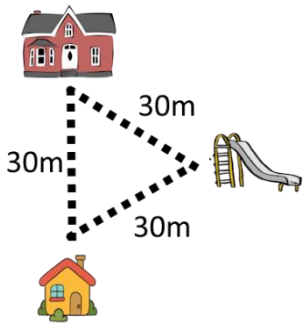
Kinematics/Ran Durbach

Distance VS displacement:

Distance is the amount of space between two points. It is commonly measured in meters around the world. For comparison the average male's height is 1.7m. Some countries like the united states used feet and miles instead of meters and kilometers (kilo=1000). Consider the following demonstration:

You are in your house and you want to get to school. You have to options: 1. Go immediately to school(A short option). 2. First go to the playground then to school(A longer option).

You will have to walk 30m if you chose the 1st options and 60m for the second.



those values are the distance it took you to get to school. That is distance, the sum of "spaces" that you had to walk. Distance takes into account the path you walked.

Displacement on the other hand is only dependent on where you started and where you ended. In the example above whether you chose the 1st or 2nd option you displacement will still be 30m. in both paths you started at home and finished in school and the shortest distance between home and school is 30m.

Velocity:

Velocity is how much distance a body travels in a given amount if time. For example if my velocity is $2\frac{m}{s}$ that means every second that passes I travel 2 meters. Velocity is also knows as the rate of change of distance, meaning: how much does the distance change over time.

$\frac{m}{s}$ read out as "meters per second) is the standard unit to denote velocity. There are also other units: mph(miles per hour) , kph(kilometer per hour) etc.

Velocity Is a vector, meaning it has a magnitude(10, 12, 31, 3) which expresses how big the velocity is. For example, an F16 fighter jet has a high magnitude of 2,414,000 $\frac{m}{s}$ while Usain bolt has a low magnitude of velocity 10.44 $\frac{m}{s}$.

In addition to magnitude velocity also has a direction: East, West, 30 degrees south, In the direction of Queensland, etc.

Speed Is a similar concept to velocity. Speed only has a magnitude and not a direction.

To measure the velocity of a body that has done x distance in t seconds we use the formula:

$$v = \frac{x}{t}$$

A situation where a car is moving at 70mph and we need to find out how much time the car needs to travel from New York to Boston if there are not traffic lights and the velocity is constant. To solve we plug in the values in the formula: $70\frac{miles}{hr} = \frac{216.13\ miles}{t}$

Multiply both side by $\frac{t}{70\ miles}$ and we get t = 3.08hr.

Acceleration:

Acceleration is the rate of change of velocity. Ergo, how much does the velocity change over time. An acceleration of $2\frac{m}{s^2}$ means the body will increase its **current** velocity by $2\frac{m}{s}$ every second. If the body starts at rest(no velocity) then after 1 second it will have a velocity of $2\frac{m}{s}$. After another second $4\frac{m}{s}$ and another second $6\frac{m}{s}$.

The general formula is given by: $a = \frac{v}{t}$