

Grade 7 · Equations of Proportional Relationships · Lesson

Common Core 7.RP.A.2c · mathovore.fr

The equation of a proportional relationship is $y = kx$, where k is the constant of proportionality, the unit rate y/x . To write it, find k from any pair in a table, any point on a graph, or the rate in a situation, then substitute that number for k . Use the equation to find missing values.

Grade 7 Common Core: 7.RP.A.2c

Key facts:

- Every proportional relationship has the form $y = kx$, and its graph is a straight line through the origin $(0,0)$.
- The constant $k = \frac{y}{x}$ is the same for every pair of values with $x \neq 0$.
- For total cost $t = pn$, the price per item p is the constant of proportionality.
- To find a missing value, substitute the known number into $y = kx$ and solve.
- Compare two proportional relationships by comparing their constants k , whatever form each is given in.

What is the equation of a proportional relationship?

Two quantities are in a **proportional relationship** when the output is always the same multiple of the input. A school store sells pencils for \$0.25 each, so the cost c in dollars of p pencils is always 0.25 times p . As an equation, $c = 0.25p$.

Equation of a proportional relationship

$y = kx$, where k is the **constant of proportionality**. It equals the ratio $\frac{y}{x}$ for every pair of values (with $x \neq 0$) and it is the unit rate: the amount of y for 1 unit of x .

Pencils p	4	8	12	20
Cost c (dollars)	1	2	3	5
Ratio c/p	0.25	0.25	0.25	0.25

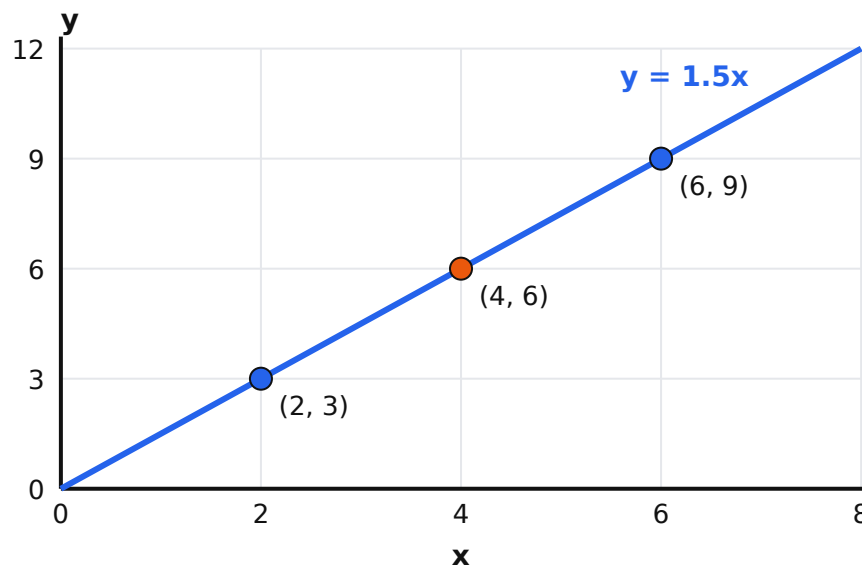
Every ratio of cost to pencils is 0.25, so $k = 0.25$ and $c = 0.25p$.

In the table, every ratio $\frac{c}{p}$ is 0.25, so $k = 0.25$. An equation such as $y = 2x + 3$ is *not* proportional: the added 3 means its graph misses the origin.

How do you write the equation from a table or a graph?

1. Choose any pair (x, y) from the table, or any point on the line other than the origin.
2. Divide to find the constant: $k = \frac{y}{x}$.
3. Write $y = kx$ with that number in place of k .
4. Check a second pair. The ratio must be the same.

Worked example. The graph is a line through the origin and the point $(4, 6)$. Then $k = \frac{6}{4} = 1.5$, so $y = 1.5x$. Check with $(2, 3)$: $1.5 \times 2 = 3$. It matches.

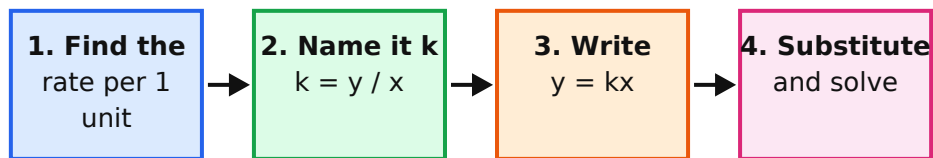


A line through the origin and $(4, 6)$ has $k = 6 / 4 = 1.5$.

How do you write the equation from a situation?

Look for the rate "per one": the price per item, the miles per hour, or the pay per hour. That rate is k . Pick letters that fit the story.

Situation	Equation	Constant k
Apples cost \$3.50 per pound (cost c , pounds p)	$c = 3.5p$	3.5
A car drives 55 miles per hour (distance d , hours h)	$d = 55h$	55
Total cost t of n items at price p each	$t = pn$	p

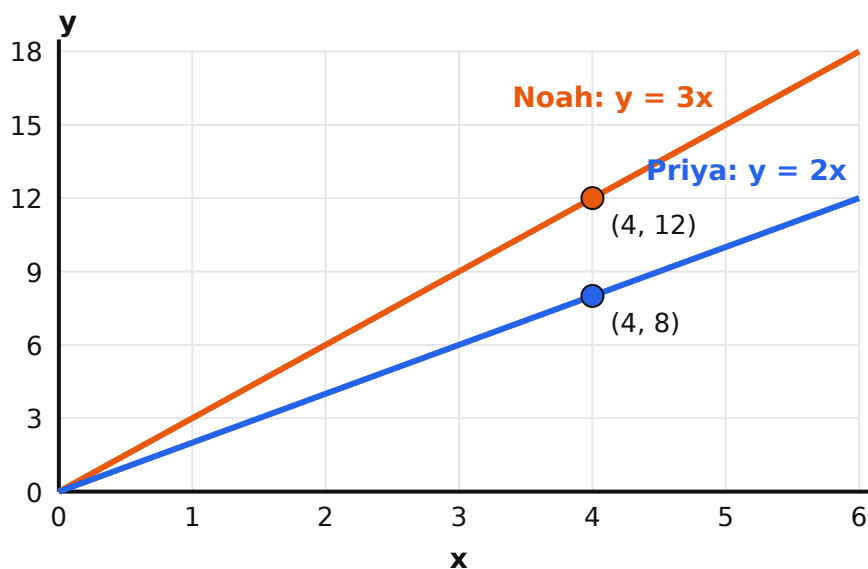


Four steps for writing and using a proportional equation.

How do you use the equation and compare relationships?

Substitute the value you know and solve. With $c = 3.5p$, 6 pounds cost $3.5 \times 6 = 21$ dollars, and \$28 buys $p = 28 \div 3.5 = 8$ pounds.

To compare two proportional relationships, find k for each one, whether it comes as a table, a graph, an equation, or words. Priya saves \$2 each week ($y = 2x$) and Noah saves \$3 each week ($y = 3x$). Noah's line is steeper because his k is larger.



Noah saves \$3 per week and Priya saves \$2 per week, so his line is steeper.

Equations of Proportional Relationships: frequently asked questions

What does k mean in $y = kx$?

The letter k is the constant of proportionality. It is the unit rate, meaning how much y changes for each 1 unit of x . In $c = 0.25p$, $k = 0.25$ means each pencil costs \$0.25.

How can you tell if an equation is proportional?

A proportional equation can be written as $y = kx$ with nothing added or subtracted. The equation $y = 4x$ is proportional, but $y = 4x + 1$ is not because its graph does not pass through the origin.

How do you find k from a graph?

Pick a point on the line, other than the origin, whose coordinates are easy to read. Divide its y -coordinate by its x -coordinate. The point $(1, k)$, if you can read it, shows k directly.

Does it matter which quantity is x and which is y ?

Yes. If y is pay and x is hours, then k is dollars per hour. If you swap the roles, the new constant is the reciprocal and means hours per dollar, so both forms describe the same relationship.

How do you compare two proportional relationships in different forms?

Find the constant of proportionality for each one: divide in a table, read a point on a graph, or take the number multiplying the variable in an equation. Then compare the two values of k using the same units.