# Proportional and Nonproportional Relationships and Functions

*Proportional Relationships*

The equation for a proportional relationship is **$y = kx$**

The constant of proportionality, k, must be <u>constant</u> (equal) **$k = y/x$**

K also represents the **unit rate** in a proportional relationship

To find k in a table, check all ratios $y/x$ are equivalent ($x$ should be the top row in the table, y the bottom - so flip the numbers upside down to find your ratios!)

The graph of a proportional relationship looks like a **straight line passing through the origin.** To find k in a graph, find a **really nice point $(x, y)$** and solve for the ratio $y/x$

To write the equation of the relationship, plug the **k** value into the equation $y = kx$

*Non proportional Relationships:*

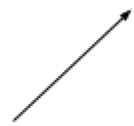
The equation of a non proportional linear relationship is **$y = mx + b$**

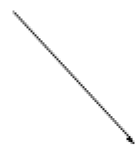
Where **m = slope (rate of change)** and **b = the y - intercept** found at **(0, b)** on the y-axis (does NOT pass through the origin) $b \neq 0$

$y/x$ is NOT constant, but the rate of change $\frac{\Delta y}{\Delta x}$ is!

To find the equation of a line from a table or coordinates, first find the slope:

$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

On a graph you can find the slope by finding the $\frac{rise}{run}$ (watch the scale!) A positive slope slants up to the right 

and a negative slope slants down to the right 

You can locate the point (0, b) in the table (you may have to backtrack by the pattern) or on the graph (on the y-axis)

To graph an equation **b**egin at the **b** (0, b) on the y-axis, then **m**ove according to the slope, **m.** The numerator tells you how many *up (+)* or *down (-)* and the denominator tells you have many *right*.

***Writing Linear Equations:***

To find the equation of a line from a table, graph, or coordinates, first find the slope:

$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

Then choose 1 point and plug in x, y, and m into y = mx + b and solve for b!

Ex: (3, 5) and (-2, -5) *remember every ordered pair is $(x, y)$

$m = \frac{\Delta y}{\Delta x} = \frac{-5-5}{-2-3} = \frac{-10}{-5} = 2$

$y = mx + b$ using (3, 5)

$5 = 2(3) + b$

$5 = 6 + b$

$\underline{-6 \quad -6}$

$-1 = b$ equation: $y = 2x - 1$

In a real - world situation, the slope describes the rate of change (example: what is happening per month, etc.) and the y - intercept describes the initial value (example: the initial fee). EXPLAIN what the m and b stand for in the SITUATION

Example: At a bowling alley you pay $5 for shoes and $3 per game.

$y = 3x + 5$, where $x$ = games, $y$ = total cost

You can compare situations by their equations by stating which has a greater/less rate of change and which has a greater/less initial value

A ***nonlinear*** non proportional relationship does NOT look like a line! The rate of change (slope) is NOT constant. The equations does NOT look like $y = mx + b$ (example: may have an exponent like $x^2$)

*Functions:*

A function is defined as **one output for every input**

In a map, the input can only have **one** arrow to one output

In a table, $x$'s can't repeat (2, 5) and (2, 6) is NOT a function
On a graph there can only be one y value for every $x$ value (vertical line test)
**All** lines are functions