

Exercise walk-through

Rates ■ E1.12

eXercise

You must be able to

- use average speed = $\frac{\text{distance}}{\text{time}}$
- use density = $\frac{\text{mass}}{\text{volume}}$
- convert times correctly and rearrange a rate formula

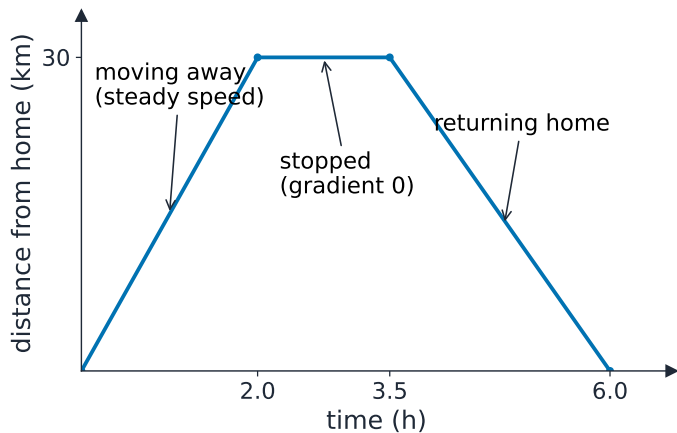
Method — Speed, distance, time

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}} \qquad \text{density} = \frac{\text{mass}}{\text{volume}}$$

- **Worked:** 45 km in 3 h 45 min = 3.75 h $\rightarrow$ speed = $\frac{45}{3.75} = 12$ km/h.
- Change minutes to a decimal of an hour (45 min = 0.75 h) — **not** 3.45.

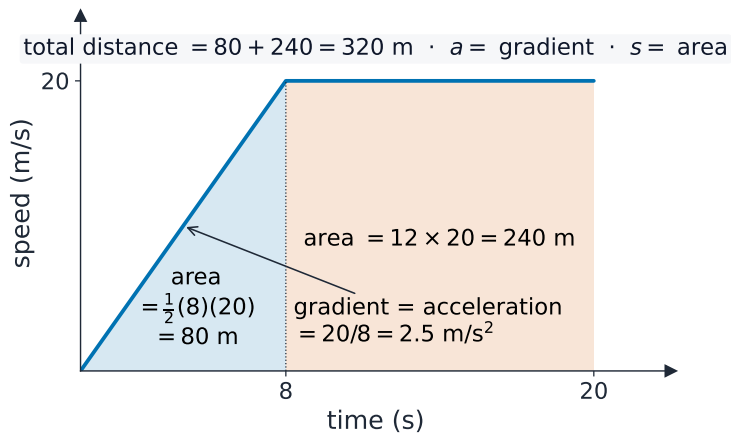
Answer shapes: **M1** a correct method, **A1** the correct answer.

Method — Speed, distance, time



A distance–time graph: gradient is the speed

Method — Speed, distance, time



A rate also reads off a speed-time graph

Practice 2.1 ■ 1 mark

A car travels 120 km in 2 hours. Calculate its average speed.

Solution 2.1

Method: Speed, distance, time

Worked steps

$$\frac{120}{2} = 60 \text{ km/h } \text{B1}.$$

Practice 2.2 ■ 2 marks

A metal block has mass 240 g and volume 30 cm³. Calculate its density.

Solution 2.2

Method: Speed, distance, time

Worked steps

$$\text{density} = \frac{240}{30} = 8 \text{ g/cm}^3 \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{240}{30}; \text{ for } 8.$$

Practice 2.3 ■ 2 marks

A runner's average speed is 5 m/s. How far does she run in 40 seconds?

Solution 2.3

Method: Speed, distance, time

Worked steps

distance = $5 \times 40 = 200$ m **M1** **A1** *for speed $\times$ time; for 200.*

Exam-style 3.1 ■ 2 marks

A train travels 150 km in 1 hour 30 minutes. Calculate its average speed in km/h.

Solution 3.1

Method: Speed, distance, time

Worked steps

$1 \text{ h } 30 \text{ min} = 1.5 \text{ h} \rightarrow \text{speed} = \frac{150}{1.5} = 100 \text{ km/h}$ **M1** **A1** *for 1.5 h and the division; for 100.*

Exam-style 3.2 ■ 2 marks

Gold has a density of 19.3 g/cm^3 . Calculate the mass of a gold bar of volume 50 cm^3 .

Solution 3.2

Method: Speed, distance, time

Worked steps

mass = density $\times$ volume = $19.3 \times 50 = 965$ g **M1** **A1** *for 19.3×50 ; for 965.*

Exam-style 3.3 ■ 3 marks

A cyclist travels 36 km at an average speed of 24 km/h. Calculate the time taken, in minutes.

Solution 3.3

Method: Speed, distance, time

Worked steps

$$\text{time} = \frac{36}{24} = 1.5 \text{ h} = 1.5 \times 60 = 90 \text{ minutes} \quad \text{M1} \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{36}{24}; \text{ for } \times 60; \text{ for } 90.$$