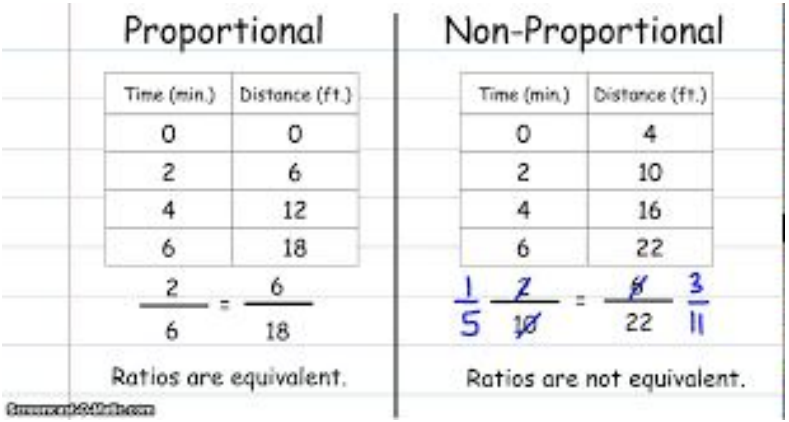
Difference Between Proportional and Non-Proportional Variables Lesson



Proportional

Time (min.)	Distance (ft.)
0	0
2	6
4	12
6	18

$\frac{2}{6} = \frac{6}{18}$

Ratios are equivalent.

Non-Proportional

Time (min.)	Distance (ft.)
0	4
2	10
4	16
6	22

$\frac{1}{5} \frac{2}{10} = \frac{6}{22} \frac{3}{11}$

Ratios are not equivalent.

Vocabulary

1. A **proportional relationship** is a linear proportional relationship that has a constant rate of change and contains the point (0, 0).

2. A **non–proportional relationship** is a linear relationship that has a constant rate of change and does not contain the point (0, 0). In other words, a non-proportional linear relationship is a line that has a y-intercept other than the origin.

3. A **ratio** is a relationship between two numbers that stays constant. If there are 15 students and 3 computers in a classroom, the ratio of students to computers is 15:3, and is expressed in lowest terms, 5:1.

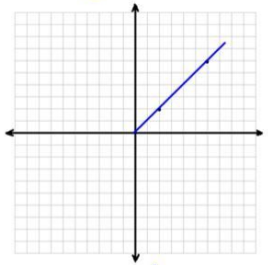
   Examples:
   Ratios can be written in different forms as shown below.
   Like it is said = 5 to 1
   Like an analogy or comparison = 5:1
   Like a fraction = ⅕

Vocabulary

4. **Direct variation** is used to describe proportional relationships. It can be written in the form, $y = kx$, $k \neq 0$ or represented on a graph by a linear function that passes through the origin.

5. **Constant rate** of change is another term for slope.

Proportional



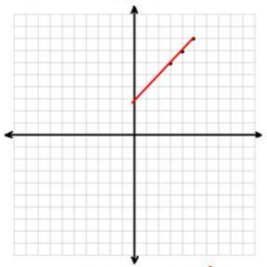
$y = kx$

crosses origin (0,0)

linear

CRoC = CoP

Non-Proportional



$y = mx + b$

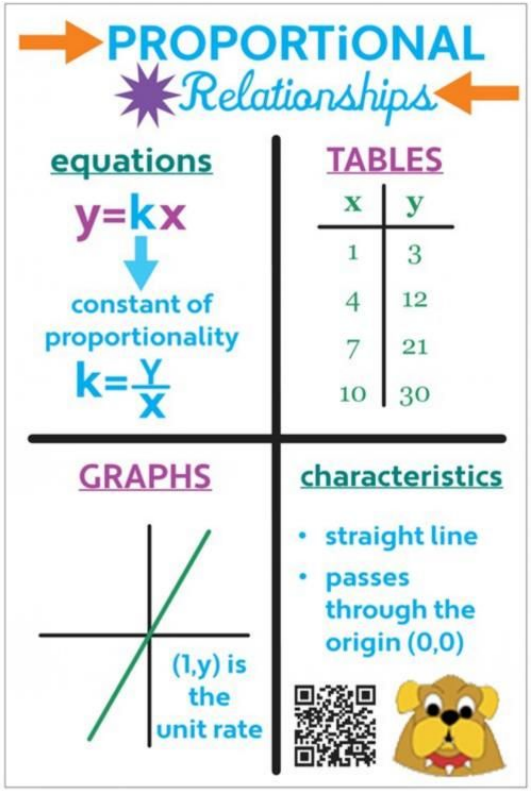
does NOT cross origin

linear

ONLY has CRoC

How to determine the difference between proportional and non-proportional

- Determine the y-intercept.
- Determine the constant rate of change.
- Make a graph from a table or equation.



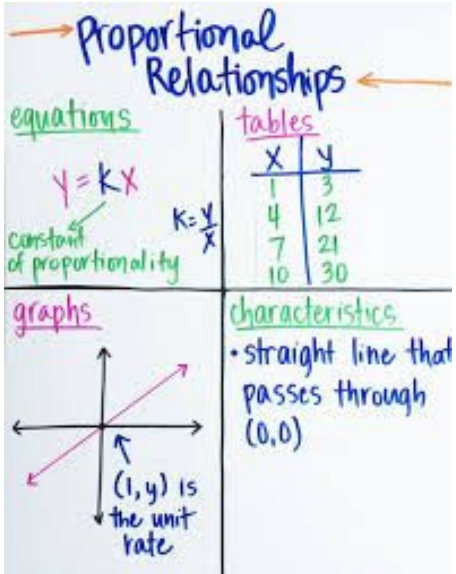
Examples

Verbal Examples

Proportional: Mr. Mangham started the year with $0. Each week he earned $25.

Non-Proportional: Mr. Mangham started the year with $75. Each week he earned $25.

How to tell the difference:
A proportional situation always starts at zero (in this case $0 at the first of the year). A non-proportional situation does not start at zero (in this case $75 at the first of the year).



Examples

Table Examples

Proportional:

Weeks	0	1	2	3	4
Money ($)	0	25	50	75	100
$\frac{\text{Money}}{\text{Weeks}}$	---	25	25	25	25

Non-Proportional:

Weeks	0	1	2	3	4
Money ($)	75	100	125	150	175
$\frac{\text{Money}}{\text{Weeks}}$	---	100	62.5	50	43.75

How to tell the difference:

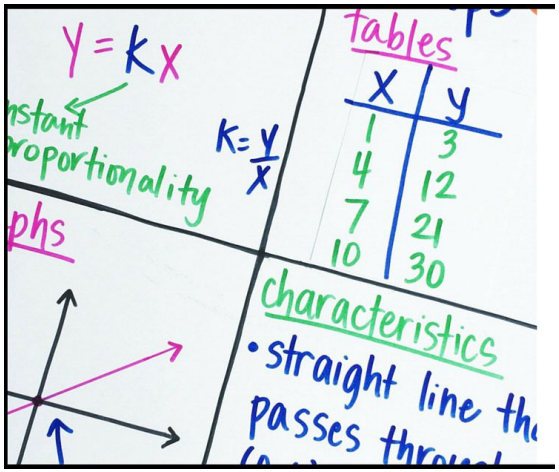
A proportional table has a constant of proportionality in that y divided by x always equals the same value. A non-proportional table will have different values when y is divided by x.

Examples

Equation Examples

Proportional: $y = 25x$ *Non-proportional:* $y = 25x + 75$

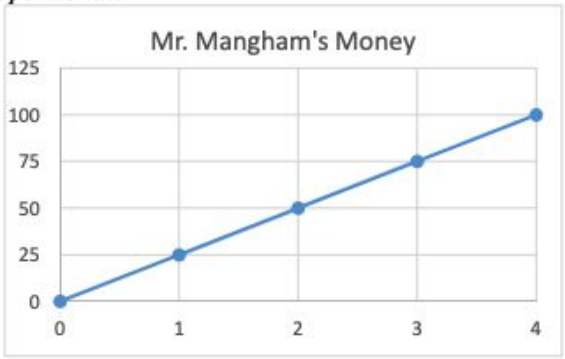
How to tell the difference:
A proportional equation is always in the form $y = kx$, where k is the unit rate or constant of proportionality. A non-proportional equation is always in the form $y = mx + b$, where m is the constant rate of change or slope. The key difference is the added b on the end.



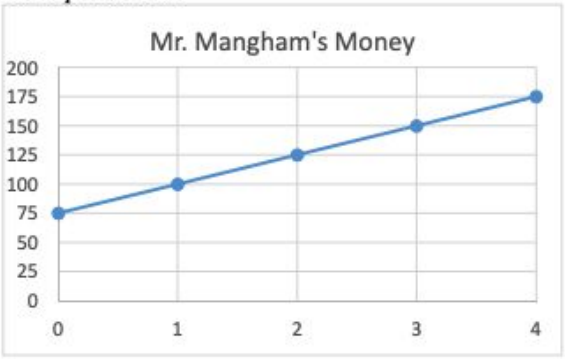
Examples

Graph Examples

Proportional:



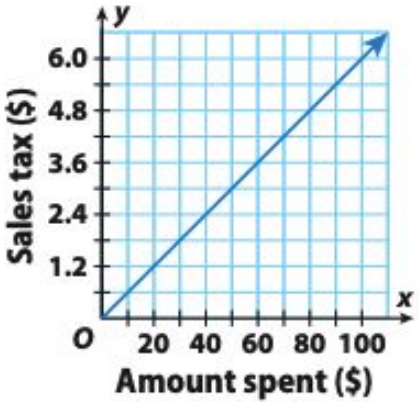
Non-Proportional:



How to tell the difference:
A proportional graph is a straight line that always goes through the origin.
A non-proportional graph is a straight line that does not go through the origin.

Practice

The graph shows the sales tax charged based on the amount spent at a video game store in a particular city. Does the graph show a linear relationship? Is the relationship proportional or nonproportional?



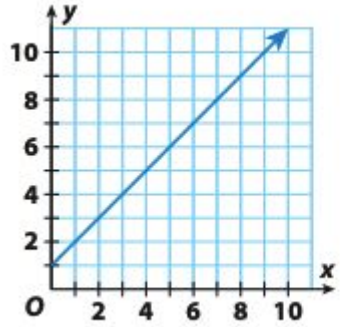
Answer:

The graph shows a linear proportional relationship because it is a line that contains the origin.

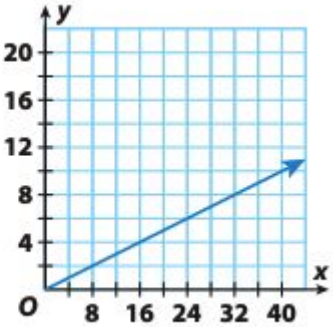
Practice

Determine if each of the following graphs represents a proportional or nonproportional relationship.

1.



2.



1. Non-proportional

2. Proportional

Practice

The number of years since Keith graduated from middle school can be represented by the equation y = a - 14, where y is the number of years and a is his age. Is the relationship between the number of years since Keith graduated and his age proportional or nonproportional?

Answer: The equation is in the form y = mx + b, with a being used as the variable instead of x. The value of m is 1, and the value of b is -14. Since b is not 0, the relationship between the number of years since Keith graduated and his age is nonproportional.

Practice

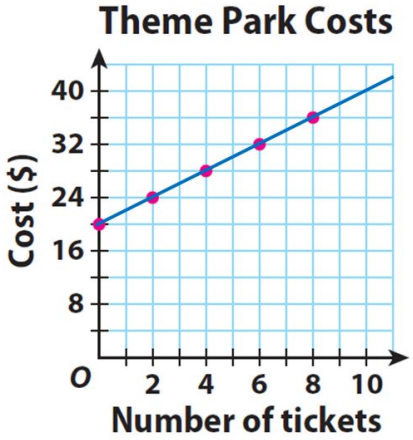
The values in the table represent the numbers of U.S. dollars three tourists traded for Mexican pesos. The relationship is linear. Is the relationship proportional or nonproportional?

U.S. Dollars Traded	Mexican Pesos Received
130	1,690
255	3,315
505	6,565

Answer: The ratio of pesos received to dollars traded is constant at 13 Mexican pesos per U.S. dollar. This is a proportional relationship.

Review

How do you know that a linear relationship given by a graph, a table, or an equation represents a non-proportional relationship?



Sample Answer: The y-intercept, the value of the dependent variable when x = 0, is not 0.

Questions.....