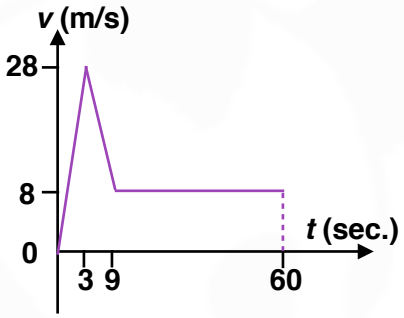
Average Speed and Average Velocity

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.
   (a) Sketch a velocity-time graph for the parachutist.
   (b) Find the height of the plane when the parachutist jumps out of the plane.

Working: (a)



(b) Area under graph = Distance travelled

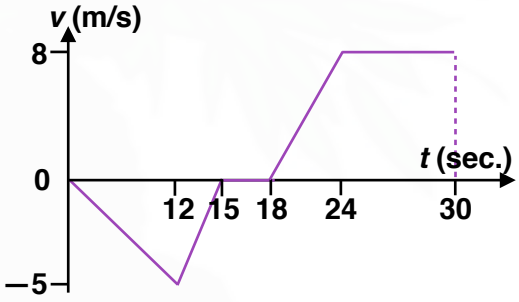
$0 - 3$ s: Distance $= \frac{1}{2} \times 3 \times 28 = 42$

$3 - 9$ s: Distance $= \frac{1}{2} \times (28 + 8) \times 6 = 108$

$9 - 60$ s: Distance $= 8 \times 51 = 408$

Height of plane $= 42 + 108 + 408 = 558$ m

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

(b) Displacement $= -37.5 + 72 = 34.5$ m

(c) $\text{Average speed} = \frac{\text{total distance}}{\text{time}} = \frac{109.5}{30} = 3.65$ m/s

(d) $\text{Average velocity} = \frac{\text{final displacement - initial displacement}}{\text{time}}$

$= \frac{34.5}{30} = 1.15$ m/s

Video: Average velocity and average speed

Solutions to Starter and E.g.s

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