

Grade 7 - Proportional Relationships and $y = kx$ - Lesson

Common Core 7.RP.A.2 · maths-pdf.fr/en/

Two quantities are **proportional** when the ratio of one to the other is always the same. That constant ratio is the constant of proportionality k , and the relationship is written $y = kx$. On a graph, a proportional relationship is a straight line through the origin, and the point $(1, k)$ shows the unit rate.

Grade 7 · Common Core State Standards: **7.RP.A.2**

Key facts

- Proportional means y/x is the same number k for every pair.
- The equation of a proportional relationship is $y = kx$.
- The graph is a straight line through the origin $(0,0)$.
- The point $(1, k)$ on the graph gives the unit rate.
- A line that misses the origin, or a table with changing ratios, is not proportional.

What does it mean for two quantities to be proportional?

Two quantities are **proportional** when their ratio is always the same. If you buy twice as many pounds of apples, you pay twice as much.

Constant of proportionality

In a proportional relationship the ratio y/x never changes. That fixed number is the **constant of proportionality**, written k . It is also the unit rate.

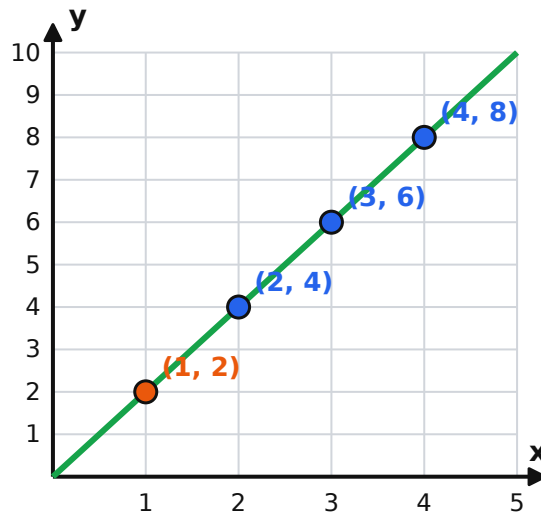
Pounds (x)	1	2	3	4
Cost (y)	\$2.50	\$5.00	\$7.50	\$10.00
y / x	2.50	2.50	2.50	2.50

Every column has the same ratio of cost to pounds, so the relationship is proportional.

In the table above, $2.50 \div 1 = 2.50$, $5.00 \div 2 = 2.50$, and so on, so $k = 2.50$ dollars per pound.

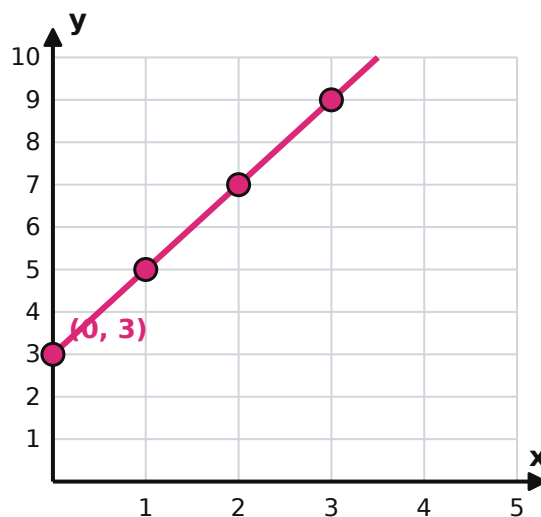
How can you tell from a graph?

A graph shows a proportional relationship only when **both** of these are true: the points lie on a straight line, and the line passes through the origin $(0,0)$.



A straight line through the origin $(0, 0)$ shows a proportional relationship. The point $(1, 2)$ shows $k = 2$.

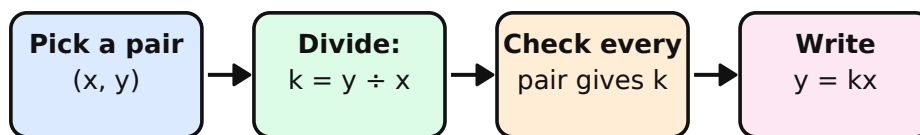
The point $(1, k)$ always lies on the graph. Its y-coordinate is the unit rate. Here the line passes through $(1, 2)$, so $k = 2$.



This line is straight but does not pass through the origin, so it is NOT proportional.

How do you write the equation $y = kx$?

Divide any y-value by its x-value to find k , then write $y = kx$. Check one more pair to be safe.



Find k once, then write the equation.

1. Choose a pair from the table, such as (3,7.50).
2. Find $k = 7.50 \div 3 = 2.50$.
3. Write $y = 2.5x$.
4. Use it: for 6 pounds, $y = 2.5 \times 6 = 15$ dollars.

What does a point on the graph mean?

A point (x,y) tells a real pair of values. The point $(0,0)$ means zero pounds cost zero dollars. The point $(1,2.50)$ means 1 pound costs \$2.50, which is the unit rate.

Test	Proportional?
Constant ratio y/x in every pair	Yes
Straight line through $(0, 0)$	Yes
Line misses the origin	No
Ratios change from pair to pair	No

Questions about proportional relationships and $y = kx$

How do you know if a table is proportional?

Divide y by x in every column. If all the quotients are equal, the relationship is proportional. If even one quotient is different, it is not.

What is the constant of proportionality?

It is the number k in $y = kx$. It equals y/x for any pair and is the same as the unit rate.

Why must the graph pass through the origin?

In $y = kx$, an x -value of 0 gives $y = 0$. So the point $(0,0)$ is always on the graph of a proportional relationship.

What does the point $(1, r)$ mean on a graph?

The y -coordinate r is the amount that goes with 1 unit. In a proportional graph, r equals k , the unit rate.

Is every straight line proportional?

No. A straight line is proportional only if it passes through the origin. The line $y = 2x + 3$ is straight but not proportional.