

Distance-Time Graphs

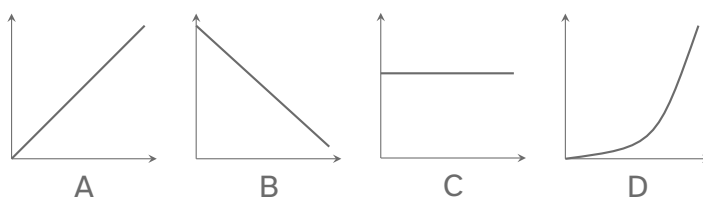
Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

Here are four distance-time graphs.



(a) Circle the graph that shows an object that is not moving.

Options: A, B, C, D

If the object is not moving, its distance does not change.

So the graph is a horizontal (flat) line.

Answer: C

(b) Circle the graph that shows an object that is speeding up.

Options: A, B, C, D

The steeper the line, the faster the object is going.

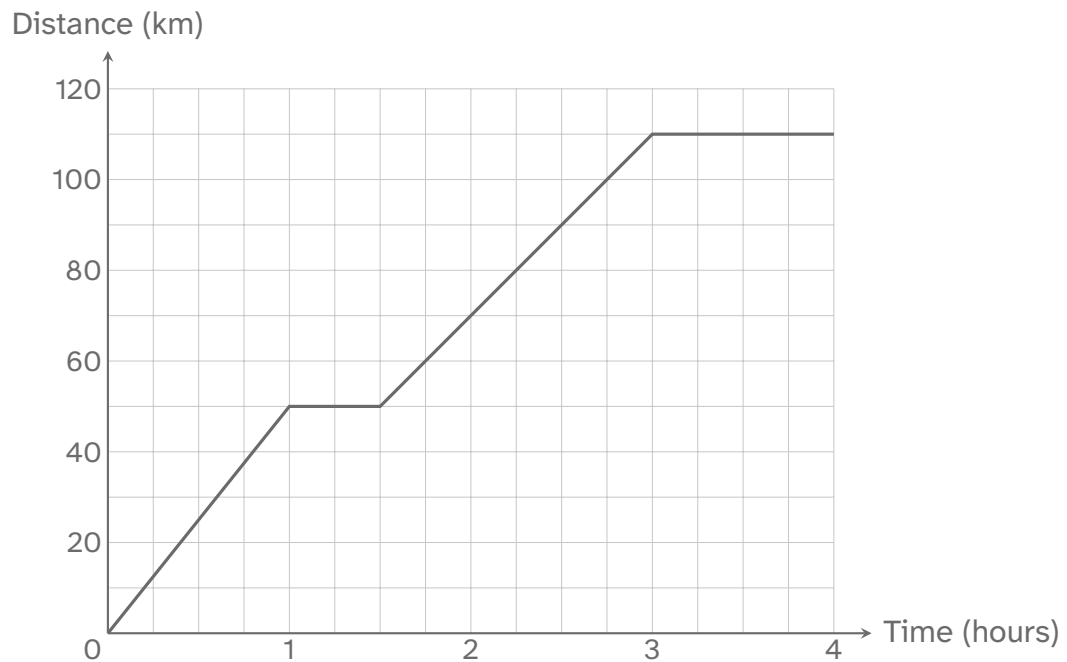
Speeding up means the graph gets steeper and steeper.

So it is a curve that bends upwards.

Answer: D

2 (5 marks)

The distance-time graph shows Sam's car journey.



- (a) How far did Sam travel in the first hour?

Go up from 1 hour on the time axis to the line.

Read across to the distance axis: 50 km.

Answer: 50 km

- (b) What happened between 1 hour and 1.5 hours?

The line is horizontal between 1 hour and 1.5 hours.

So the distance did not change.

Sam was not moving.

Answer: Sam stopped (for 30 minutes)

- (c) Work out Sam's speed between 1.5 hours and 3 hours.

Distance travelled = $110 - 50 = 60$ km

Time taken = $3 - 1.5 = 1.5$ hours

Speed = distance $\div$ time

$$\text{Speed} = 60 \div 1.5 = 40 \text{ km/h}$$

Answer: 40 km/h

Tip: Use the **change** in distance ($110 - 50$), not the reading of 110 at the end of the section.

Marks: 1 mark for $60 \div 1.5$. 1 mark for 40.

- (d) Was Sam faster in the first hour or between 1.5 and 3 hours?
Give a reason for your answer.

First hour: $50 \div 1 = 50 \text{ km/h}$

Between 1.5 and 3 hours: 40 km/h (from part (c)).

50 km/h is faster than 40 km/h.

You can also see this on the graph: the first section is steeper.

Answer: The first hour (50 km/h is faster than 40 km/h; the line is steeper)

3 (5 marks)

Tomasz cycles from his home to his grandmother's house.

He cycles the first 6 km at a constant speed of 18 km/h.

He then stops at a shop for 10 minutes.

He then cycles the last 4 km in 20 minutes.

- (a) On the grid, draw a distance-time graph for his journey.

First 6 km at 18 km/h:

$$\text{Time} = \text{distance} \div \text{speed} = 6 \div 18 = \frac{1}{3} \text{ hour.}$$

$$\frac{1}{3} \text{ hour} = 20 \text{ minutes.}$$

Draw a line from (0, 0) to (20, 6).

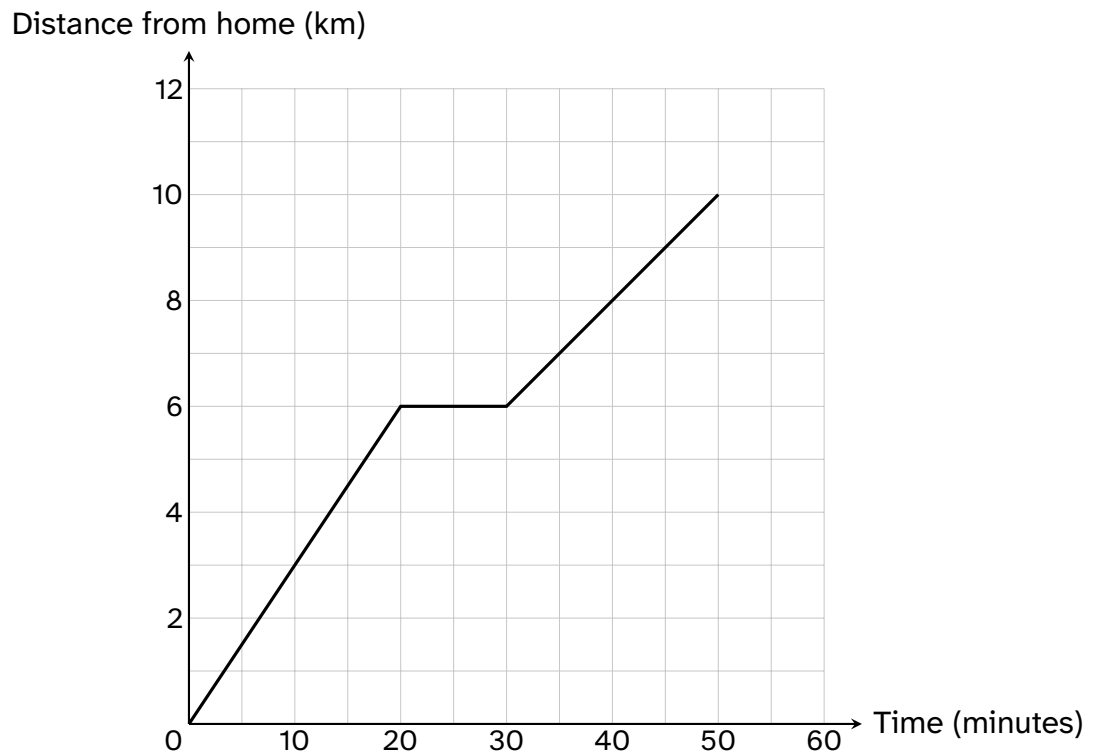
Stop for 10 minutes:

Draw a horizontal line from (20, 6) to (30, 6).

Last 4 km in 20 minutes:

He reaches $6 + 4 = 10 \text{ km}$ at $30 + 20 = 50 \text{ minutes}$.

Draw a line from (30, 6) to (50, 10).



Tip: Time = distance $\div$ speed, so the first part takes $6 \div 18$ of an hour. Working out $18 \div 6 = 3$ is the wrong way round.

Marks: 1 mark for a line from (0, 0) to (20, 6). 1 mark for a horizontal line from 20 to 30 minutes. 1 mark for a line from (30, 6) to (50, 10).

- (b) Work out his average speed for the whole journey.
Give your answer in km/h.

Total distance = 10 km

Total time = 50 minutes = $\frac{50}{60} = \frac{5}{6}$ hour

Average speed = total distance $\div$ total time

$$\text{Average speed} = 10 \div \frac{5}{6} = 10 \times \frac{6}{5} = 12 \text{ km/h}$$

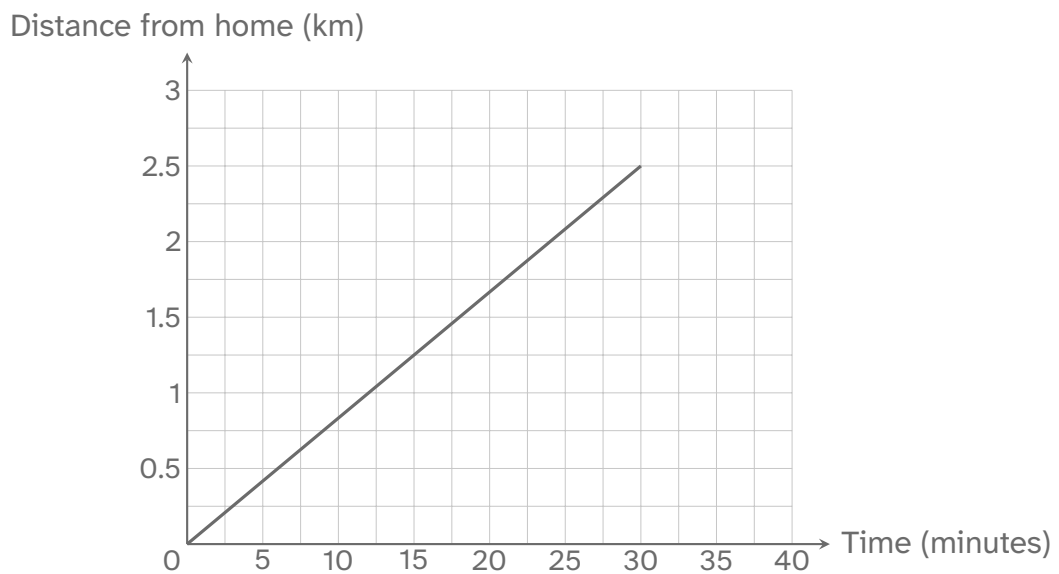
Answer: 12 km/h

Tip: Use the total time, including the 10 minutes at the shop. Do not just find the mean of the two speeds.

Marks: 1 mark for $10 \div \frac{50}{60}$. 1 mark for 12.

4 (5 marks)

Kasia walks from her home to the railway station.
The distance-time graph shows her walk.



- (a) Work out Kasia's walking speed in km/h.

She walks 2.5 km in 30 minutes.

$$30 \text{ minutes} = \frac{1}{2} \text{ hour.}$$

$$\text{Speed} = \text{distance} \div \text{time}$$

$$\text{Speed} = 2.5 \div \frac{1}{2} = 2.5 \times 2 = 5 \text{ km/h}$$

Answer: 5 km/h

Tip: $2.5 \div 30$ gives km per **minute**. Change the time to hours to get km/h.

Marks: 1 mark for $2.5 \div \frac{30}{60}$ or 2.5×2 . 1 mark for 5.

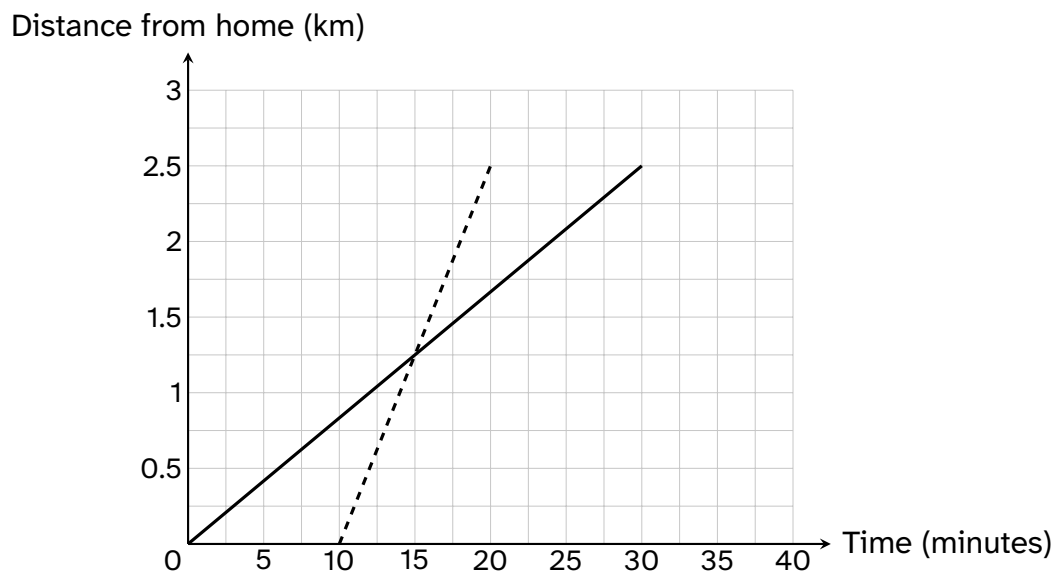
- (b) Her brother Rhys leaves home 10 minutes after Kasia.
He cycles along the same route to the station at a constant speed of 15 km/h.
Draw a line on the graph to show Rhys's journey.

$$\text{Time for Rhys} = \text{distance} \div \text{speed} = 2.5 \div 15 = \frac{1}{6} \text{ hour.}$$

$$\frac{1}{6} \text{ hour} = 10 \text{ minutes.}$$

He leaves at 10 minutes, so he gets to the station at $10 + 10 = 20$ minutes.

Draw a straight line from (10, 0) to (20, 2.5).



Tip: Rhys starts at 10 minutes, not at 0. His line starts on the time axis at 10.

Marks: 1 mark for a line starting at (10, 0). 1 mark for it ending at (20, 2.5).

- (c) How far from home were they when Rhys passed Kasia?

Rhys passes Kasia where the two lines cross.

The lines cross at 15 minutes.

Read across to the distance axis: 1.25 km.

Answer: 1.25 km (accept 1.2 to 1.3)

5 (2 marks)

Grace cycles from her home to a swimming pool 3 km away.

She cycles at a constant speed of 12 km/h.

She stays at the pool for 40 minutes.

She then cycles home at a constant speed in 20 minutes.

Grace's graph (on the worksheet) goes up to 3 km at 20 minutes, is horizontal until 50 minutes, then comes down to 0 at 70 minutes.

Write down **two** mistakes in her graph.

Check each part of the trip against the graph.

The ride to the pool: $\text{time} = 3 \div 12 = \frac{1}{4}$ hour = 15 minutes.

The graph reaches 3 km at 20 minutes, so this part is wrong.

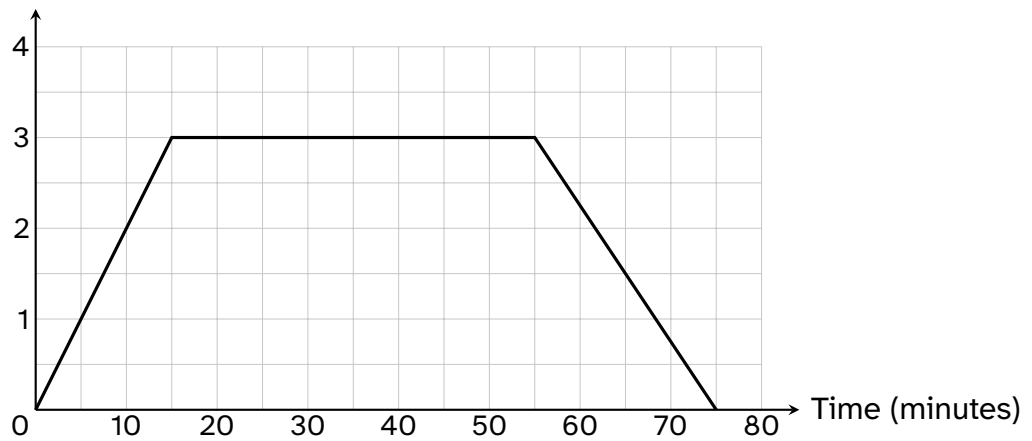
The stay at the pool: the graph is horizontal from 20 to 50 minutes.

That is only 30 minutes, but she stayed for 40 minutes.

The ride home: the graph goes from 50 to 70 minutes. That is 20 minutes, so this part is correct.

The correct graph looks like this:

Distance from home (km)



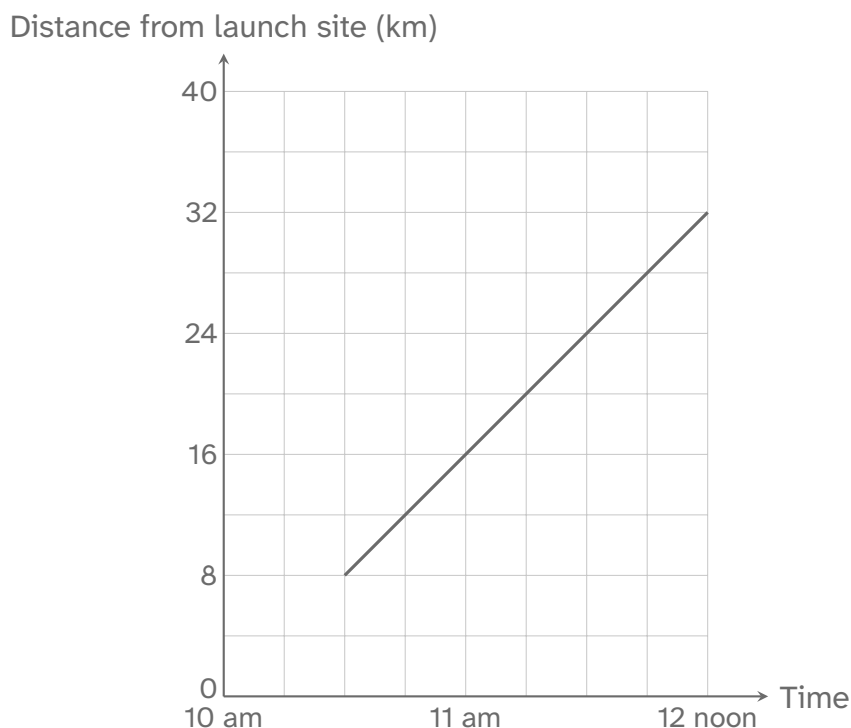
Answer: She should reach the pool after 15 minutes, not 20. The stay at the pool is only 30 minutes (it should be 40).

Tip: Check every section of the graph, including the parts where you need to work something out first (here, the time to cycle 3 km at 12 km/h).

Marks: 1 mark for each correct mistake.

6 (3 marks)

A hot-air balloon drifts in a straight line away from its launch site.
The distance-time graph shows part of its flight.



Work out the speed of the balloon between 10:30 am and 12 noon.

At 10:30 am the balloon is 8 km from the launch site.

At 12 noon it is 32 km from the launch site.

Distance travelled = $32 - 8 = 24$ km

Time taken = $1\frac{1}{2}$ hours = 1.5 hours

Speed = distance $\div$ time

Speed = $24 \div 1.5 = 16$ km/h

Answer: 16 km/h

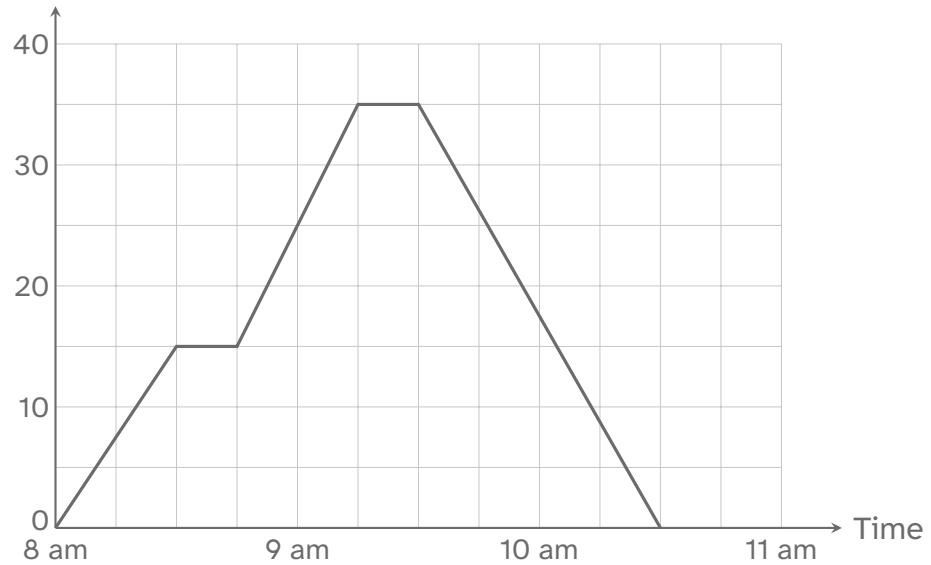
Tip: The line does not start at 0 km, so use the change in distance ($32 - 8$). Also, 1 hour 30 minutes is 1.5 hours, not 1.3 hours.

Marks: 1 mark for reading both distances (8 and 32). 1 mark for $(32 - 8) \div 1.5$. 1 mark for 16.

7 (4 marks)

Here is the distance-time graph for a coach trip between 8 am and 10:30 am.

Distance from coach station (miles)



- (a) Work out the speed of the coach between 8:45 am and 9:15 am.

At 8:45 am the coach is 15 miles from the coach station.

At 9:15 am it is 35 miles from the coach station.

$$\text{Distance} = 35 - 15 = 20 \text{ miles}$$

$$\text{Time} = 30 \text{ minutes} = \frac{1}{2} \text{ hour}$$

$$\text{Speed} = 20 \div \frac{1}{2} = 40 \text{ mph}$$

Answer: 40 mph

Marks: 1 mark for $20 \div \frac{1}{2}$ or 20×2 . 1 mark for 40.

- (b) Work out the average speed of the coach for the whole trip, from 8 am to 10:30 am.

Going out: the coach travels 35 miles away from the coach station.

Coming back: it travels 35 miles back.

$$\text{Total distance} = 35 + 35 = 70 \text{ miles}$$

$$\text{Total time: } 8 \text{ am to } 10:30 \text{ am} = 2.5 \text{ hours}$$

Average speed = $70 \div 2.5 = 28$ mph

Answer: 28 mph

Tip: The total distance includes the journey back, so it is $35 \times 2 = 70$ miles, not 35. The total time includes the stops.

Marks: 1 mark for $70 \div 2.5$. 1 mark for 28.
