In this activity you will match cards describing real situations involving motion with graphs modelling the motion.

## Information sheet  Scalars and vectors

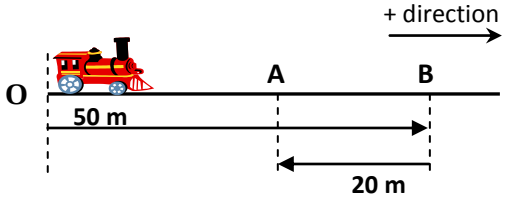
**Distance** is a scalar quantity – it has **magnitude**, but no **direction**.

**Displacement** is a vector – it has **magnitude** and **direction**.

For example, if an engine moves forward 50 m then reverses 20 m, these displacements can be taken as 50 m and – 20 m.

Total distance moved = 50 + 20 = 70 m

Total displacement = 50 + (– 20) = 30 m




### Think about…

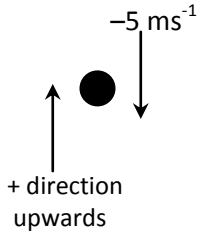
What does the displacement tell you about the train's final position?

**Speed and Velocity**

For an object moving at a constant speed, **speed =** $\frac{\textbf{distance}}{\textbf{time}}$

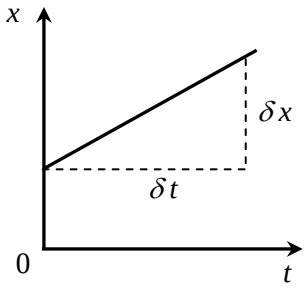
**Speed** is a **scalar quantity** – it has **magnitude**, but **no direction.**

**Velocity** is the rate at which the displacement changes with time.
It is a **vector**, having direction as well as magnitude.
For example, if upwards is taken as the positive direction, then a ball falling at a speed of 5 $ms^{-1}$ has a velocity of –5 $ms^{-1}$.



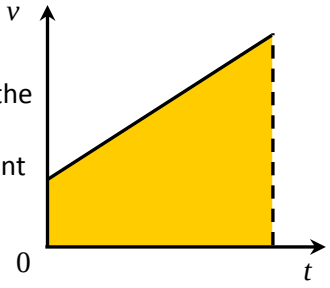

### Displacement–time graph

Gradient = $\frac{\delta x}{\delta t}$
gives the velocity




### Velocity–time graph

Area between the graph and the time axis gives the displacement

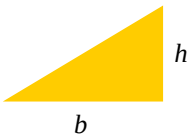



### Think about…

What would a negative gradient mean on each graph?

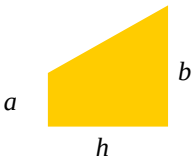
## Useful area formulae

**Area of a triangle** $= \frac{\text{base} \times \text{height}}{2} = \frac{bh}{2}$




**Area of a trapezium** $= \frac{\text{sum of parallel sides} \times \text{distance between}}{2}$

$= \frac{(a+b)h}{2}$




## Reflect on your work

What is the difference between distance and displacement?

Is speed the same as velocity? Can you explain your answer?

How are velocity–time graphs and displacement–time graphs related?

How realistic are the graphs as models of the motion described?
Can you suggest what more realistic graphs would look like?