

Motion and Motion Graphs

1.

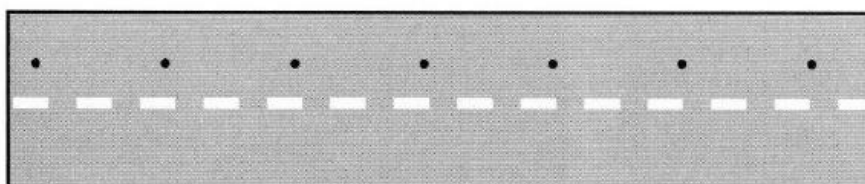
A sprinter runs 100 metres in 12.5 seconds. Work out her speed in m/s.

2.

A snail crawls at a speed of 0.0004 m/s. How long will it take to climb a garden cane 1.6 m high?

3.

The diagram below shows a trail of oil drips made by a car as it travels along a road. The oil is dripping from the car at a steady rate of one drip every 2.5 seconds.



- a) What can you tell about the way the car is moving?
- b) The distance between the first and the seventh drip is 135 metres. What is the average speed of the car?
-

4.

Explain the difference between the following terms:

- a) *average speed* and *instantaneous speed*
- b) *speed* and *velocity*.
-

5.

A student's journey to school takes 10 minutes and is 3.6 kilometres. What is his average speed in km/min? (1 mark)

6.

- a) A runner runs 400 metres in 1 minute 20 seconds. What is her speed in m/s? (1 mark)
- b) At one point she is running due west at 6 m/s. Later she is running due east at 4 m/s. How could we write her velocities to show that they are in opposite directions? (2 marks)
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7.

A sports car accelerates uniformly from rest to 24 m/s in 6 s. What is the acceleration of the car?

8.

A plane starting from rest accelerates at 3 m/s^2 for 25 s. By how much has the velocity increased after:

- a) 1 s b) 5 s c) 25 s?
-

9.

A train moves away from a station along a straight track, increasing its velocity from 0 to 20 m/s in 16 s. What is its acceleration in m/s^2 ? (1 mark)

10.

A rally car accelerates from 100 km/h to 150 km/h in 5 s. What is its acceleration in:

- a) km/h per second (1 mark)
b) m/s^2 ? (1 mark)
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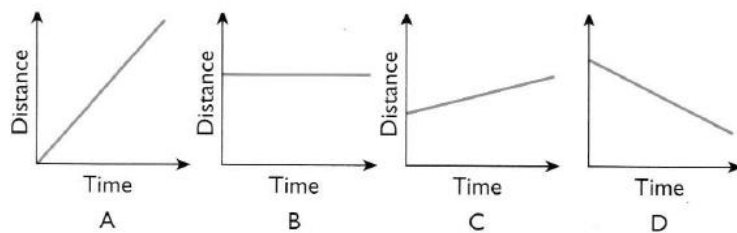
11.

A student cycles to his friend's house. In the first part of his journey, he rides 200 m from his house to a road junction in 20 s. After waiting for 10 s to cross the road, he cycles for 20 s at 8 m/s to reach his friend's house.

- a) What is his average speed for the first part of the journey? (3 marks)
b) How far is it from the road junction to his friend's house? (2 marks)
c) What is his average speed for the whole journey? (2 marks)
-

12.

Look at the following sketches of distance–time graphs of moving objects.



In which graph is the object:

- a) moving backwards
b) moving slowly
c) moving quickly
d) not moving at all?

13.

Sketch a distance–time graph to show the motion of a person walking quickly, stopping for a moment, then continuing to walk slowly in the same direction.

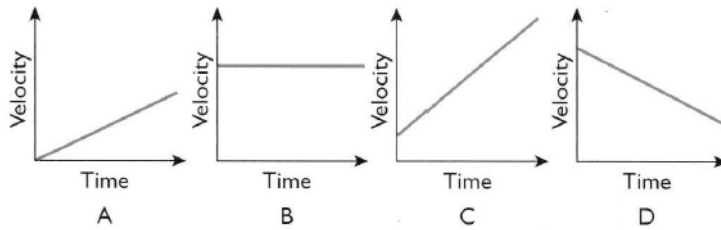
14.

A car is travelling at 20 m/s. It accelerates uniformly at 3 m/s^2 for 5 s.

- Draw a velocity-time graph for the car during the period that it is accelerating. Include numerical detail on the axes of your graph.
 - Calculate the distance the car travels while it is accelerating.
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15.

Look at the following sketches of velocity-time graphs of moving objects.



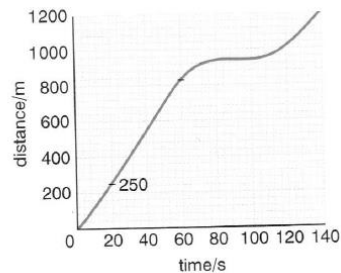
In which graph is the object:

- not accelerating
 - accelerating from rest
 - decelerating
 - accelerating at the greatest rate?
-

16.

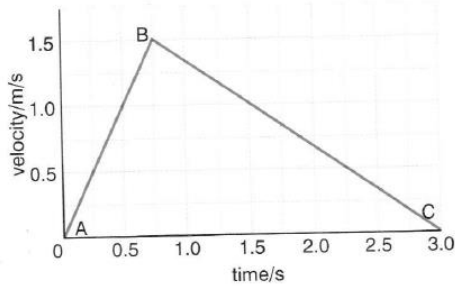
The graph shows a distance/time graph for a car journey.

- What does the graph tell us about the speed of the car between 20 and 60 seconds? (2 marks)
- How far did the car travel between 20 and 60 seconds? (3 marks)
- Calculate the speed of the car between 20 and 60 seconds. (3 marks)
- What happened to the car between 80 and 100 seconds? (2 marks)



17.

Look at the velocity/time graph for a toy tractor.



Calculate the total distance travelled by the tractor from A to C.

(3 marks)

18.

In 2009, Usain Bolt set the world record for 100 m at 9.58 s.

a) i) State the equation linking average speed, distance moved and time taken. (1)

ii) Calculate the average speed for Usain Bolt's run.

Give your answer to an appropriate number of significant figures. (3)

iii) At some part of the race, Usain Bolt must have run faster than this.

Explain why. (3)

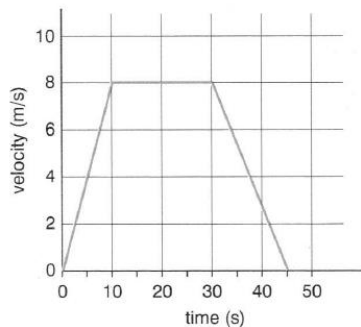
b) At the start of the race, it is counted as a false start when a runner moves before 0.10 s after the starter has fired the starting gun.

Suggest why. (3)

(Total 10 marks)

19.

The graph shows how the velocity of a cyclist varies.



a) i) Between what times was the cyclist travelling at a constant speed? (1)

ii) How can you tell from the graph? (1)

Calculate the acceleration of the cyclist during the first 10 s. (3)

Use the graph to find the total distance travelled by the cyclist. (3)

(Total 8 marks)