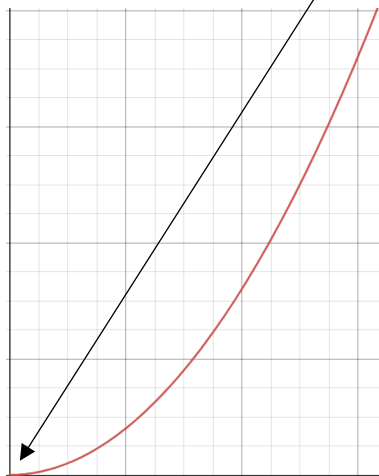
All direct proportion graphs start at (0, 0)



Linear proportionality

y is directly proportional to x

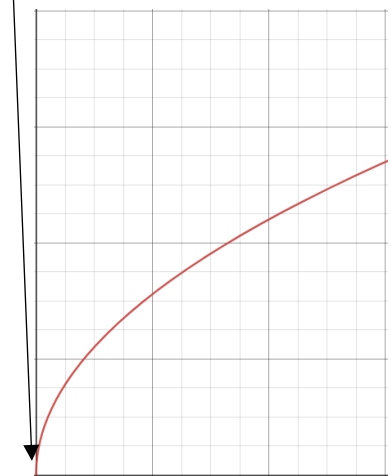
$$y \propto x$$



Quadratic proportionality

y is directly proportional to x^2

$$y \propto x^2$$



Square root proportionality

y is directly proportional to the square root of x

$$y \propto \sqrt{x}$$

e.g. E varies directly with the square of f .

When E equals 56, f equals 2.

- Find the value of E when $f = 0.5$
- Find the value of f when $E = 224$

"Varies directly" is another way of saying "directly proportional to"

The greek letter alpha. Used to represent 2 things being proportional

First, find the equation linking E and f .

$$E \propto f^2$$

$$E = kf^2$$

$$56 = k \times 2^2$$

$$56 = 4k$$

$$k = 56 \div 4 = 14$$

$$E = 14f^2$$

$$a) f = 0.5$$

$$E = 14 \times 0.5^2$$

$$E = 3.5$$

$$b) E = 224$$

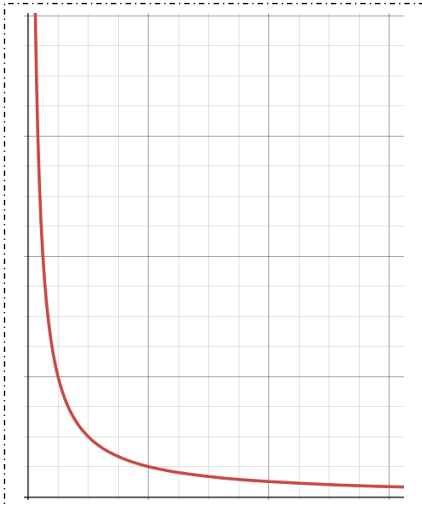
$$224 = 14f^2 \quad (\text{divide by } 14)$$

$$16 = f^2 \quad (\text{square root})$$

$$4 = f$$

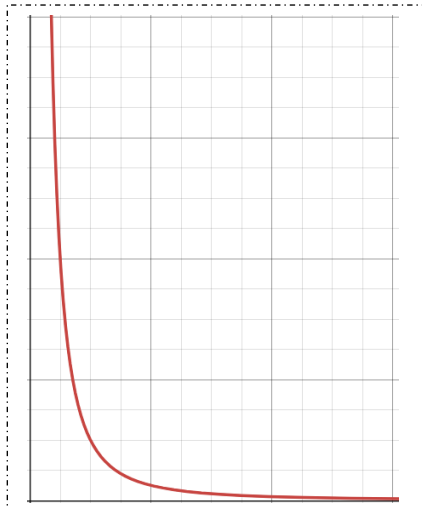
Inverse Proportion

Examples of inverse proportionality and their respective graphs



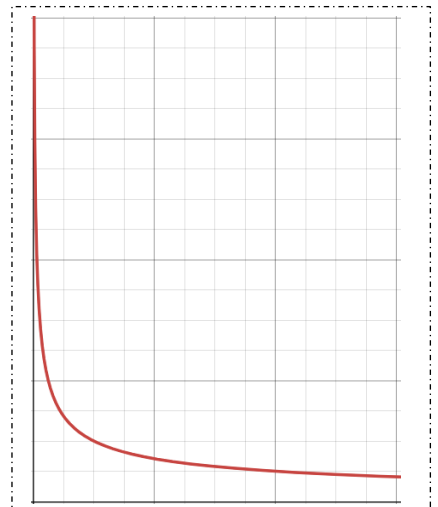
y is inversely proportional to x

$$y \propto \frac{1}{x}$$



y is inversely proportional to x^2

$$y \propto \frac{1}{x^2}$$



y is inversely proportional to the square root of x

$$y \propto \frac{1}{\sqrt{x}}$$

Inversely proportional graphs all have the same general shape.

e.g. C varies inversely with the square root of r.

When C equals 20, r equals 4.

- Find the value of C when r = 16
- Find the value of r when C = 4

First, find the equation linking C and r.

$$C \propto \frac{1}{\sqrt{r}}$$

$$C = \frac{k}{\sqrt{r}}$$

$$20 = \frac{k}{\sqrt{4}}$$

$$20 \times \sqrt{4} = k = 40$$

$$C = \frac{40}{\sqrt{r}}$$

a) r = 16

$$C = \frac{40}{\sqrt{16}} = \frac{40}{4} = 10$$

b) C = 4

$$4 = \frac{40}{\sqrt{r}}$$

($\times \sqrt{r}$)

$$4\sqrt{r} = 40$$

($\div 4$)

$$\sqrt{r} = 10$$

(square)

$$r = 10^2 = 100$$

GLUE HERE