

# Topic 2: Motion knowledge organiser

## Scalars and vectors

Scalar quantities have only a magnitude. Vector quantities have a magnitude and direction.

Scalars	Vectors
Distance	Displacement
Speed	Velocity
Mass	Weight
Temperature	Force
Volume	Acceleration

## Representing vectors

Since forces are a vector quantity, it is useful to show their magnitude (size) and direction using an arrow. The arrow points in the direction that the force acts, and its length shows the magnitude. For example in the diagram the force acting to the left of the object is larger than the force acting to the right.



## Speed and velocity

Speed and velocity are both quantities that measure the rate of change of distance, but velocity includes the direction. This makes velocity a vector quantity, so we can show velocity with an arrow. Typical speeds are walking: 1.5 m/s, running 3m/s, cycling 6 m/s. Speed is calculated using the equation:

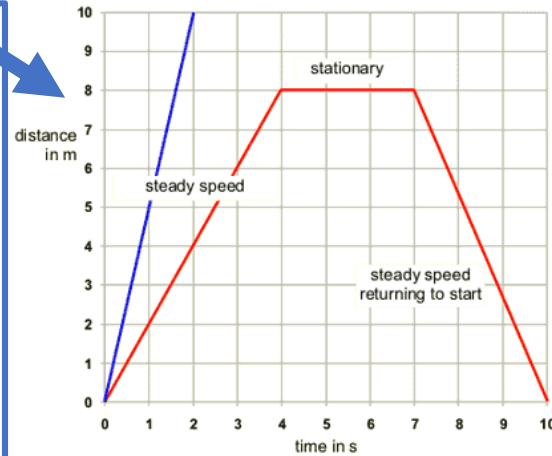
$$\text{speed (m/s)} = \frac{\text{distance (m)}}{\text{time (s)}}$$

This can be rearranged to:

$$\text{distance (m)} = \text{speed (m/s)} \times \text{time (s)}$$

## Distance time graph

A distance-time graph shows how far an object has gone from its starting point at a certain time. A slope means the object is moving, (distance is changing as time changes.) A horizontal line means the object is not moving (distance is not changing with time.) The gradient (steepness of the slope) tells you the speed of the object.



## velocity time graph

A velocity-time graph shows the velocity of an object at any particular time on its journey. Using the gradient of a slope, you can find the acceleration. The distance travelled during the journey is found by calculating the area under the line on the graph. You can count the squares or find the area of a rectangle / triangle.

