Unit Rates and Proportional Relationships

A unit rate is a relationship between two quantities that have different units with a denominator (divisor) of one.

Examples: miles per hour, cost per pound, cost per day

We use division to find a unit rate when given a total and asked to solve for one of something.

Clue words: per, each, an, in, every.

Usually the division is set up for us in the word problem:

_____ per _____		
First number	÷	Second number
Numerator	÷	Denominator
Dividend	÷	Divisor
Inside the box	÷	Outside the box
$$$	÷	Time

A proportional relationship is one where the two quantities have a rate of change that is constant (equal). They form a proportion (two equal ratios/fractions).

Examples: $\frac{1}{2} = \frac{2}{4}$ $\frac{10}{5} = \frac{12}{6} = \frac{2}{1}$

The constant of proportionality is the rate of change in a proportional relationship (the number you get when all the ratios are equal). We represent this value with the variable k. k is found by comparing the ratios in a table, graph, or ordered pairs. $k = \frac{y}{x}$. Think: What is happening to x to get y? That's your k! If y is smaller than x, k should be a fraction.

A proportional relationship has the equation $y = kx$. Substitute the value you found for k into the equation. You can check your equation by plugging in a value of x, multiplying it by k, and checking you get the corresponding y value.

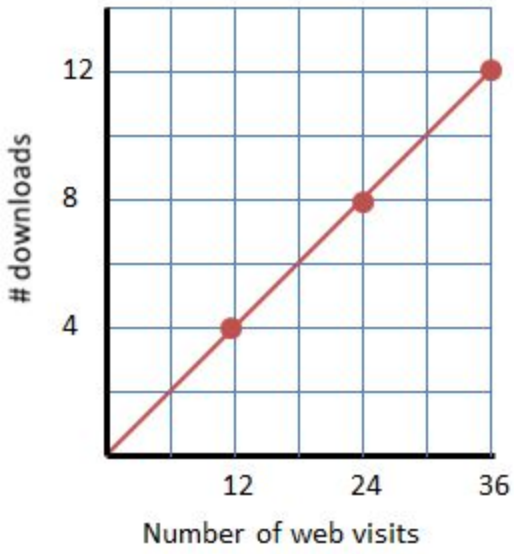
When you find the rate of change to check if a relationship is proportional from a table, you need to flip the table upside down! X is always the top row, or left column in a table. Y is always the bottom row, or right column in a table. Find the ratios $\frac{y}{x}$ to get the constant of proportionality.

Examples:

x	2	3	4
y	8	12	16

$k = \frac{y}{x}$ $\frac{8}{2} = \frac{12}{3} = \frac{16}{4}$ all ratios reduce to $\frac{4}{1}$ so $k = 4$

The equation will be $y = 4x$ Check: $8 = 4(2)$ ✔



Use REALLY NICE POINTS to find the ratios.
Remember every ordered pair is (x, y)
x is the horizontal axis, y is the vertical axis

(12, 4), (24, 8), (36, 12)

k = $\frac{y}{x}$ $\frac{4}{12} = \frac{8}{24} = \frac{12}{36}$ all ratios reduce to $\frac{1}{3}$ so **k = $\frac{1}{3}$**

The equation will be y = $\frac{1}{3}$x Check: 4 = ⅓ (12) ✔

As you can see, a proportional relationship forms a **straight line, passing through the origin.**

The constant of proportionality is the unit rate! When given a graph, if clearly visible, you can look where x = 1, and find the corresponding y value to find k! If a point is not clearly visible, use a REALLY NICE POINT and find k. Once you have an equation, plug in x values to find the corresponding y values.