Motion graphs

In motion graphs, we often use the gradient of a line and the area under a line to find values of quantities.

Gradient

We calculate the gradient by choosing two points on the line and calculating the change in the y axis (up/down) and the change in the x axis (across).

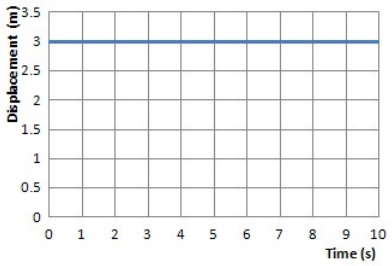
$$gradient = \frac{\Delta y}{\Delta x}$$

Area under graph

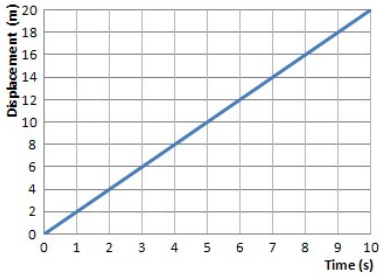
In IB Physics, we will not be asked to calculate the area under curves, only straight lines.

We do this be breaking the area into rectangles (base x height) and triangles (½ base x height).

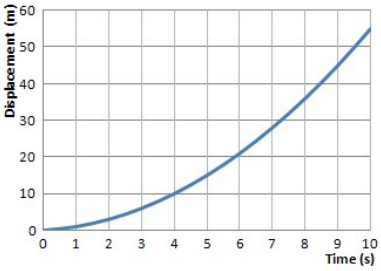
Displacement-time graphs



A



B



C

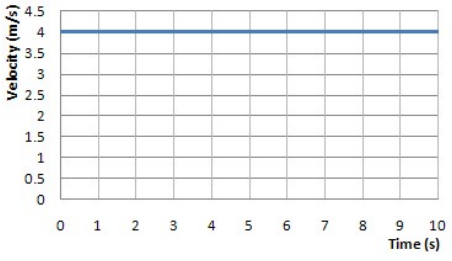
Graph A shows that the displacement stays at 3m, it is stationary.

Graph B shows that the displacement increases by the same amount each second, it is travelling with constant velocity.

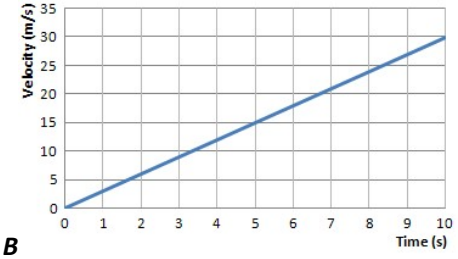
Graph C shows that the displacement covered each second increases each second, it is accelerating.

Since $gradient = \frac{\Delta y}{\Delta x}$ and y = displacement and x = time → $gradient = \frac{\Delta s}{\Delta t}$ → $\boxed{gradient = velocity}$

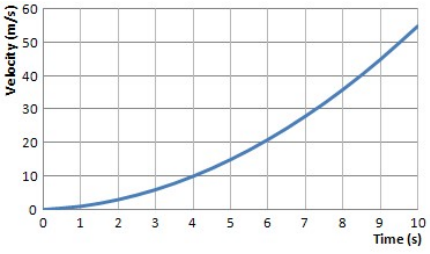
Velocity- time graphs



A



B



C

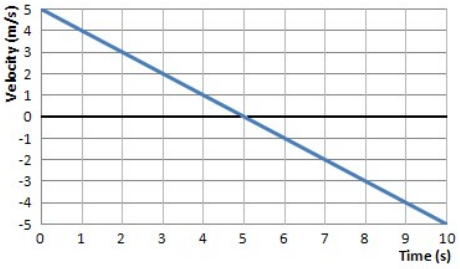
Graph A shows that the velocity stays at 4m/s, it is moving with constant velocity.

Graph B shows that the velocity increases by the same amount each second, it is accelerating by the same amount each second (uniform acceleration).

Graph C shows that the velocity increases by a larger amount each second, the acceleration is increasing (non-uniform acceleration).

Since $gradient = \frac{\Delta y}{\Delta x}$ and y = velocity and x = time → $gradient = \frac{\Delta v}{\Delta t}$ → $\boxed{gradient = acceleration}$

area = base x height → area = time x velocity → $\boxed{area = displacement}$



This graph show the velocity decreasing in one direction and increasing in the opposite direction.

If we decide that ←is negative and →is positive then the graph tells us:

The object is initially travels at 5 m/s →

It slows down by 1m/s every second

After 5 seconds the object has stopped

It then begins to move ←

It gains 1m/s every second until it is travelling at 5m/s ←