

Distance-Time Graphs

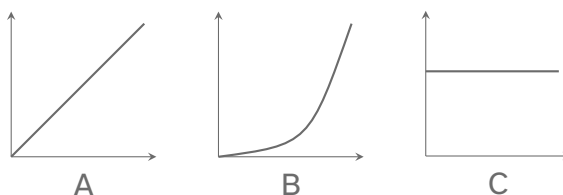
Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 (3 marks)

Here are three distance-time graphs.



Match each description to a graph.

Travelling at a constant speed

Stationary

Speeding up

Constant speed: a straight sloping line. This is graph A.

Stationary (not moving): the distance does not change, so a horizontal line. This is graph C.

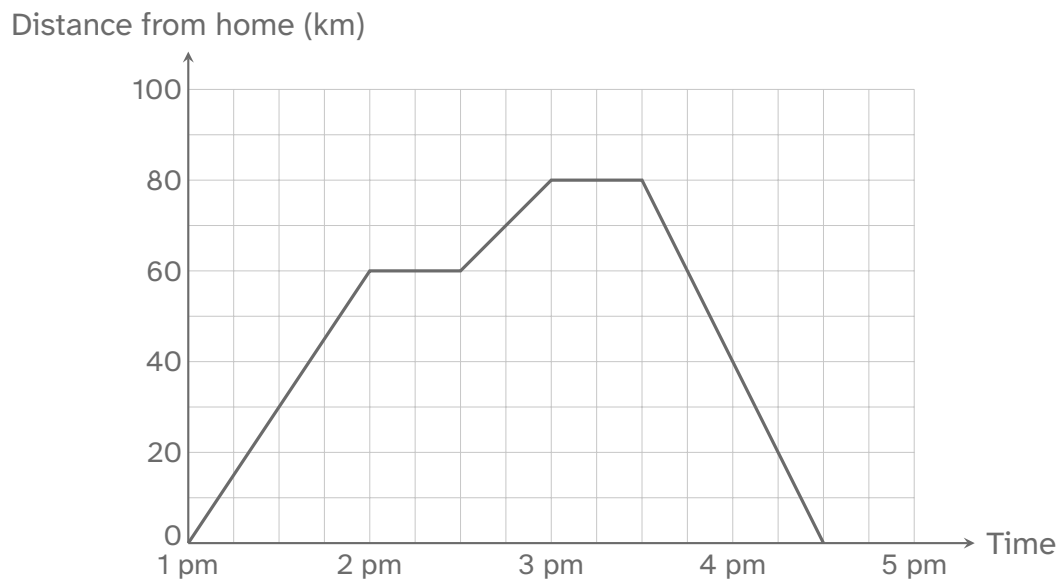
Speeding up: the graph gets steeper and steeper, so a curve. This is graph B.

Answer: Constant speed: A. Stationary: C. Speeding up: B.

Marks: 1 mark for each correct match.

2 (5 marks)

Kim drove from her home to a garden centre and back.
Here is the travel graph for her journey.



- (a) At what time did Kim stop for the first time?

Kim is stopped when the line is horizontal.

The first horizontal section starts at 2 pm.

Answer: 2 pm

- (b) How far from home was Kim at 3 pm?

Go up from 3 pm to the line.

Read across to the distance axis: 80 km.

Answer: 80 km

Tip: Work out the scale first: each small square on the distance axis is 10 km.

- (c) Work out Kim's average speed on the journey home.

The journey home is the line going down to 0.

Distance = 80 km

Time: 3:30 pm to 4:30 pm = 1 hour

Speed = distance $\div$ time

Speed = $80 \div 1 = 80$ km/h

Answer: 80 km/h

Marks: 1 mark for $80 \div 1$. 1 mark for 80.

- (d) Between which two times was Kim travelling fastest on the way to the garden centre?

Give a reason for your answer.

1 pm to 2 pm: 60 km in 1 hour, so 60 km/h.

2:30 pm to 3 pm: $80 - 60 = 20$ km in $\frac{1}{2}$ hour, so $20 \div \frac{1}{2} = 40$ km/h.

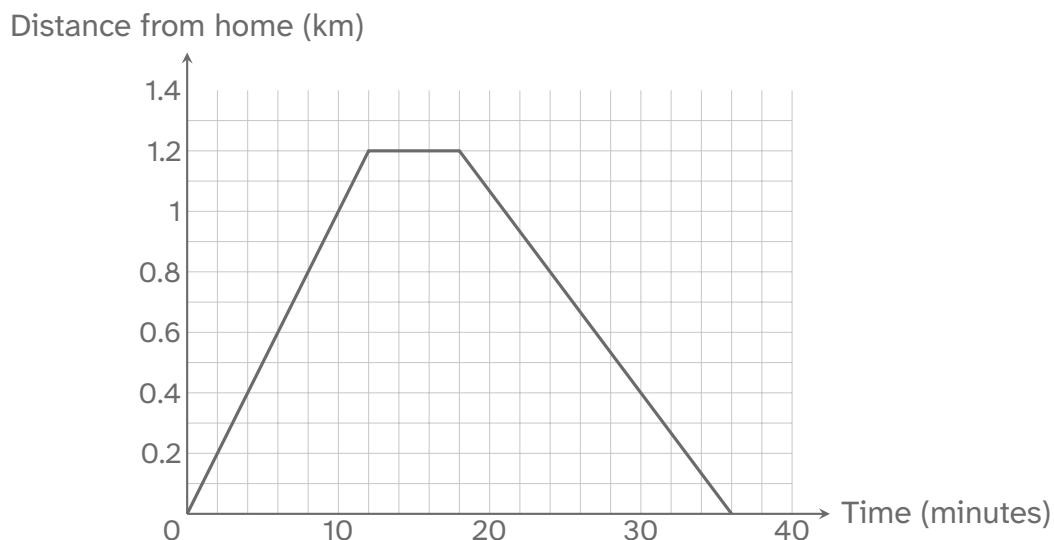
60 km/h is faster.

You can also see this on the graph: the line from 1 pm to 2 pm is steeper.

Answer: 1 pm and 2 pm (60 km/h, compared with 40 km/h; the line is steeper)

3 (4 marks)

Owen walked from his home to the post office.
He stayed at the post office for a few minutes.
Then he walked home.
Here is the travel graph for his walk.



- (a) Work out Owen's speed on the way home.
Give your answer in km/h.

The walk home is the line going down to 0.

He walks 1.2 km from 18 minutes to 36 minutes.

$$\text{Time} = 36 - 18 = 18 \text{ minutes} = \frac{18}{60} = 0.3 \text{ hours}$$

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

$$\text{Speed} = 1.2 \div 0.3 = 4 \text{ km/h}$$

Answer: 4 km/h

Tip: Read the time for the walk home as $36 - 18 = 18$ minutes, not 36 minutes. Then change 18 minutes into hours before dividing.

Marks: 1 mark for $1.2 \div \frac{18}{60}$. 1 mark for 4.

- (b) Owen says,
“I walked faster on the way to the post office than on the way home.”
Is Owen correct?
You must show how you get your answer.

To the post office: 1.2 km in 12 minutes.

$$12 \text{ minutes} = \frac{12}{60} = 0.2 \text{ hours}$$

$$\text{Speed} = 1.2 \div 0.2 = 6 \text{ km/h}$$

On the way home his speed was 4 km/h (from part (a)).

6 km/h is faster than 4 km/h, so Owen is correct.

You can also see this on the graph: the line to the post office is steeper.

Answer: Yes: 6 km/h to the post office is faster than 4 km/h on the way home.

Marks: 1 mark for 6 km/h (or comparing times for the same 1.2 km: 12 minutes and 18 minutes). 1 mark for yes with a correct comparison.

4 (4 marks)

Ben leaves home at 10 am.
He cycles 12 km to a lake at a speed of 16 km/h.
He stays at the lake for 30 minutes.
He then cycles home at a speed of 12 km/h.

On the grid, draw a travel graph for Ben's journey.

To the lake: time = distance $\div$ speed = $12 \div 16 = 0.75$ hours

0.75 hours = 45 minutes, so he arrives at 10:45 am.

Draw a line from (10 am, 0) to (10:45 am, 12).

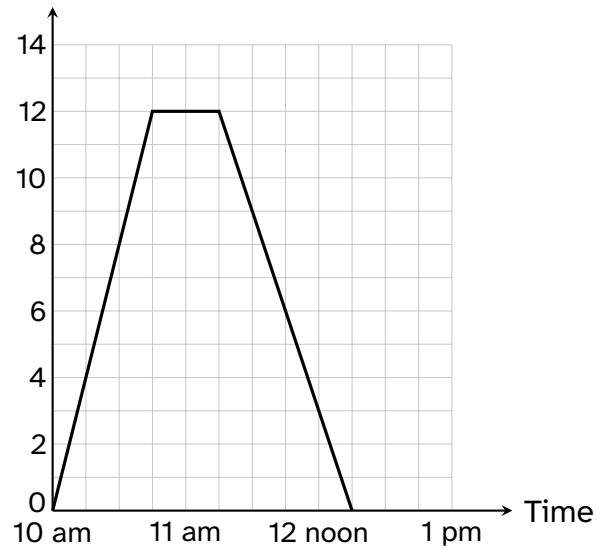
At the lake: he stays 30 minutes, until 11:15 am.

Draw a horizontal line at 12 km from 10:45 am to 11:15 am.

Going home: time = $12 \div 12 = 1$ hour, so he gets home at 12:15 pm.

Draw a line from (11:15 am, 12) down to (12:15 pm, 0).

Distance from home (km)

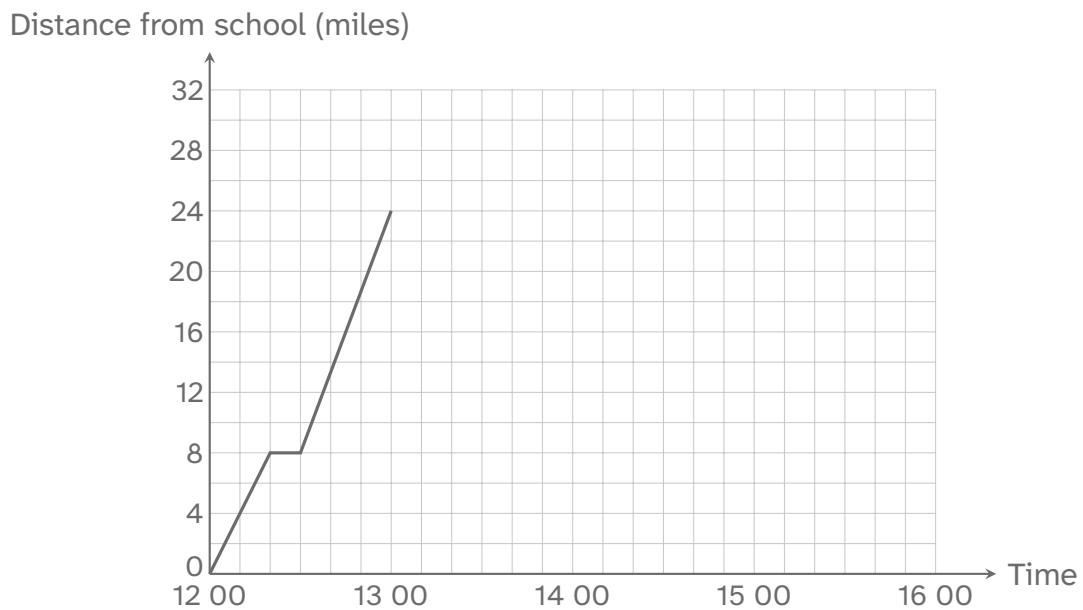


Tip: Each small square on the time axis is 15 minutes. The horizontal line must last **for** 30 minutes (2 small squares), not go **to** a time of 30 minutes.

Marks: 1 mark for working out 45 minutes. 1 mark for the line to (10:45, 12). 1 mark for a horizontal line lasting 30 minutes. 1 mark for the line back to 0 at 12:15.

5 (5 marks)

A minibus took a football team from their school to a football ground.
On the way, it stopped to pick up one of the players.
Here is the travel graph for the journey to the football ground.



- (a) At what time did the minibus arrive at the football ground?

The graph ends when the minibus reaches the ground.

This is at 13 00.

Answer: 13 00

- (b) Work out the average speed of the minibus between 12 30 and 13 00

At 12 30 the minibus is 8 miles from the school.

At 13 00 it is 24 miles from the school.

Distance = $24 - 8 = 16$ miles

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

$$\text{Speed} = 16 \div \frac{1}{2} = 32 \text{ miles per hour}$$

Answer: 32 miles per hour

Tip: Each small square on the time axis is 10 minutes. Use the change in distance (24 – 8), not 24.

Marks: 1 mark for $16 \div \frac{1}{2}$ or 16×2 . 1 mark for 32.

- (c) The minibus stayed at the football ground for 2 hours.
It then travelled back to the school without stopping, at an average speed of 36 miles per hour.
On the grid, complete the travel graph.

The minibus stays at the ground from 13 00 until 15 00.

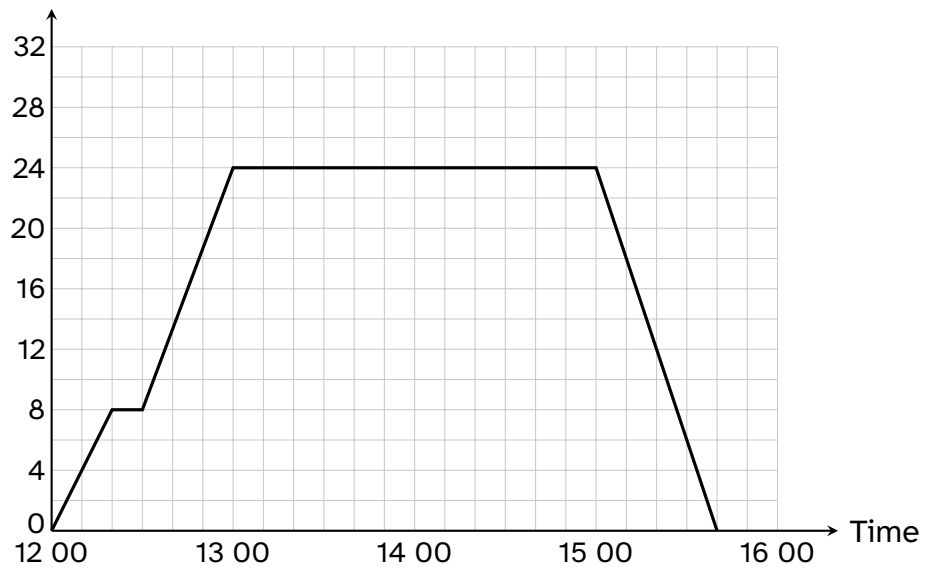
Draw a horizontal line at 24 miles from 13 00 to 15 00.

Time to travel back = distance $\div$ speed = $24 \div 36 = \frac{2}{3}$ hour.

$\frac{2}{3}$ hour = 40 minutes, so it gets back at 15 40.

Draw a straight line from (15 00, 24) down to (15 40, 0).

Distance from school (miles)

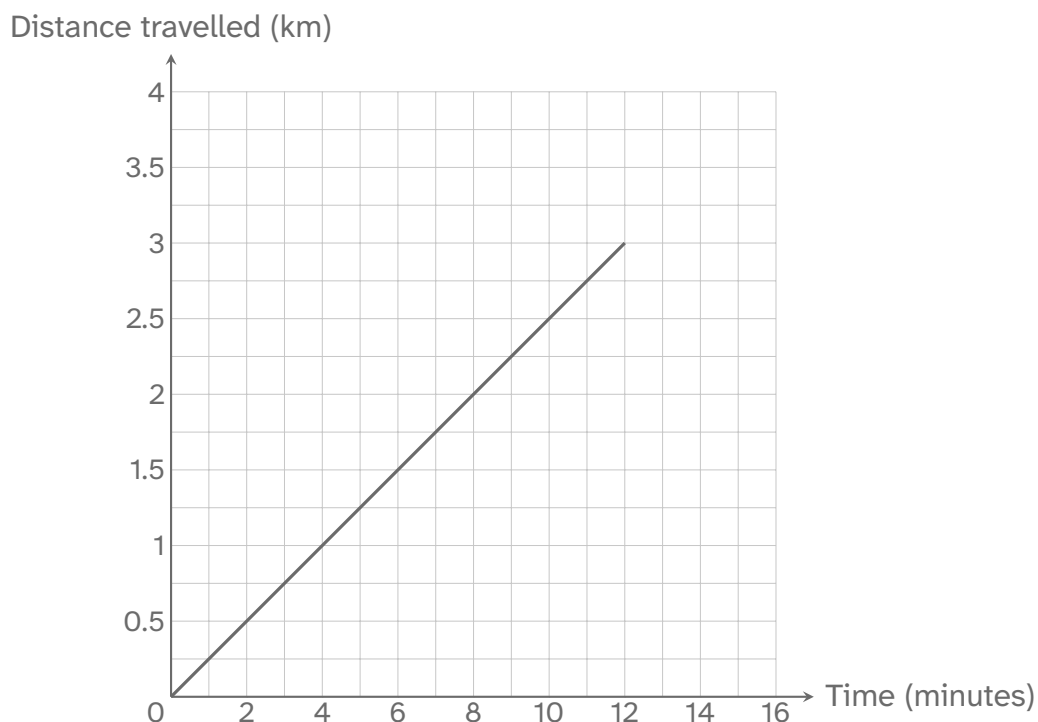


Tip: $\frac{2}{3}$ of an hour is 40 minutes, not 0.66 or 66 minutes.

Marks: 1 mark for a horizontal line at 24 miles from 13 00 to 15 00. 1 mark for a line from (15 00, 24) to (15 40, 0).

6 (3 marks)

A cable car travels up a mountain from the bottom station to the top station.
The graph shows how far the cable car has travelled at different times during its journey.



- (a) Work out the speed of the cable car.
Give your answer in km/h.

The cable car travels 3 km in 12 minutes.

$$12 \text{ minutes} = \frac{12}{60} = \frac{1}{5} \text{ of an hour.}$$

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

$$\text{Speed} = 3 \div \frac{1}{5} = 3 \times 5 = 15 \text{ km/h}$$

(Or: $3 \div 12 = 0.25$ km per minute, and $0.25 \times 60 = 15$.)

Answer: 15 km/h

Tip: There are 60 minutes in an hour, not 100. So 12 minutes is $\frac{1}{5}$ of an hour (0.2 hours), not 0.12 hours.

Marks: 1 mark for a correct method, e.g. $3 \div 12 \times 60$. 1 mark for 15.

- (b) How many minutes does the cable car take to travel the first 1 km?

Go across from 1 km on the distance axis to the line.

Read down to the time axis: 4 minutes.

(Or: 3 km takes 12 minutes, so 1 km takes $12 \div 3 = 4$ minutes.)

Answer: 4 minutes
