

Constant acceleration 9A

1 a A displacement = 40 km, time = 0.5 h and $\frac{40}{0.5} = 80$

So the average velocity is 80 km h⁻¹.

B displacement = 20 km, time = 0.5 h and $\frac{20}{0.5} = 40$

So the average velocity is 40 km h⁻¹.

C displacement = 0 km, time = 0.5 h and $\frac{0}{0.5} = 0$

So the average velocity is 0 km h⁻¹.

D displacement = 40 km, time = 1 h and $\frac{40}{1} = 40$

So the average velocity is 40 km h⁻¹.

E displacement = -100 km, time = 1.5 h and $\frac{100}{1.5} = -66.7$ (to 3 s.f.)

So the average velocity is -66.7 km h⁻¹.

b The average velocity for the whole journey is 0 km h⁻¹ as the overall displacement is 0 km.

c Total distance travelled = 200 km

Total time taken = 4 h

average speed = $\frac{200}{4} = 50$ km h⁻¹

2 a For first section of the journey: average velocity = 60 km h⁻¹, time taken = 2.5 h

displacement = 2.5 × 60 = 150 km

This is 6 squares on the vertical axis, so one square is $\frac{150}{6} = 25$ km

total displacement shows as 7.5 squares = 7.5 × 25 = 187.5 km

b Time for whole journey = 3.75 h

average velocity = $\frac{187.5}{3.75} = 50$ km h⁻¹

3 a displacement = 12 km, time = 1 h

average velocity = $\frac{12}{1} = 12$ km h⁻¹

b Sarah passed her home at 12:45.

c For the penultimate stage: displacement = -12 + (-3) = -15 km, time = 1.5 h

average velocity = $\frac{-15}{1.5} = -10$ km h⁻¹

For the final stage: displacement = 3 km, time = 1 h

average velocity = $\frac{3}{1} = 3$ km h⁻¹

3 d Total distance travelled = 30 km
Total time taken = 4 h
average speed = $\frac{30}{4} = 7.5 \text{ km h}^{-1}$

4 a Reading from the graph:

maximum height = 2.5 m
time taken to reach this = 0.75 s

b When it reaches the highest point, the velocity of the ball is 0 m s^{-1} .

c i The velocity of the ball is positive (upwards) and decreases (the ball is decelerating) until it reaches 0 at the highest point.

ii The velocity of the ball is negative (downwards), and increases (the ball is accelerating) until it hits the ground at the same speed at which it was launched.