

## Inverse Proportion Equations

### Starter

1. **(Review of last lesson)** The time taken,  $t$ , for a ball to drop  $d$  metres is directly proportional to the square root of  $d$ . Given that a ball takes 3 second to drop 44.1 m, find:
- the value of the constant of proportionality,  $k$
  - the time taken for the ball to drop 15 m.

### Notes

So far we have looked at **directly proportional** relationships e.g.  $y \propto x$   $y \propto x^2$  etc.

There are also **inversely proportional** relationships.

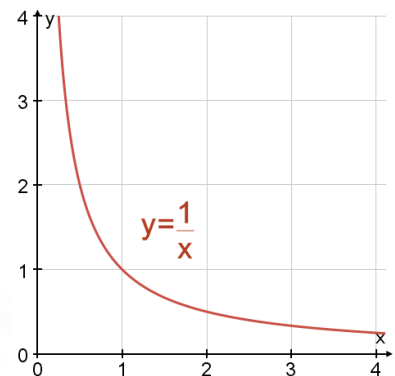
If  $y$  is **inversely proportional** to  $x$  then  $y \propto \frac{1}{x}$  so  $y = \frac{k}{x}$

So inversely proportional means proportional to “1 over...”

This means that:

- if we double  $x$ , we halve  $y$
- if we treble  $x$ , we divide  $y$  by 3

The graph of inversely proportional is to the right.



The working for inversely proportional is very similar to that for direct proportion but the start is:

$$y \propto \frac{1}{x} \quad \Rightarrow \quad y = \frac{k}{x}$$

The rest of the working is the same.

**E.g. 1** A quantity  $M$  is inversely proportional to  $T$ . When  $M = 8$ ,  $T = 6$ .

- Find the constant of proportionality.
- Find  $M$  when  $T = 24$ .
- Find  $T$  when  $M$  is 3.

**Working:**

(a)	$M \propto \frac{1}{T}$	$\Rightarrow$	$M = \frac{k}{T}$	
	<b>When <math>M = 8, T = 6</math>:</b>		$8 = \frac{k}{6}$	<b>(substitute)</b>
			$k = 48$	<b>(find <math>k</math>)</b>

(b) ...

**E.g. 2** The quantity  $p$  is inversely proportional to  $q$ . When  $p = 7$ ,  $q = 4$ . What is the value of  $p$  when  $q = 56$ ?

**Hints:** find the constant of proportionality first and then write down the equation connecting  $p$  and  $q$

**E.g. 3** Complete the table given that  $x$  and  $y$  are inversely proportional to one another.

$x$	2		36	-6	
$y$	18	3			72

**Hint:** use the first column to find the constant of proportionality and then write down the equation connecting  $x$  and  $y$

**N.B.** When  $x$  and  $y$  are inversely proportional to one another, the product of  $x$  and  $y$  is constant i.e.  $xy$  is constant.

**Video:** [Inverse proportion](#)

[Solutions to Starter and E.g.s](#)

### Exercise

Click on the blue link above to find the answers to the questions 2-5.

- 9-1 class textbook: p149 M5.8 Qu 1-4, 6  
A\*-G class textbook: p138 E5.4 Qu 1, 3  
9-1 homework book: p51 M5.8 Qu 1, 2, 4, 6, 7  
A\*-G homework book: p39 E5.4 Qu 1-3
- The quantity  $y$  is inversely proportional to  $x$ . When  $y = 16$ ,  $x = 2$ .
  - Find an equation for  $y$  in terms of  $x$ .
  - Find  $y$  when  $x$  is 10.
  - Find  $x$  when  $y$  is 4.
- The quantity  $w$  is inversely proportional to  $z$ . When  $w = 15$ ,  $z = 4$ .
  - What is the value of  $z$  when  $w = 25$ ?
  - Explain what happens to  $z$  when  $w$  5 times bigger.
- Complete the table given that  $a$  and  $b$  are inversely proportional to one another.

$a$	4	8		-10	
$b$	64		16		128

- $R$  is inversely proportional to  $I$ . When  $I = 5$ ,  $R = 3$ .
  - Find  $R$  when  $I = 7.5$ .
  - Find  $I$  when  $R = 30$ .

**[Homework book answers \(only available during a lockdown\)](#)**