Line in a Plane: Proportionality

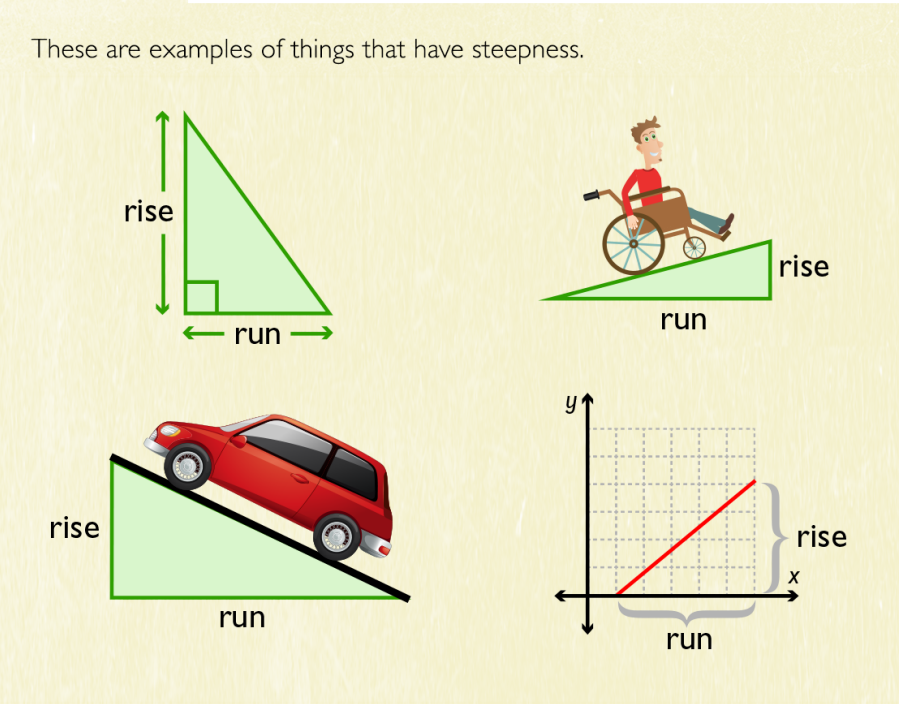
A Line in a Plane: Proportionality

What Is Slope?

Slope is a measure of steepness.

Slope is the relationship between how far up something rises and how far along it runs. It is the ratio of rise (change in the vertical direction) to run (change in the horizontal direction).

EXAMPLE



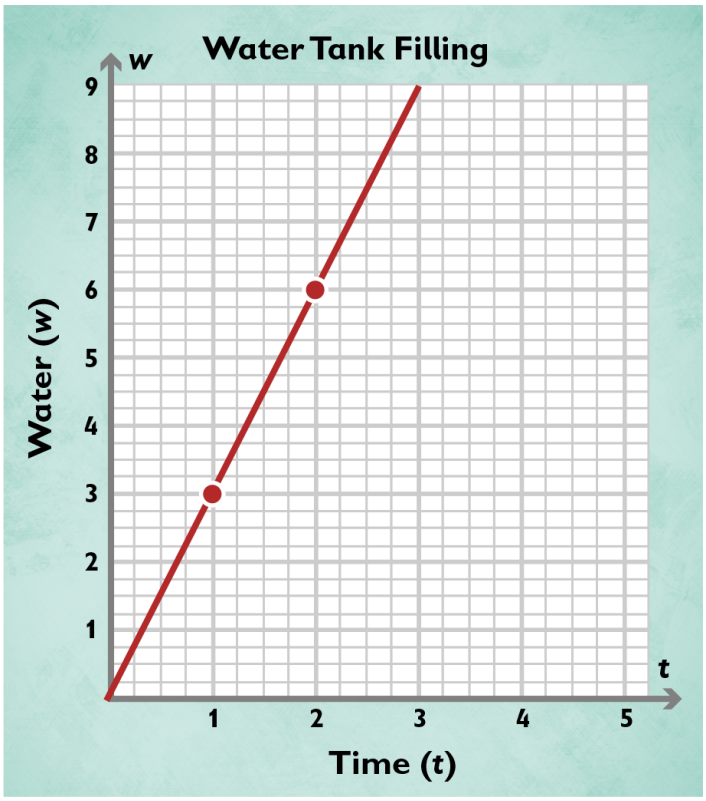
Rate as the Slope

You can apply your understanding of graphs in order to represent a rate and understand the slope of a line.

Suppose you want to graph the relationship between the amount of water and the time passed in the following situation:

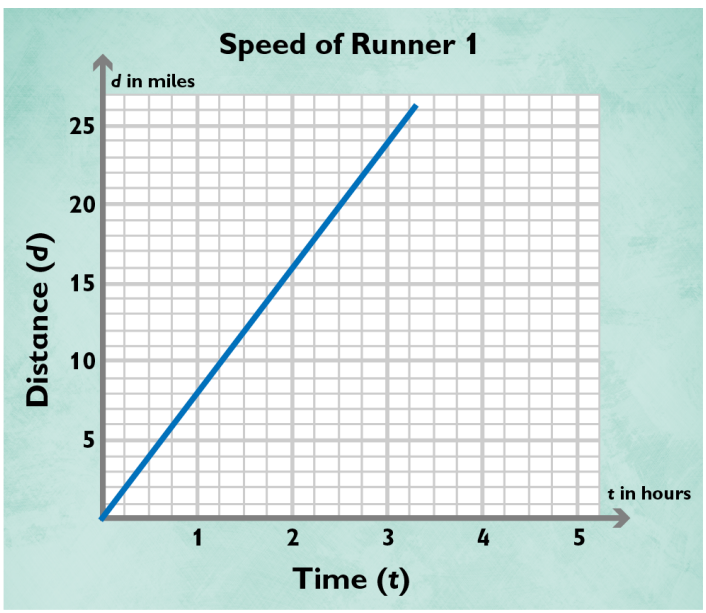
Jamie is filling a bucket of water. Every minute, 3 mL of water goes into the bucket.

In this situation, the rate of filling is 3 mL per minute. Here is a graph of the relationship:



A formula for this relationship and its graph is $w = 3t$, where w is the amount of water in milliliters after a time t in minutes. The number 3, with the unit "mL per minute," is the constant rate of filling. It is also the *slope* of the graph.

Here is another example. This graph shows the speed of Runner 1 in a marathon:

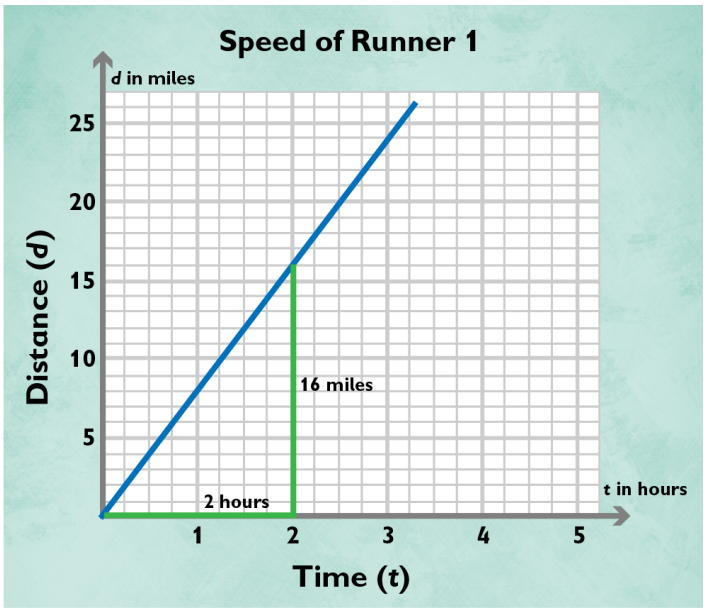


There is another runner in the race, Runner 2. Her time is expressed with the equation: $d = 7.5t$.

This equation shows the relationship between the distance d in miles and the time t in hours for that runner.

Which runner ran faster? You can determine this by comparing the rates. You know that the rate in the equation is 7.5 mph. This means that Runner 2 ran 7.5 mph.

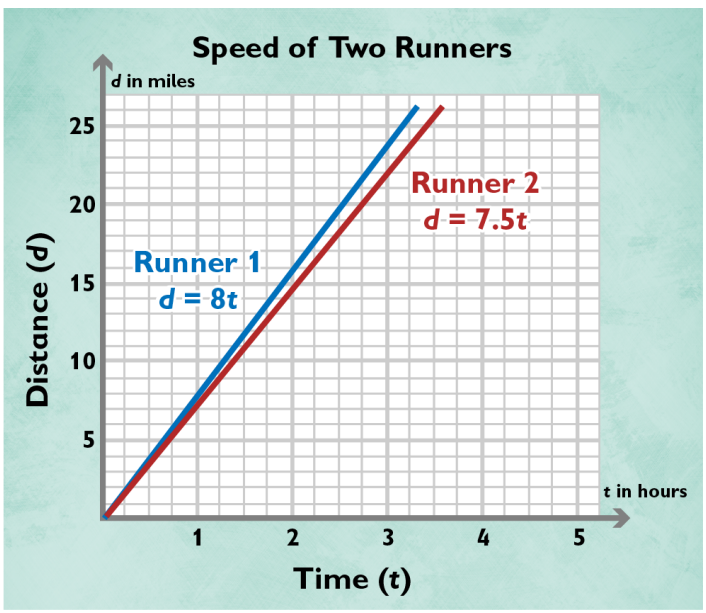
To find the rate for the relationship in the graph, you need to find the *slope*. To do this, draw a right triangle under the graph:



The slope is equal to the rise divided by the run. The rise of the triangle is the vertical side, 16 mi; the run is the horizontal side, 2 hr. Thus, you have a slope of $\frac{16\text{mi}}{2\text{hr}}$ = 8 mph. Runner 1 ran 8 mph.

Comparing this to the speed of Runner 2 at 7.5 mph, you can see that Runner 1 ran faster than Runner 2.

Here are the graphs and the equations for both runners:



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