

Exercise 2A

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

$$\text{average speed} = \frac{200}{4} = 50 \text{ km h}^{-1}$$

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

$$\text{displacement} = 2.5 \times 60 = 150 \text{ km}$$

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

$$\text{total displacement shows as } 7.5 \text{ squares} = 7.5 \times 25 = 187.5 \text{ km}$$

b Time for whole journey = 3.75 h

$$\text{average velocity} = \frac{187.5}{3.75} = 50 \text{ km h}^{-1}$$

3 a displacement = 12 km, time = 1 h

$$\text{average velocity} = \frac{12}{1} = 12 \text{ km h}^{-1}$$

b Sarah passed her home at 12:45.

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

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

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

$$\text{average velocity} = \frac{3}{1} = 3 \text{ km h}^{-1}$$

- 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.