Average Velocity

What is the difference between velocity and speed?

Speed in the distance over time without direction; velocity involves the amount on abject changes direction in a time frame and which direction is goes

Velocity: is a **vector** that describes how quickly an object's position changes and in which **direction**

Speed: is a **scalar** that measures the magnitude of velocity

*Both speed and velocity are measured in metres per second (m/s)

Write your own example to differentiate between speed and velocity

The cheetah was running at 20 m/s (speed); the cheetah was running 20 m/s [E] (velocity)

How to calculate average velocity:

average velocity = displacement/time = $(d_f - d_i)/(t_f - t_i)$

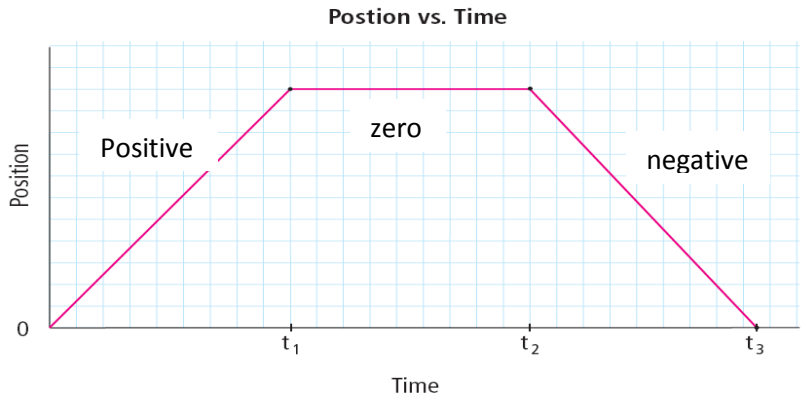
$$\vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t}$$

Average velocity: the rate of change in **position** over a time interval

Why do we use average velocity?

Recall: uniform motion – what is it again?

Average velocity is that line of best fit we have been using



Label the slopes above as positive, negative, or zero. State which direction the object is moving.

Practice:

1. What is the average velocity of a dog that takes 4.0 s to run forward 14 m?

$$V_{avg} = \frac{(14\ m - 0\ m)}{(4.0\ s - 0\ s)} = 3.5\frac{m}{s} forward$$

2. A boat travels 280 m east in a time of 120 s. What is the boat's average velocity?

$$V_{avg} = \frac{280\ m}{120\ s} = 2.3\ \frac{m}{s} east$$

3. What is the displacement of a bicycle that travels 8.0 m/s [N] for 15 s?

$$8.0\frac{m}{s} = \frac{\Delta d}{(15\ s)} = 120\ m\ [N]$$

4. A person, originally at the starting line, runs west at 6.5 m/s. What is the runner's displacement after 12 s?

$$6.5\ \frac{m}{s} = \frac{\Delta d}{(12\ s)} = 78\ m\ [W]$$

5. How long would it take a cat walking north at 0.80 m/s to travel 12 m north?

$$0.80\frac{m}{s} = \frac{12\ m}{\Delta t} = 15\ s$$

6. A car is driving forward at 15 m/s. How long would it take this car to pass through an intersection that is 11 m long?

$$15\ \frac{m}{s} = \frac{11\ m}{\Delta t} = 0.73\ s$$

Converting between units: *But why!?!* Well…everything must be in SI units unless otherwise stated!

Change from km to m → 1 km = 1000 m

Change from hours to seconds → 1 h = 3600 s

Example: Convert 75 km/h to m/s

$$\frac{75\text{ km}}{1\text{h}} \times \left(\frac{1000\text{m}}{1\text{km}}\right) \times \left(\frac{1\text{h}}{3600\text{s}}\right) = 21\text{m/s}$$