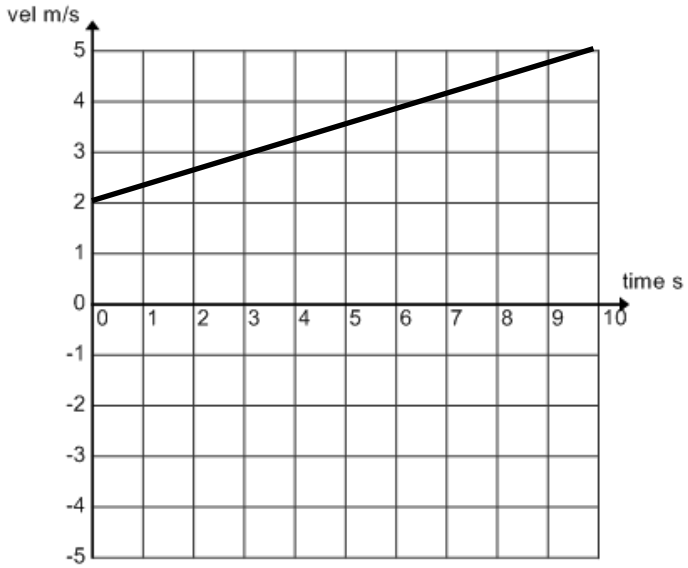
From the graphs of motion physicists can deduce equations of motion which can be used to calculate displacements, velocities and accelerations.

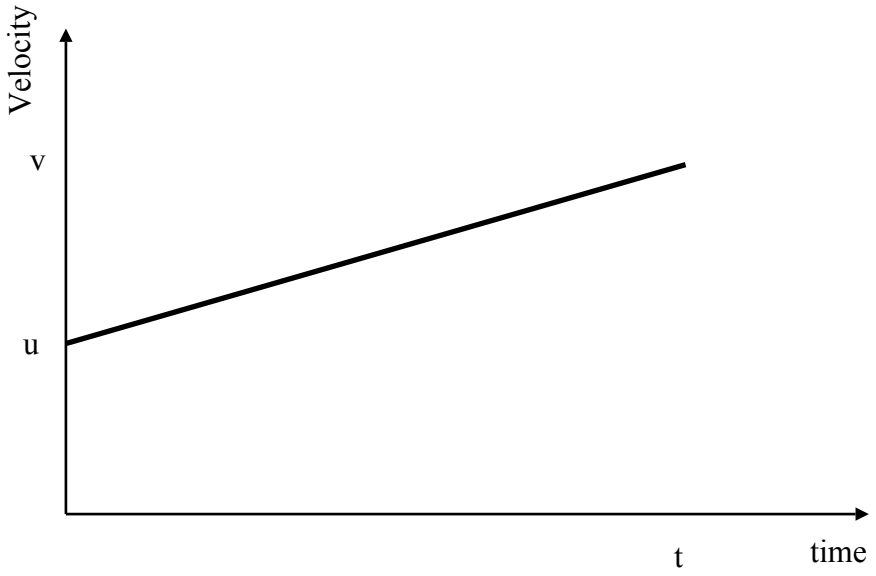
Famous physicists, like Galileo, Copernicus and Kepler used these equations of motion to fully describe movement in nature.

It is these same equations that got man to the moon!

Such equations are called ***Kinematic Equations.*** The word *kine comes from the Latin word moving.*

Deriving the Kinematic equations.




Velocity
v
u
t
time

The Kinematic equations.

$$v = u + at$$

Initial velocity
Final velocity
Acceleration
Displacement
Time

$$S = ut + \frac{1}{2}at^2$$

Initial velocity
Final velocity
Acceleration
Displacement
Time

$$v^2 = u^2 + 2as$$

Initial velocity
Final velocity
Acceleration
Displacement
Time

The Kinematics equations: Examples

A car has an initial velocity of 4 ms^{-1} It accelerates at 4 ms^{-2} over 20 m.

Find the final velocity of the car at 20 m

The velocity of a yacht at a marker buoy is 15 ms^{-1} It accelerates at 2 ms^{-2} as it passes the marker buoy.

Find the yacht`s displacement from the marker buoy 10 seconds after it passes it.

A first aid parcel is dropped from 30 m from a hovering helicopter.

Find the velocity the parcel as it lands and the time it took to to land.

A bag of sand is thrown down from a stationary hot air balloon with a speed of 2 ms^{-1}.

If the sand bag hits the ground with a speed of 50 ms^{-1} determine the height it was dropped from.

A metal strut falls off a helicopter while it is ascending up with a constant speed of 1 ms^{-1}

Determine the height the strut fell off if it lands with a speed of 15 ms^{-1}

When an object is on something that is moving with a constant speed the initial velocity of the object takes the size and direction of the thing that is moving.

hovering

Constant velocity upwards

Constant velocity downwards