

Distance Time Graphs

Mark Scheme



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1. Whether it is a car racing down a track or a person stopping for a rest, a distance-time graph translates the story of a physical journey into a single line like a diagram summary of the trip.

For each of the following questions **circle** the letter of the correct answer.

- a) A bus moves at a constant speed for a while and then begins to accelerate.
Which distance-time graph shows this motion?

A – is the only correct answer.	1 mark
	Total: 1 mark

- b) Which distance time graph below shows an object that is stationary?

C – is the only correct answer.	1 mark
	Total: 1 mark

- c) The figure below shows the distance-time graph of a **moving** object.

C – is the only correct answer.	1 mark
	Total: 1 mark

- d) A high-speed train takes 45 minutes to travel between two cities that are 120 km apart.

What is the average speed of the train?

C – is the only correct answer.	1 mark
	Total: 1 mark

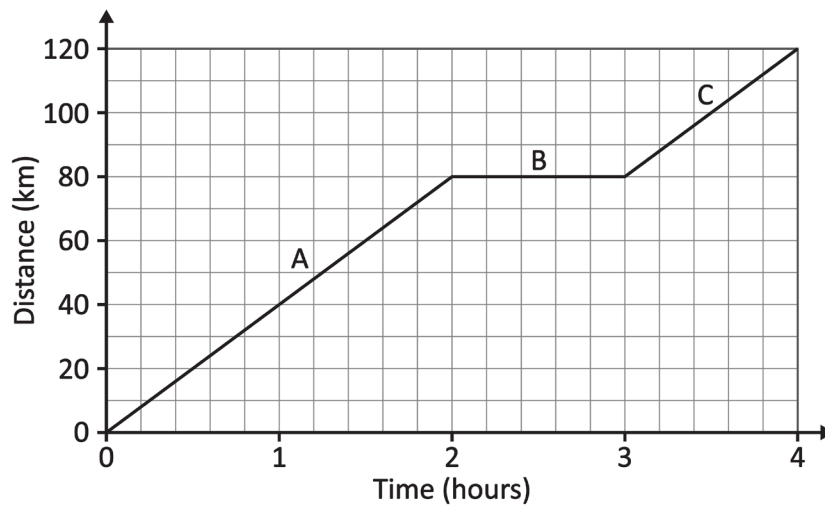
- e) The figure below shows the distance-time graph for a .

At which labelled point is the car moving with constant speed?

P – is the only correct answer.	1 mark
	Total: 1 mark

(Total for Question 1 is 5 marks)

2. A family is driving to a holiday resort. The distance-time graph below shows their journey.



- a) State how far the family travelled during the first 2 hours of the journey.

80 (km)	1 mark
Total: 1 mark	

- b) State what is shown by section B of the graph.

The car is stationary / stopped.	1 mark
Accept: the distance is not changing or resting.	
Total: 1 mark	

- c) The speed of the car can be determined from the graph.

Calculate the speed of the car during section A of the graph.

Speed = distance ÷ time	
Speed = $80 \div 2$	1 mark
Speed = 40	1 mark
Unit: km/h	1 mark
Total: 3 marks	

- d) State whether the car was travelling faster during Section A or Section C.

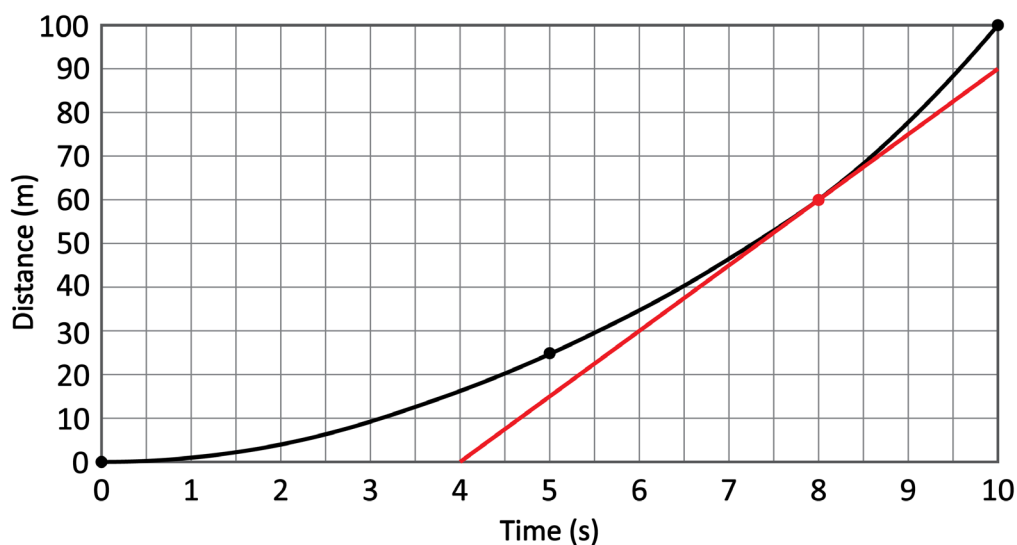
Give a reason for your answer.

They are travelling at the same speed.	1 mark
Accept: neither or any correct version of this statement.	
Reason: The lines have the exact same steepness or gradient.	1 mark
Total: 2 marks	

(Total for Question 2 is 6 marks)

3. A drone is taking off and flying vertically upwards.

The distance-time graph below shows the first 10 seconds of its flight.



- a) Describe the motion of the drone between 0 seconds and 10 seconds.

Explain how the graph shows this.

Description: The drone is <u>accelerating</u> or speeding up.	1 mark
Explanation: The graph shows this because the line/gradient is getting steeper.	1 mark
Allow: 1 mark for linking the description to the increasing steepness of the curve.	
	Total: 2 marks

- b) Calculate the average speed of the drone over the entire 10-second flight.

Average speed = total distance ÷ total time	
Average speed = $100 \div 10$	1 mark
Average speed = 10 (m/s)	1 mark
	Total: 2 marks

- c) Determine the actual speed of the drone at exactly $t = 8$ seconds.

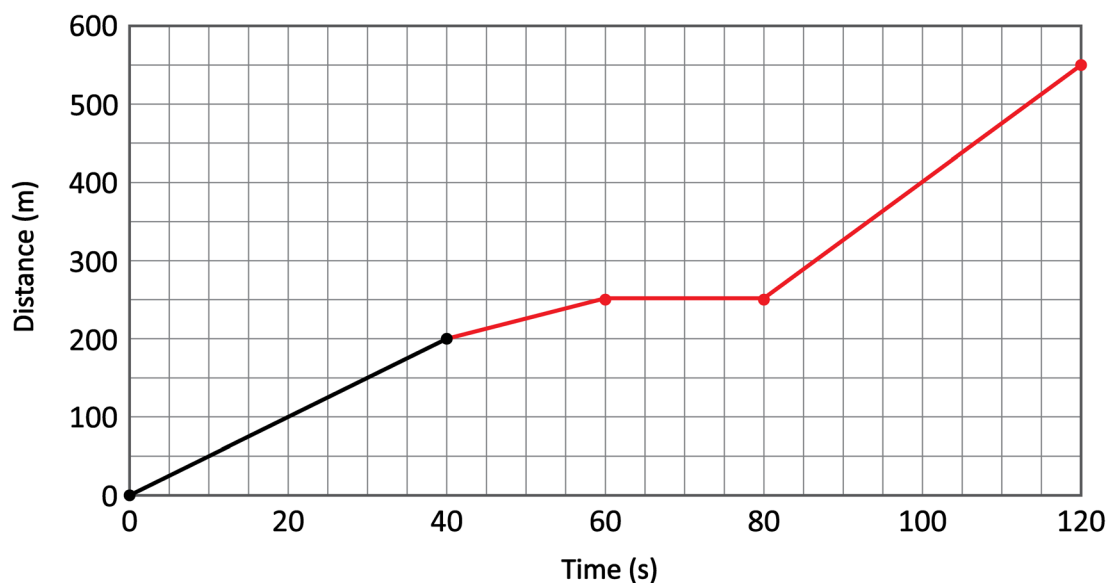
You **must** show clearly on the graph how you obtained your answer.

Student draws a straight line touching the curve exactly at $t = 8$ s.	1 mark
The student then calculates the gradient of the tangent.	1 mark
Change in y value ÷ change in x value	1 mark
Speed = 16 (m/s)	1 mark
	Total: 4 marks

(Total for Question 3 is 8 marks)

4. A cyclist is travelling along a straight, flat road.

The distance-time graph below shows the first part of their journey.



- a) State the distance travelled by the cyclist during the first 20 seconds of the journey.

100 (m)	1 mark
	Total: 1 mark

- b) Calculate the speed of the cyclist during the first 40 seconds of the journey.

Speed = distance ÷ time	
Speed = 200 ÷ 40	1 mark
Speed = 5 (m/s)	1 mark
	Total: 2 marks

- c) After 40 seconds, the cyclist encounters a hill and their speed drops to 2.5 m/s.

Calculate the distance the cyclist travels over the next **20 seconds**.

Distance = speed × time	
Speed = 2.5 × 20	1 mark
Speed = 50 (m/s)	1 mark
	Total: 2 marks

d) Use your answer from part (c), and the information below, to complete the distance-time graph on the grid above.

- Between $t = 40$ s and $t = 60$ s, the cyclist travels at 2.5 m/s.
- At $t = 60$ s, the cyclist stops for a rest for 20 seconds.
- The cyclist then travels a further 300 m at a constant speed, finishing their journey at $t = 120$ s.

Compare the following marking points to the graph drawn above.	
The student draws a straight diagonal line from (40, 200) to (60, 250)	1 mark
The student draws a perfectly flat, horizontal line from (60, 250) to (80, 250)	1 mark
Draws a straight diagonal line from (80, 250) to (120, 550).	1 mark
Marking note: if an alternative method is used to get the same results as above then award full marks for that method.	
	Total: 3 marks

(Total for Question 4 is 8 marks)

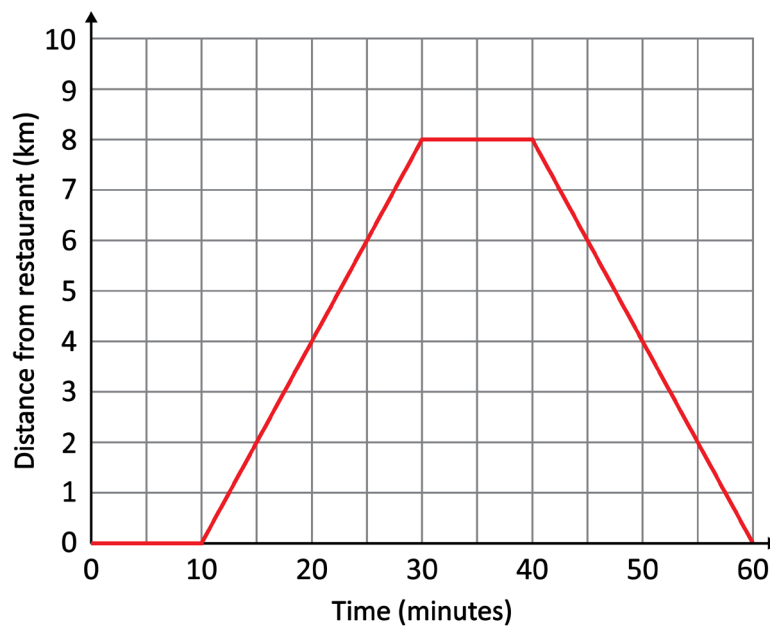
5. A food delivery driver is waiting at a restaurant.

They receive an order and deliver it to a customer's house before returning to the restaurant.

The driver's journey went like this:

- **0 to 10 minutes:** The driver waits at the restaurant for the food to be prepared.
- **10 to 30 minutes:** The driver leaves the restaurant and travels at a steady speed to the customer's house, which is **8 km** away.
- **30 to 40 minutes:** The driver parks at the customer's house to hand over the food.
- **40 to 60 minutes:** The driver drives straight back to the restaurant at a steady speed.

a) Use the information above to draw a complete distance-time graph of the driver's journey on the grid provided.



Compare the following marking points to the graph drawn above.	
The student draws a flat, horizontal line along the x-axis from (0,0) to (10, 0)	1 mark
The student draws a straight diagonal line from (10, 0) to (30, 8)	1 mark
The student draws a flat, horizontal line from (30, 8) to (40, 8)	1 mark
The student draws a straight diagonal line sloping <u>downwards</u> from (40, 8) back to the x-axis at (60, 0)	1 mark
	Total: 4 marks

b) Calculate the speed of the driver during their journey to the customer's house.

Speed = distance ÷ time	1 mark
Speed = $8 \div 20$	1 mark
Speed = 0.4 (m/s)	1 mark
	Total: 3 marks

(Total for Question 5 is 7 marks)

6. An athlete is competing in a cross-country cycling race.

The distance-time graph below shows their progress during the first two hours of the event.

- a) During which stage of the race (A, B, C, or D) was the cyclist travelling at the highest speed?

Explain how you can tell from the graph.

Stage C	1 mark
Explanation: Because the line is <u>steeper</u> than Stage A (and B/D are stationary).	1 mark
Allow: 1 mark for linking highest speed to the steepest gradient/line	
	Total: 2 marks

- b) Calculate the speed of the cyclist during stage A.

Give your answer in km/h.

Speed = distance ÷ time	
Speed = $20 \div 0.5$	1 mark
Speed = 40 (km/h)	1 mark
	Total: 2 marks

- c) The athlete's coach wants to know their overall performance.

Calculate the average speed of the cyclist over the entire 120-minute period shown on the graph.

Give your answer in m/s.

You must show all of your working

Convert units:	
50 km = 50,000 m Time = $120 \times 60 = 7200$ seconds	1 mark
Speed = distance ÷ time	
Speed = $50,000 \div 7200$	1 mark
Speed = 6.94 (m/s)	1 mark
	Total: 3 marks

(Total for Question 6 is 7 marks)