# Motion Graphs

To be able to interpret displacement-time and velocity-time graphs
To be able to represent motion with displacement-time and velocity-time graphs
To know the significance of the gradient of a line and the area under it.

## Gradient

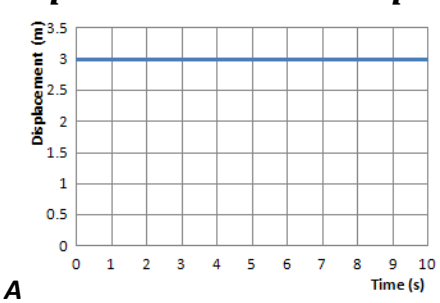
We calculate the gradient by choosing two points on the line and calculating the change in the y axis (up/down) and the change in the x axis (across).

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

## Area Under Graph

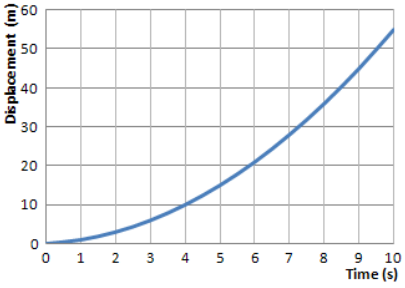
At this level we will not be asked to calculate the area under curves, only straight lines.
We do this be breaking the area into rectangles (base x height) and triangles (½ base x height).

## Displacement-Time Graphs




**A**


**B**

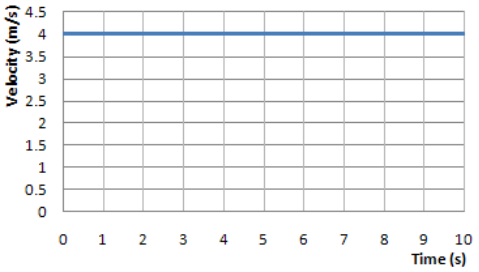



**C**

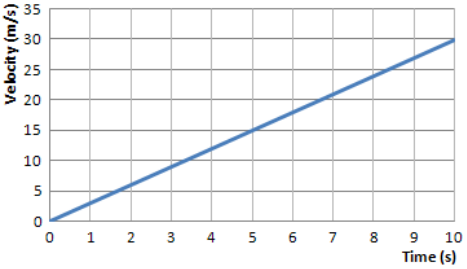
Graph A shows that the displacement stays at 3m, it is stationary.
Graph B shows that the displacement increases by the same amount each second, it is travelling with constant velocity.
Graph C shows that the displacement covered each second increases each second, it is accelerating.

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

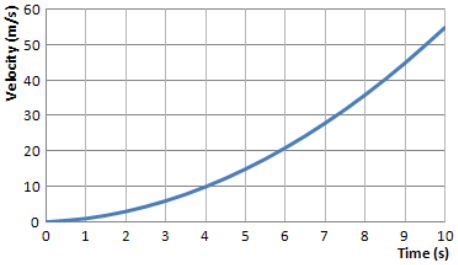
## Velocity- Time Graphs




**A**



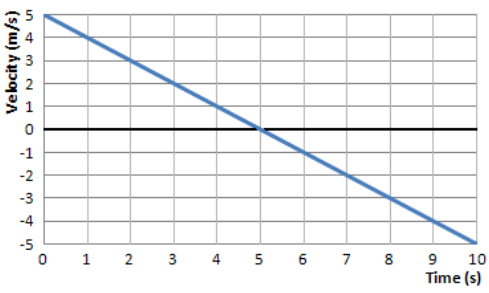

**B**




**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 →

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

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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 ←