

Average Speed and Average Velocity

Starter

1. **(Review of last lesson)** When a parachutist jumps from a helicopter hovering above an airfield her speed increases at a constant rate to 28 m/s in the first 3 seconds of her fall. It then decreases uniformly to 8 m/s in a further 6 s, it then remains constant until she reaches the ground. Her total descent takes 1 minute.
- Sketch a velocity-time graph for the parachutist.
 - Find the height of the plane when the parachutist jumps out of the plane.

Notes

Distance to speed is what displacement is to velocity.

Distance vs displacement

Distance: areas below the t -axis are considered positive

Displacement: areas below the t -axis are considered negative

N.B. Speeds are always quoted as positive numbers but velocities can be positive or negative.

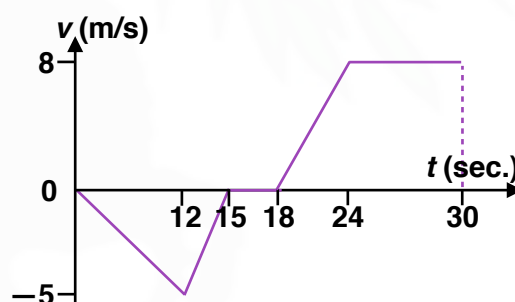
$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{time}}$$

$$\text{Average velocity} = \frac{\text{total displacement}}{\text{time}}$$

$$\text{Average acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

N.B. If an object moves in just one direction (i.e. no moving backwards), then displacement equals distance.

- E.g. 1** The velocity-time graph shows the motion of a car as it moves in a straight line. Find:
- the total distance travelled
 - the displacement from the starting point at the end of the journey
 - the average speed of the journey
 - the average velocity of the journey.



Working:

(a) 0 – 15 s: Distance = $\frac{1}{2} \times 15 \times 5 = 37.5$

18 – 30 s: Distance = $\frac{1}{2} \times (12 + 6) \times 8 = 72$

Distance travelled = $37.5 + 72 = 109.5$ m

Video: [Average velocity and average speed](#)

[Solutions to Starter and E.g.s](#)

Exercise

p443 19E Qn 1i, iii, 2-7

Summary

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Displacement: areas below the t -axis are considered negative

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