

Writing and Using $y = kx$ Equations

Grade 7 math · Lesson · Standards: 7.RP.A.2c

Quick answer: An equation of a proportional relationship has the form $y = kx$, where k is the constant of proportionality, the unit rate. To write it, divide any y -value by its x -value to find k . Then use the equation to find missing values or to compare rates across tables, graphs and stories.

Standards: 7.RP.A.2c · **Level:** Grade 7

What is the equation of a proportional relationship?

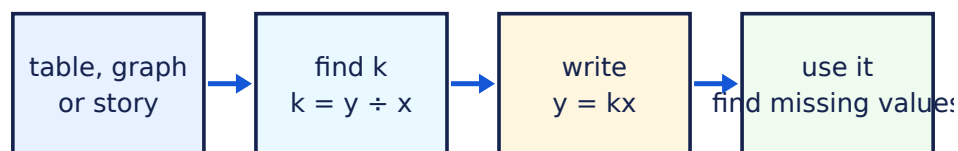
Every proportional relationship can be written as one short equation. If y is the amount that depends on x , then y equals the constant of proportionality times x .

Equation of a proportional relationship

$$y = kx$$

Here k is the unit rate. In a store, with total cost t , price per item p and number of items n , the same idea reads $t = pn$.

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



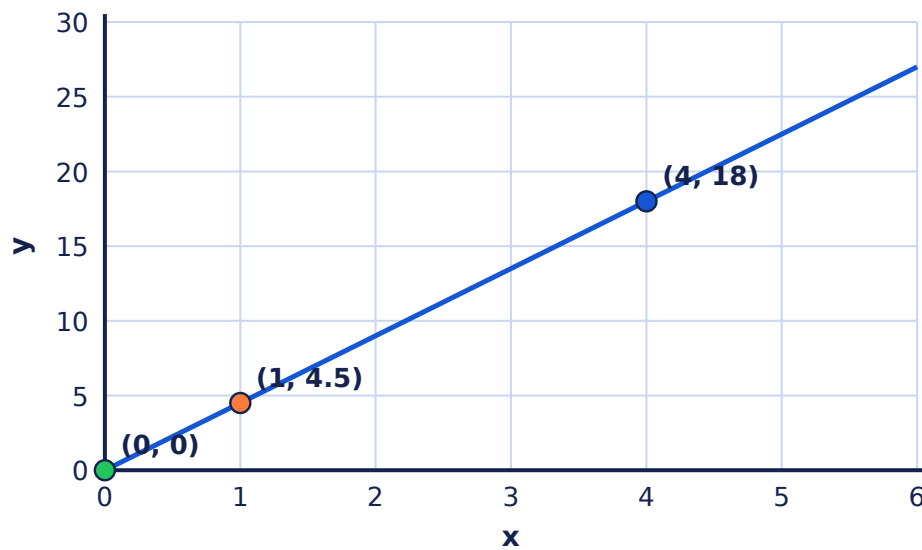
The path from data to an equation.

Method: build and use $y = kx$

1. Find k : divide any y by its x , or read the y -value at $x = 1$ on a graph, or take the rate from the story.
2. Check a second pair, so you know the relationship really is proportional.
3. Write $y = kx$ with the number in place of k .
4. To find y , multiply k by x . To find x , divide y by k .

Worked example

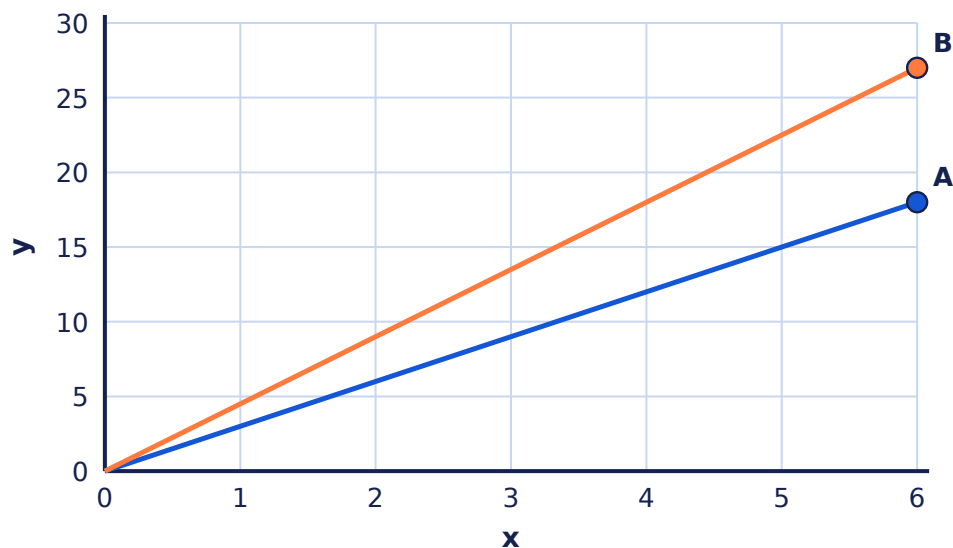
The line in the graph passes through (4, 18). Then $k = 18 \div 4 = 4.5$, so the equation is $y = 4.5x$. At $x = 10$, $y = 4.5 \times 10 = 45$. For $y = 63$, $x = 63 \div 4.5 = 14$. Answer: **$y = 4.5x$** .



The line $y = 4.5x$ passes through (4, 18), so $18 \div 4 = 4.5$.

How do you compare two proportional relationships?

Find the constant of proportionality of each one, whatever its form: a table, a graph, an equation or a sentence. The larger k means the faster rate and, on a graph, the steeper line through the origin.



Plan A is $y = 3x$. Plan B passes through (6, 27), so its constant is $27 \div 6 = 4.5$. Steeper means a larger constant.

Common mistake

Writing $y = x \div k$ or $x = ky$ by accident. The constant always multiplies the input: check by substituting a known pair.

Mathbot's tip

Say the equation as a sentence: "the output is 4.5 times the input." If the sentence matches the story, the equation is right.

Key points to remember

- The equation $y = kx$ models every proportional relationship.
- Find k by dividing y by x for any pair in the table, or read it at $x = 1$ on the graph.
- To find a missing y , multiply by k ; to find a missing x , divide by k .
- In a store, total cost $t = pn$, with price p per item and n items.
- Compare relationships by comparing their constants of proportionality.

Writing and Using $y = kx$ Equations: frequently asked questions

How do you write $y = kx$ from a table?

Divide one y -value by its matching x -value to get k , check one more pair, and then write $y = kx$ with that number. For example, 18 and 4 give $k = 4.5$, so $y = 4.5x$.

What does k represent?

It is the amount of y for each 1 unit of x , the unit rate. In $t = pn$, k is the price per item p .

How do I find x when I know y ?

Divide y by k . If $y = 4.5x$ and $y = 63$, then $x = 63$ divided by 4.5, which is 14.

How can I compare relationships in different forms?

Convert each one to its constant of proportionality. Read it from the equation, compute y divided by x in the table, or read the point at $x = 1$ on the graph, then compare the numbers.

Can the equation have a fraction for k ?

Yes. If 3 feet are covered in 8 minutes, then distance $d = (3/8)t$. You can also use a decimal such as 0.375 when that is easier.