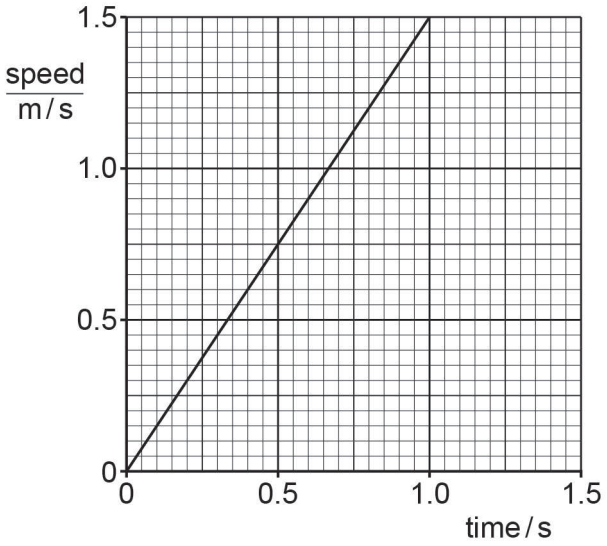
1 A trolley is released from the top of a ramp.

The graph is the speed–time graph for this trolley.



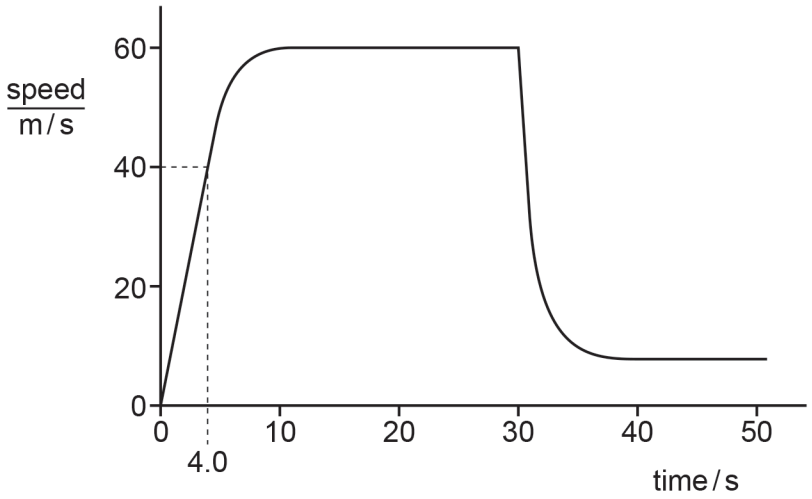
Using the speed–time graph, calculate the distance travelled by the trolley in the first 0.5 s.

distance = ... [2]

[Total: 2]

2 A sky-diver jumps out of a hot-air balloon, which is 4000 m above the ground. At time = 30 s, she opens her parachute.

The graph is the speed-time graph of her fall.

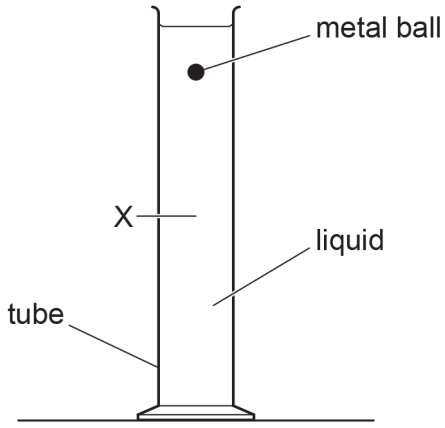


Calculate the average speed of the sky-diver in the first 4.0 s of her fall.

average speed = ... [2]

[Total: 2]

3 The diagram shows a metal ball at rest in a tube of liquid.



The ball is released and reaches terminal velocity at point X.

Explain the motion of the ball as it falls from rest until it reaches point X.

Use ideas of force and acceleration in your answer.

.....

.....

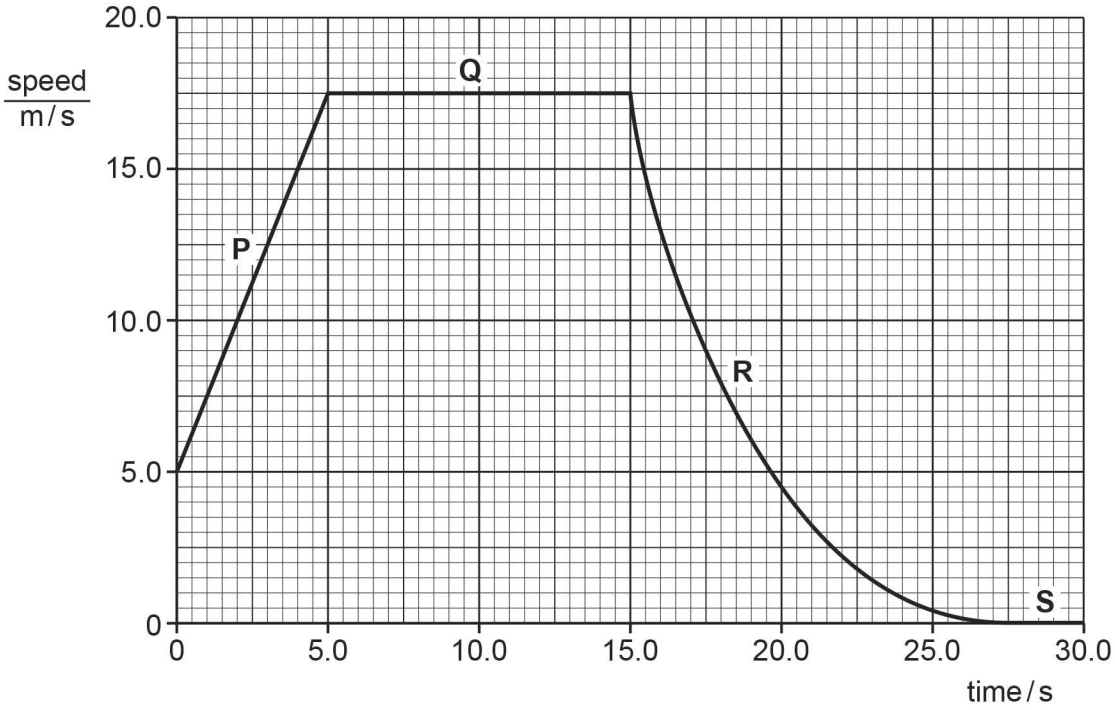
.....

.....

..... [3]

[Total: 3]

4 The graph is a speed–time graph for a skier in a race.



Describe the motion of the skier at each point **P**, **Q**, **R** and **S** on the graph.

P .....

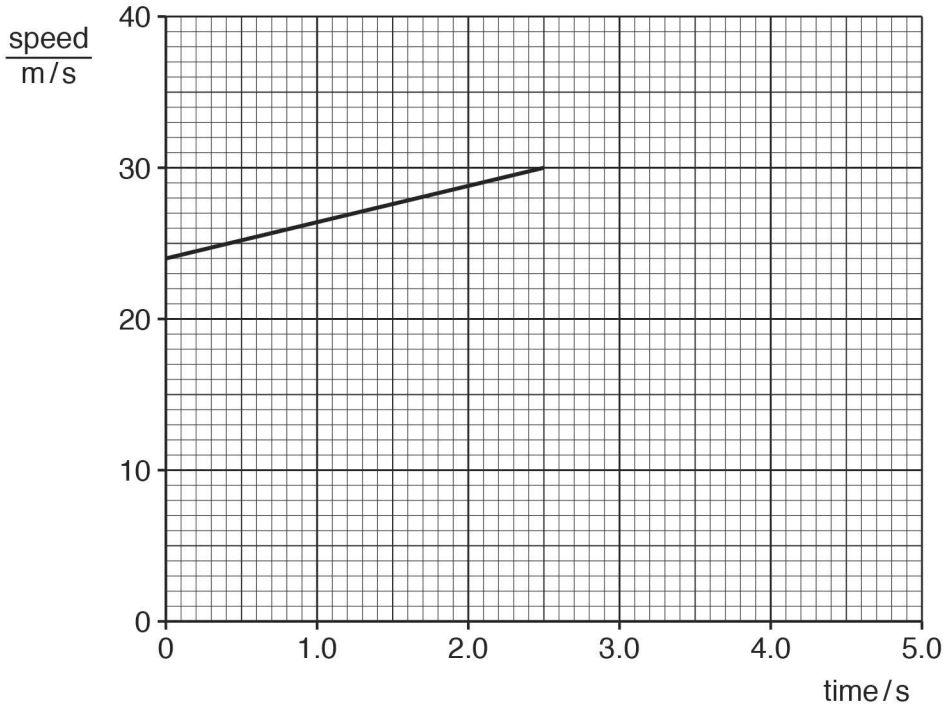
Q .....

R .....

S ..... [4]

[Total: 4]

5 A motorcycle accelerates as shown in the graph. Calculate the distance the motorcycle travels while it is accelerating. Use information from the graph.

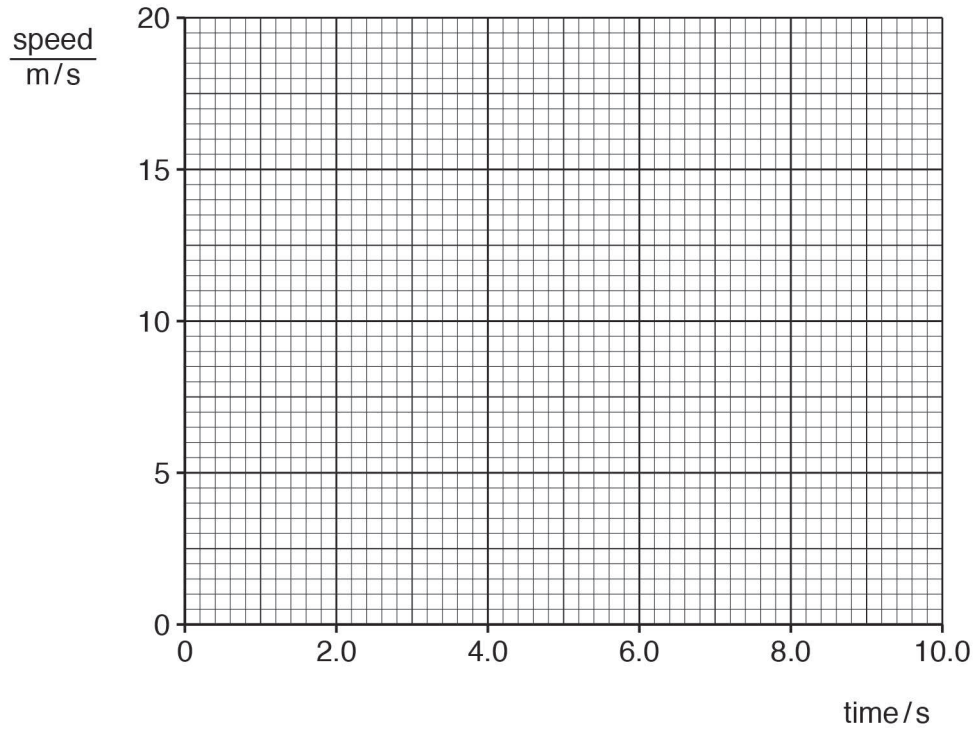


distance travelled = ... m [3]

[Total: 3]

6 A car moves at a constant speed of 16 m / s for 4.0 seconds. During the next 2.0 seconds, the car decelerates from a speed of 16 m / s to a speed of 13 m / s. It then continues at a constant speed of 13 m / s for 3.0 seconds.

On the grid, plot the speed–time graph for the motion of the car during these 9.0 s.



[3]

[Total: 3]

7 Some students determine the speed of a car on a road. The students measure the time for the car to travel 30 m along the road. The time is 5.4 s.

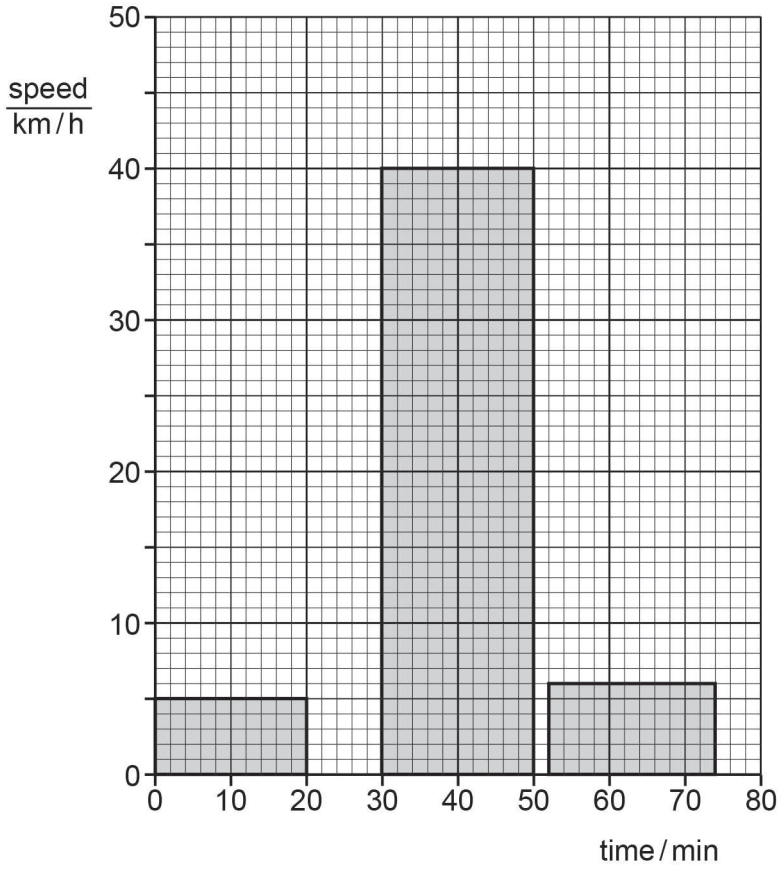
Calculate the average speed of the car.

average speed = ... m / s [3]

[Total: 3]

8 The graph is a speed–time graph of a person on a journey.

On the journey, he walks and then waits for a bus. He then travels by bus. He gets off the bus and waits for two minutes. He then walks again. His journey takes 74 minutes.



(a) For the whole journey calculate the distance travelled.

distance = ... [3]

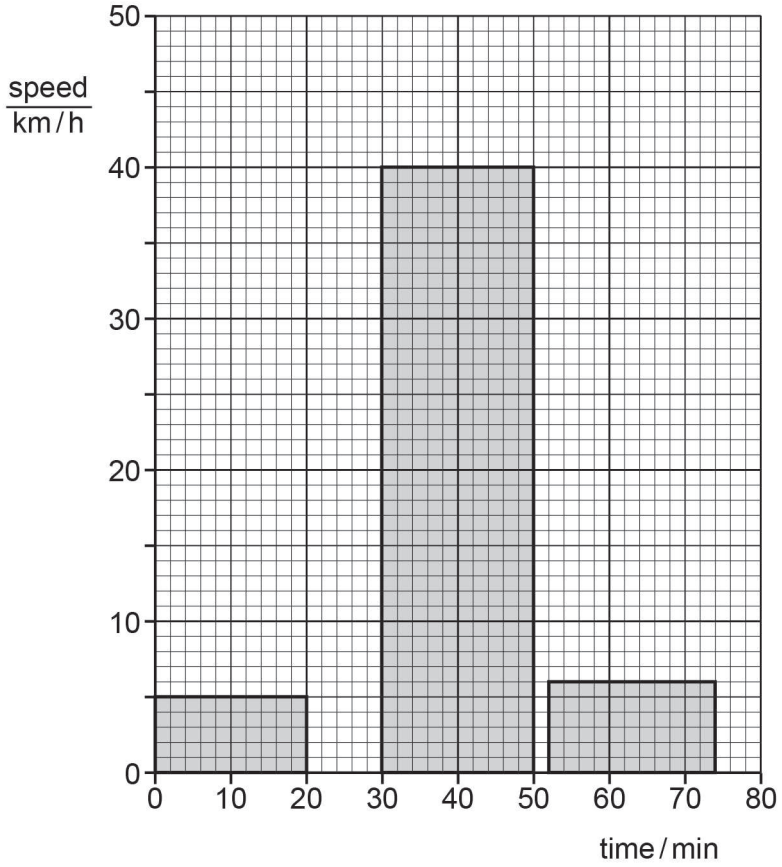
(b) For the whole journey calculate the average speed.

average speed = ... [2]

[Total: 5]

9 The graph is the speed–time graph of a person on a journey.

On the journey, he walks and then waits for a bus. He then travels by bus. He gets off the bus and waits for two minutes. He then walks again. His journey takes 74 minutes.



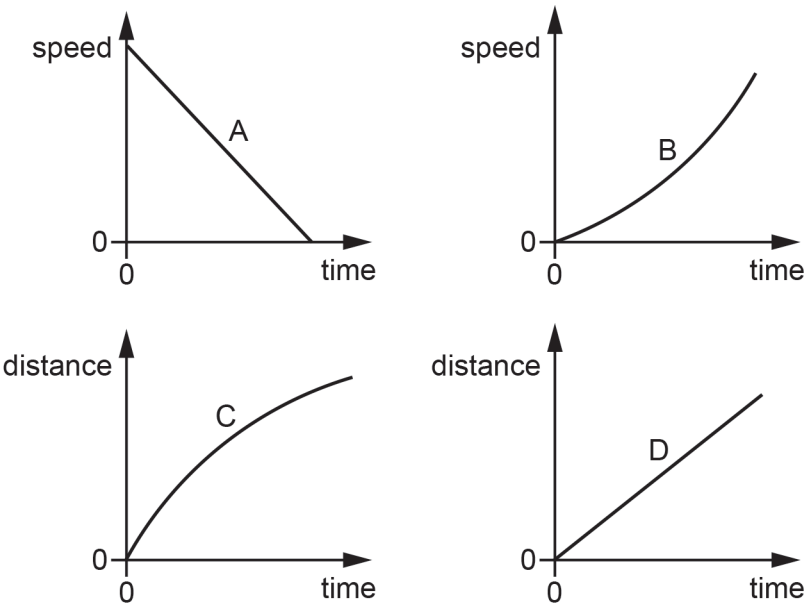
State and explain the acceleration of the person at time = 40 minutes.

.....

..... [2]

[Total: 2]

10 The diagram shows two speed–time graphs, A and B, and two distance–time graphs, C and D.



Describe the motion shown by:

(a) graph A

.....

..... [2]

(b) graph B

.....

..... [2]

(c) graph C

.....

..... [1]

(d) graph D.

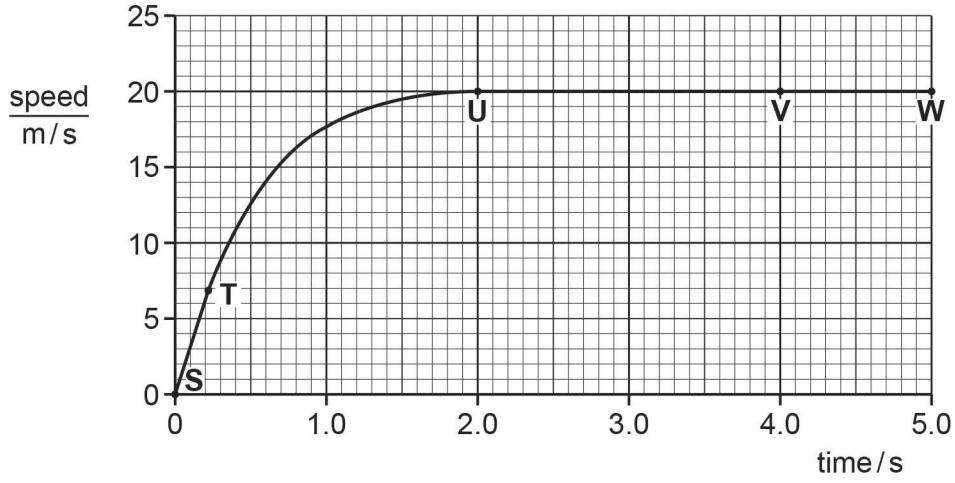
.....

..... [1]

[Total: 6]

11 A student drops a ball from a high window.

The graph shows the speed of the ball while it is falling. The points **S**, **T**, **U**, **V** and **W** are shown on the graph.



In section **S–T** the ball is moving with a constant acceleration.

Draw **one** line from each section of the graph to the correct description of the motion.

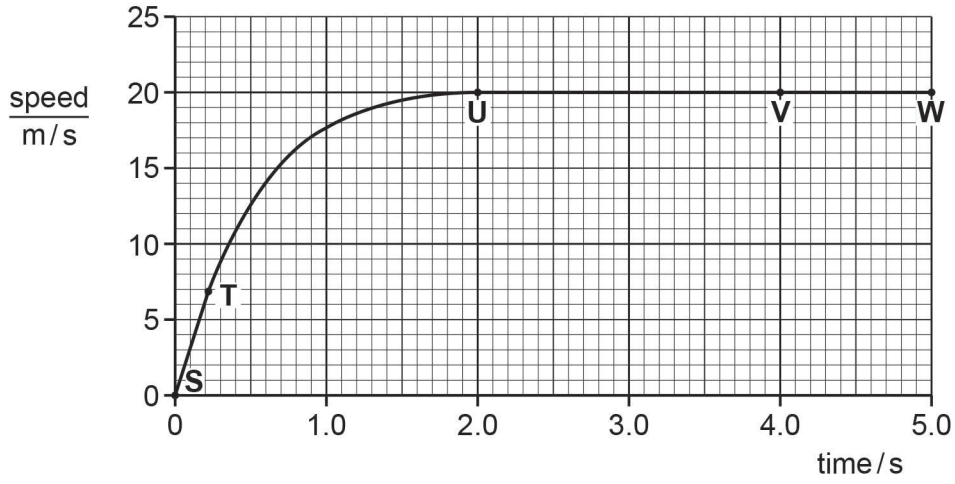
section of graph	description of motion
T–U	at rest
U–V	decreasing acceleration
	moving with constant speed
	slowing down

[2]

[Total: 2]

12 A student drops a ball from a high window.

The graph shows the speed of the ball while it is falling. The points **S**, **T**, **U**, **V** and **W** are shown on the graph.



(a) Determine the distance fallen by the ball in section **U–V** of the graph.

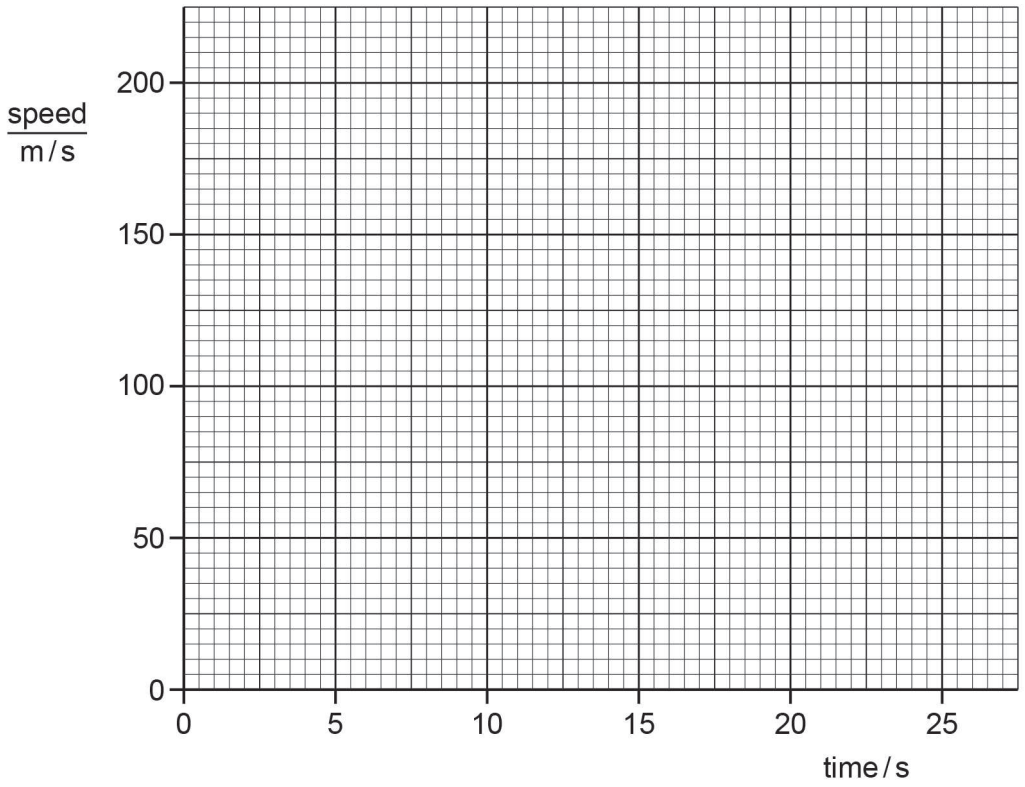
distance = ... m [3]

(b) State the distance fallen by the ball in section **V–W** of the graph.

distance = ... m [1]

[Total: 4]

13 A rocket is launched vertically upwards from the ground. The rocket travels with uniform acceleration from rest. After 8.0 s, the speed of the rocket is 120 m / s.



(a) On the grid, draw the graph for the motion of the rocket in the first 8.0 s. [1]

(b) Use the graph to determine the height of the rocket at 8.0 s.

height = ... [2]

(c) From time = 8.0 s to time = 20.0 s, the rocket rises with increasing speed but with decreasing acceleration.

From time = 20.0 s to time = 25.0 s, the rocket has a constant speed of less than 200 m / s.

On the grid, draw the graph for this motion. [3]

[Total: 6]

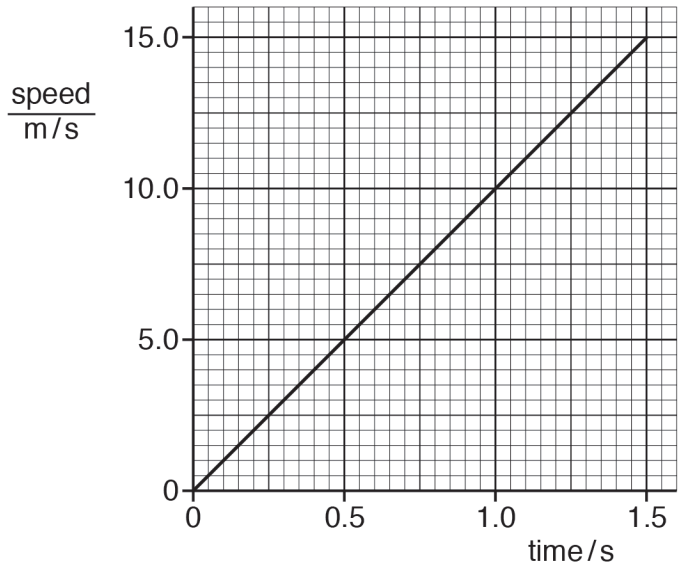
14 A rocket is launched vertically upwards from the ground. The rocket travels with uniform acceleration from rest. After 8.0 s, the speed of the rocket is 120 m / s.

Calculate the acceleration of the rocket.

acceleration = ... [2]

[Total: 2]

15 In an experiment a student determines the speed of a falling weight at different times. The graph is a speed–time graph for his results.

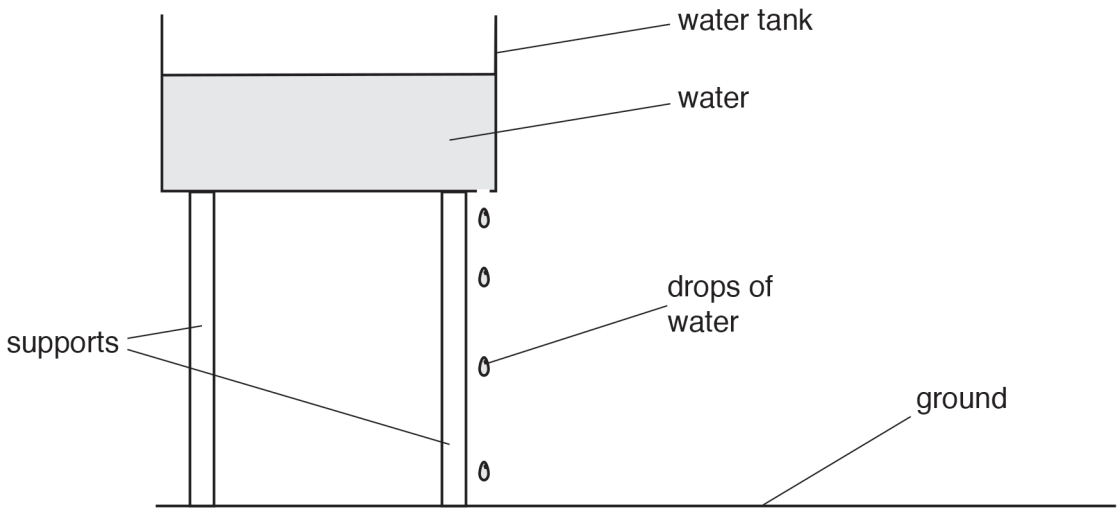


Calculate the distance fallen by the weight in the first 1.5 s.

distance = ...m [3]

[Total: 3]

16 The diagram shows a water tank that is leaking. Drops of water fall from the tank at a constant rate.



The diagram shows that the drops get further apart as they get close to the ground.

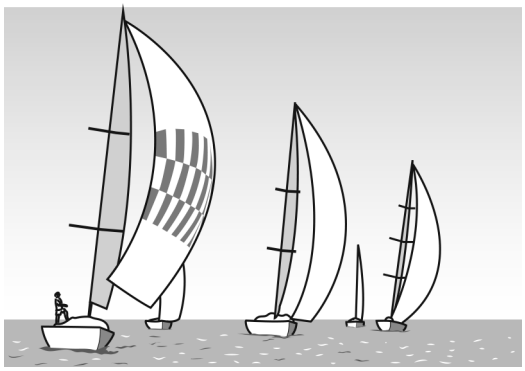
State why the drops get further apart.

.....

..... [1]

[Total: 1]

17 A boat race starts on the sea, but close to land. The diagram shows the boats at the start of the race.



On the land, a cannon produces a loud bang to start the race. There is a flash of light at the same time as the bang.

(a) One of the sailors is 500 m from the cannon. She measures a time difference of 1.6 seconds between seeing the flash of light and hearing the bang.

Calculate the speed of sound.

speed of sound = ... m / s [3]

(b) The value of the speed of sound obtained in **(a)** is lower than expected.

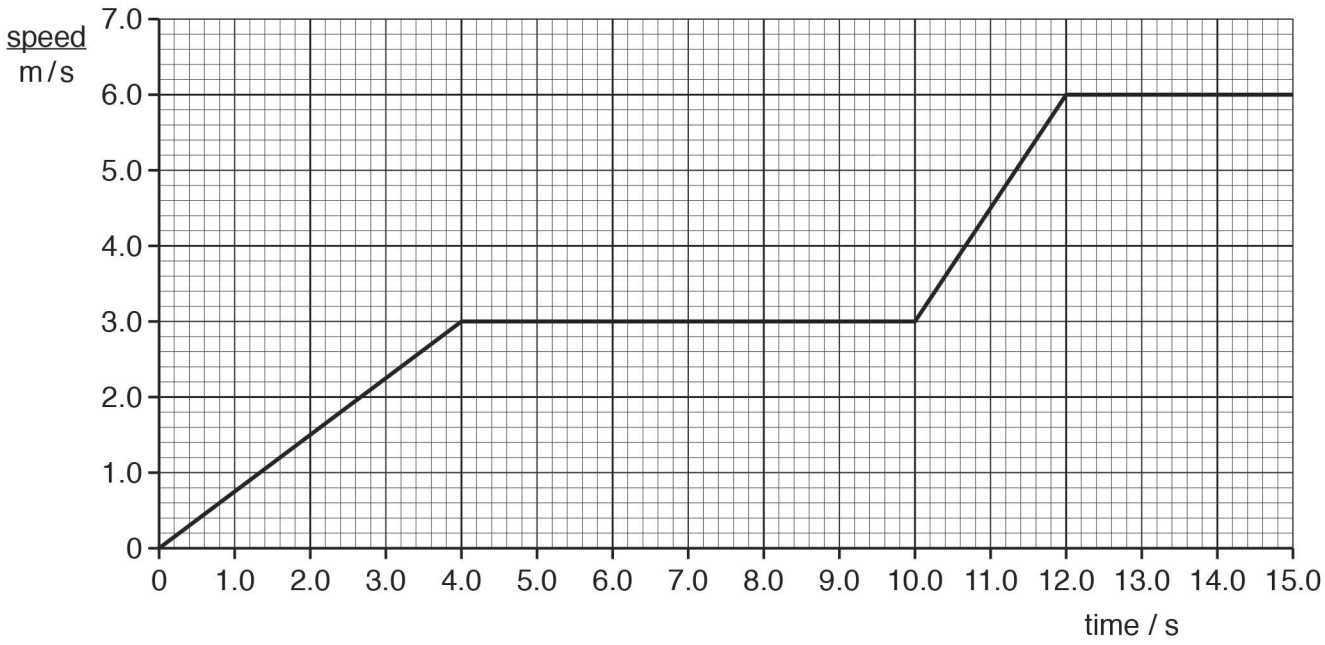
Suggest a reason for this difference.

.....

..... [1]

[Total: 4]

18 The graph is a speed-time graph for a footballer for the first 15.0 seconds of a game.



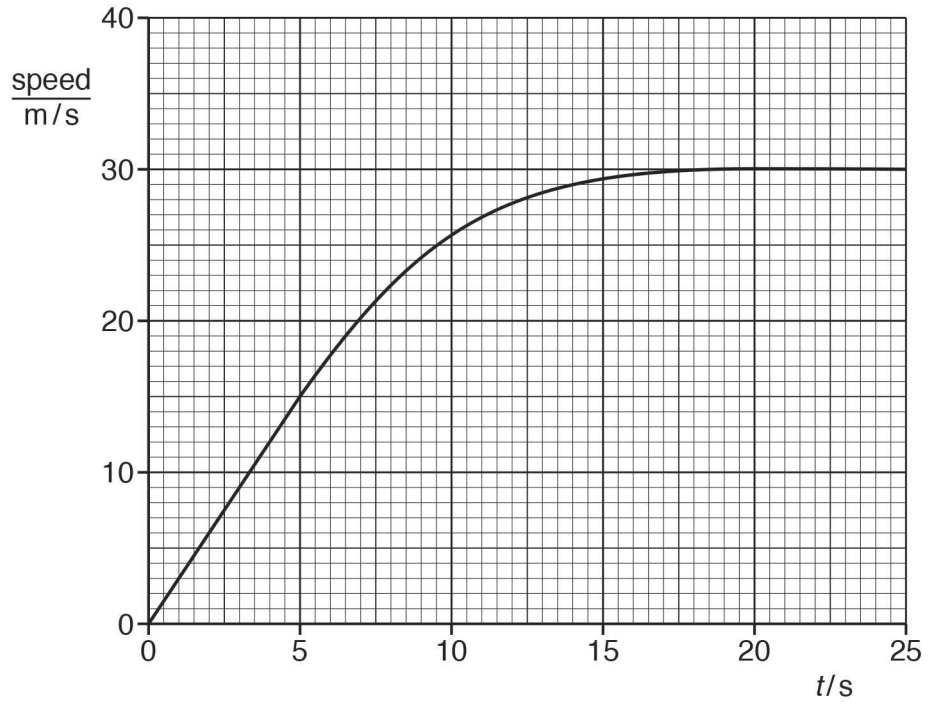
Use the graph to calculate the distance travelled by the footballer during the first 4.0 seconds.

distance = ... m [3]

[Total: 3]

19 A car accelerates from rest at time $t = 0$ to its maximum speed.

The graph is the speed-time graph for the first 25 s of its motion.



Describe the motion of the car between $t = 10$ s and $t = 15$ s. Explain how the graph shows this.

.....

.....

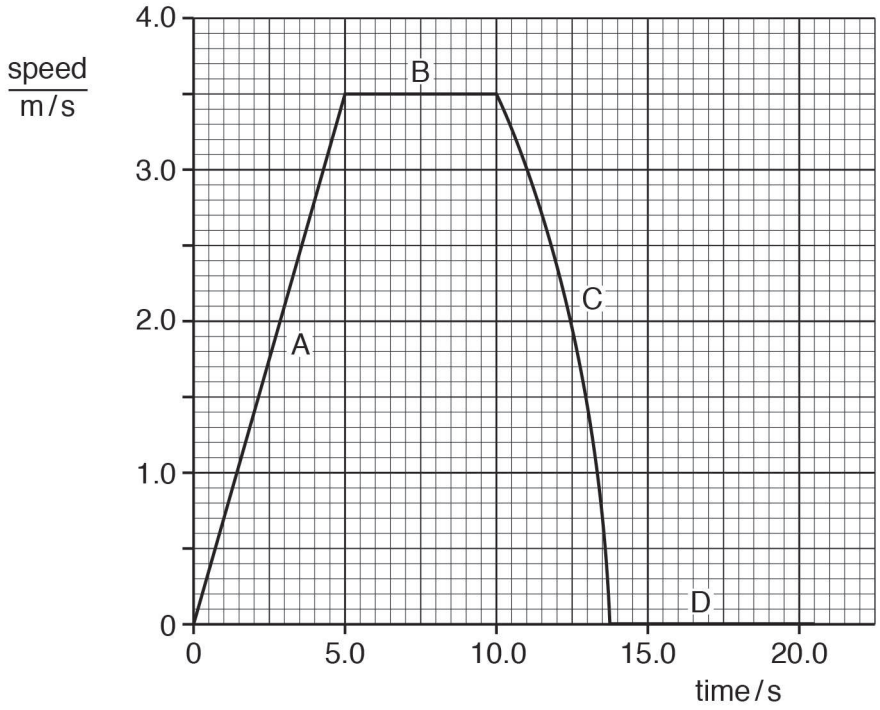
.....

..... [3]

[Total: 3]

20 A student moves a model car along a bench.

The graph is the speed-time graph for the motion of the model car.



(a) Describe the motion of the car in each of the sections A, B, C and D.

A .....

B .....

C .....

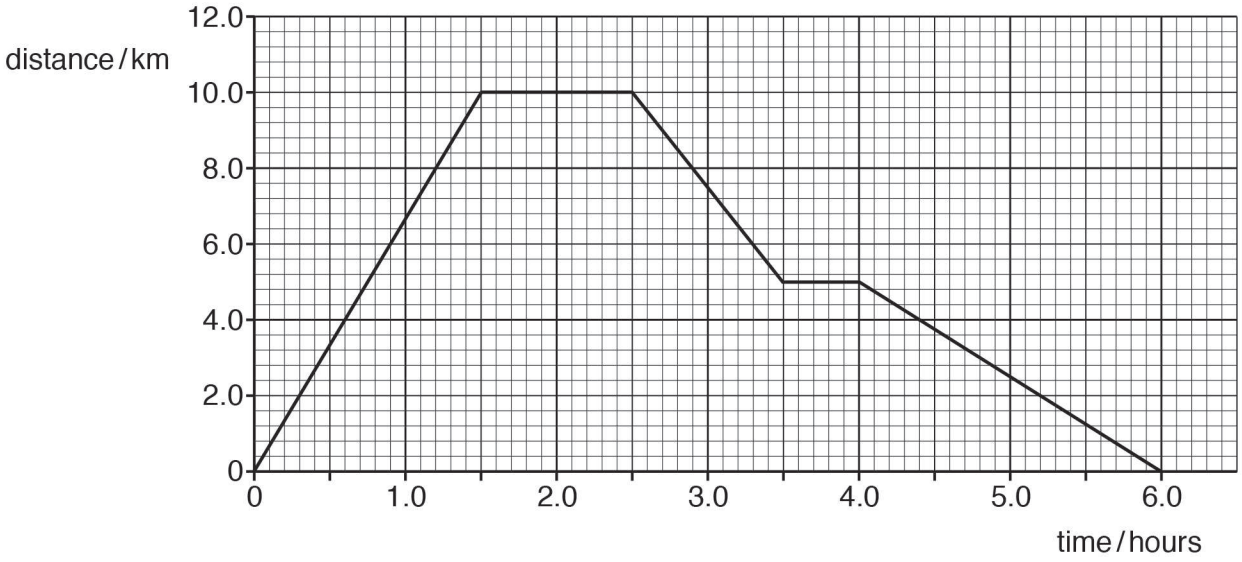
D ..... [4]

(b) Determine the distance moved by the model car in the first five seconds.

distance = ... m [3]

[Total: 7]

21 The graph is a distance-time graph for a man walking from home to a café. At the café the man stops for a drink. On the return journey from the café, the man stops to rest.



(a) Using the graph, determine the distance from the man's home to the café.

distance = ... km [1]

(b) Using the graph, determine the time taken to walk to the café.

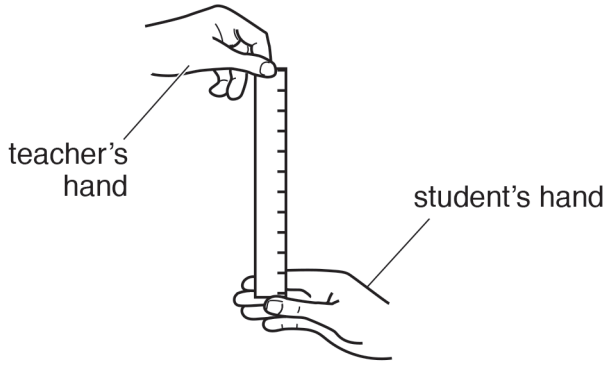
time = ... hours [1]

(c) Determine the speed, in km / hour, of the man as he walks to the café.

speed = ... km / hour [3]

[Total: 5]

22 A teacher investigates the reaction time of five students. A 0.50 m ruler is held above the hand of a student before being allowed to fall. The arrangement is shown in the diagram.



As soon as the ruler falls the student closes their hand, catching the ruler. The further the ruler falls, the greater the reaction time of the student.

The ruler drops a distance of 11.0 cm and has an average speed of 16 cm / s.

Calculate the reaction time.

reaction time = ... s [3]

[Total: 3]

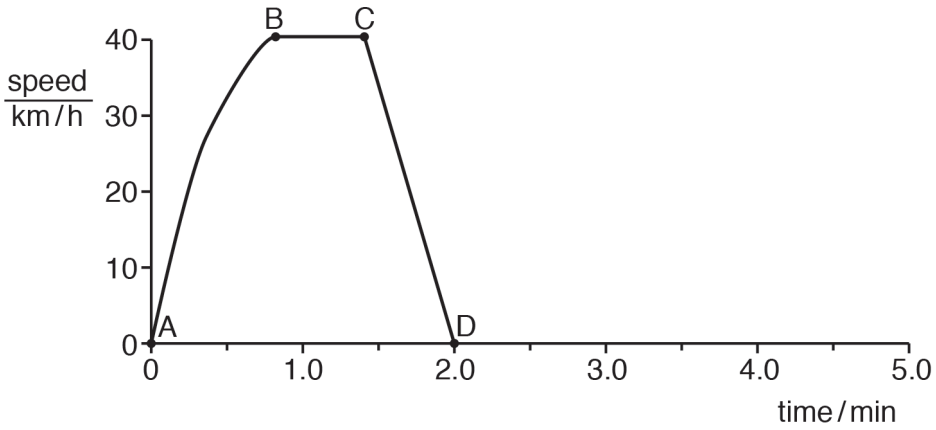
23 Define *acceleration*.

.....

..... [1]

[Total: 1]

24 A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. The graph is a speed-time graph for the bus.



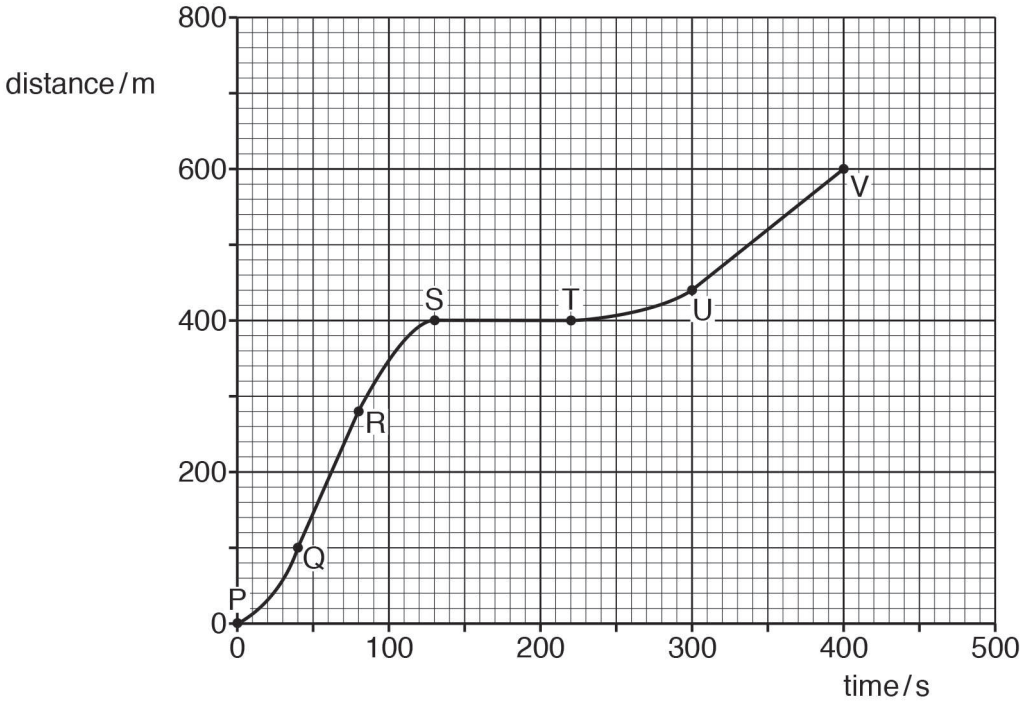
The average speed of the bus between A and D is 23 km / h.

Calculate the distance between A and D.

distance = ... [3]

[Total: 3]

25 The graph shows a distance-time graph for a cyclist travelling between points P and V on a straight road.

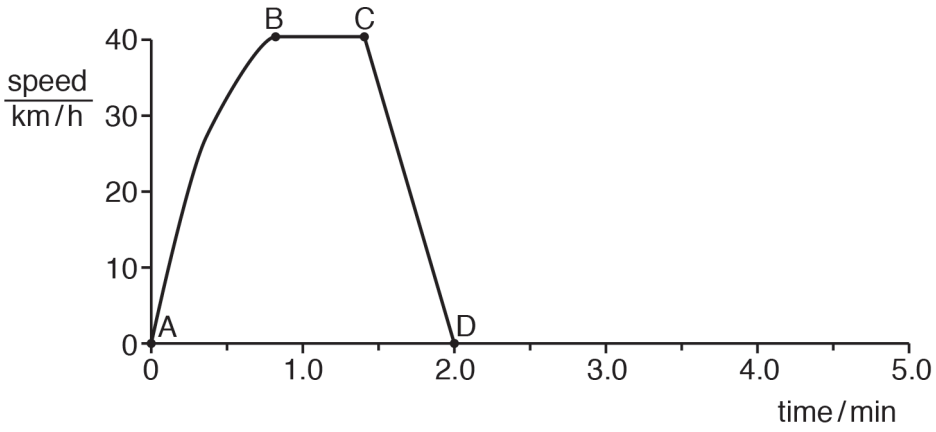


Calculate the speed between U and V.

speed = ... [2]

[Total: 2]

26 A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. The graph is a speed-time graph for the bus.



Describe the motion of the bus between each of the bus stops. Select the appropriate description from the list below.

constant acceleration	**decreasing acceleration**
increasing acceleration	**moving backwards at constant speed**
moving forwards at constant speed	**stationary**

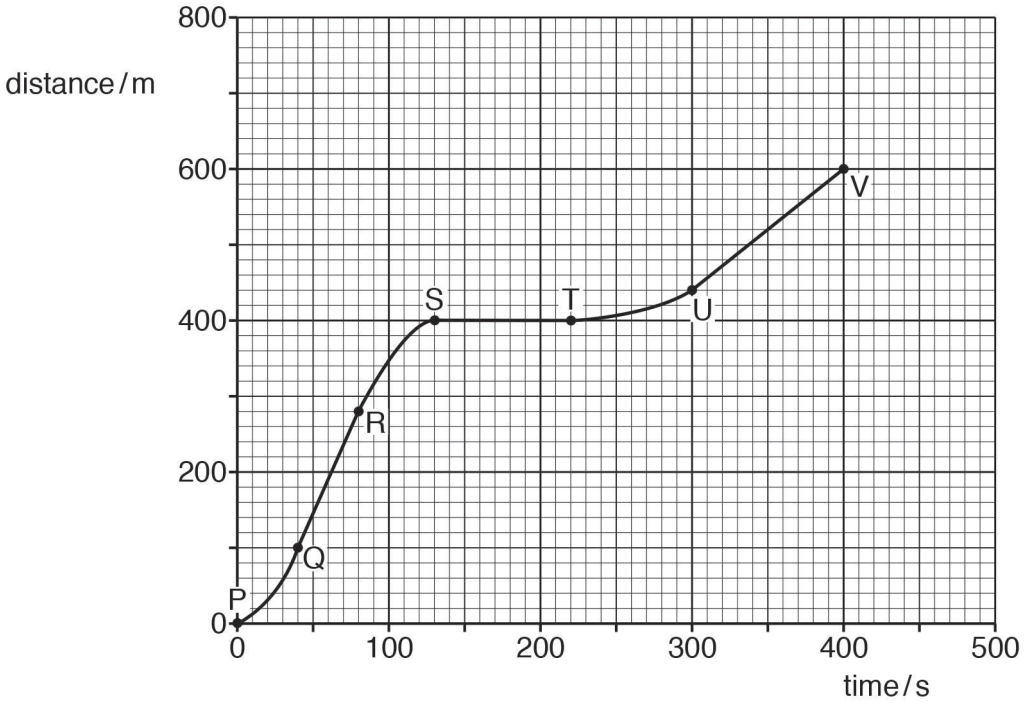
1. between A and B .....

2. between B and C .....

3. between C and D ..... [3]

[Total: 3]

27 The diagram shows a distance-time graph for a cyclist travelling between points P and V on a straight road.



Describe the motion between:

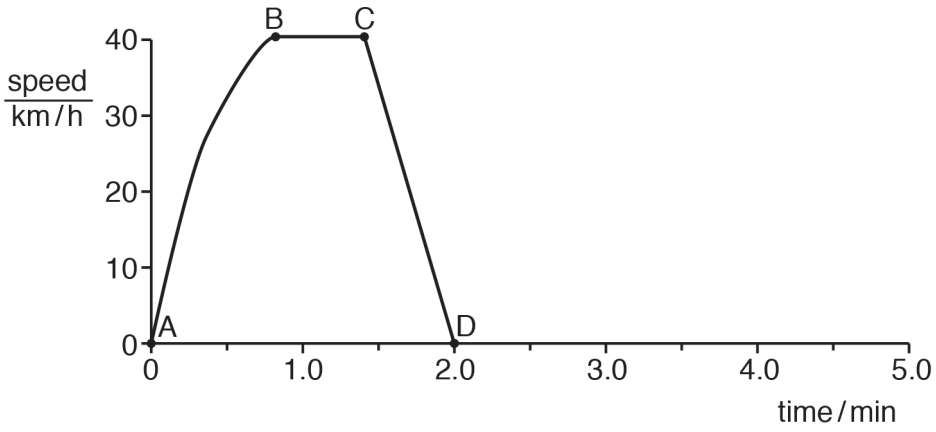
Q and R .....

R and S .....

S and T. ..... [3]

[Total: 3]

28 A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. The graph is a speed-time graph for the bus.



The bus stops at D for 1 min and then travels at a constant acceleration for 30 seconds.

On the graph, sketch a possible graph for this additional motion. Label X when the bus starts to accelerate and label Y for 30 seconds later. [3]

[Total: 3]

29 The diagram shows students getting onto a school bus.

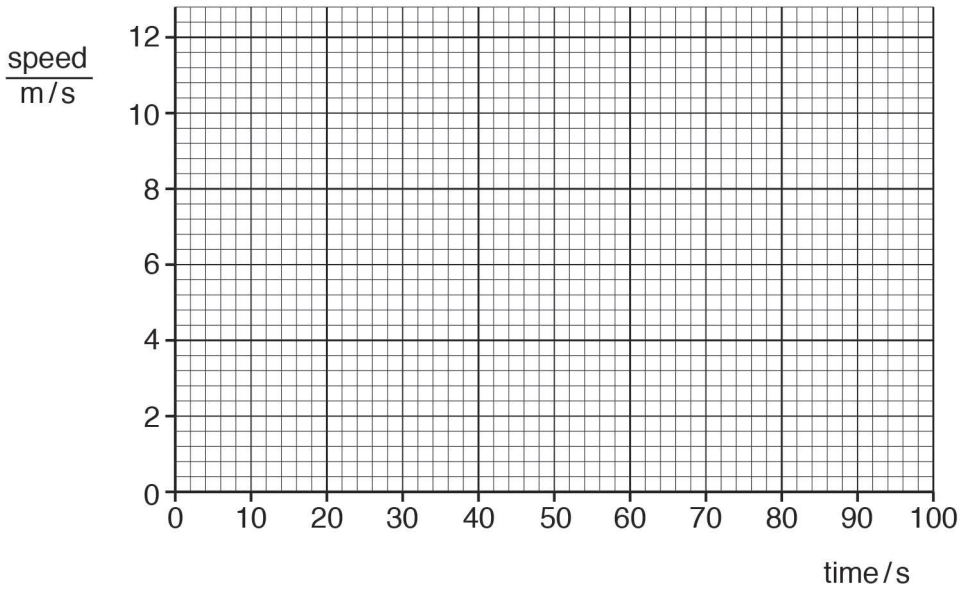
A student describes part of the journey.

The bus accelerates from rest at a constant rate for 10 s. It reaches a maximum speed of 10 m / s.

The bus maintains a constant speed of 10 m / s for 60 s.

The bus then decelerates at a constant rate for 15 s, until it stops.

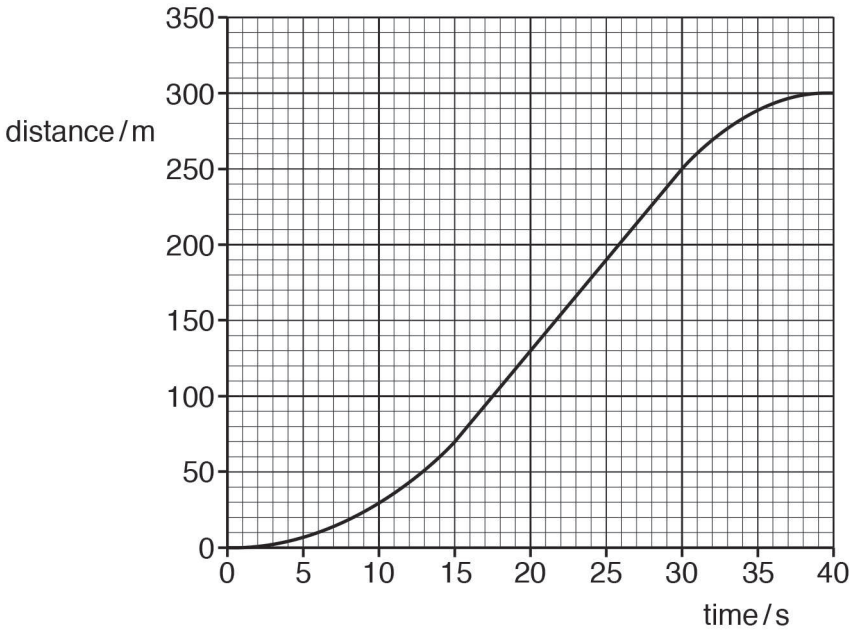
On the grid, draw the speed-time graph for this part of the journey made by the bus.



[5]

[Total: 5]

30 The graph is the distance-time graph for the journey of a cyclist.

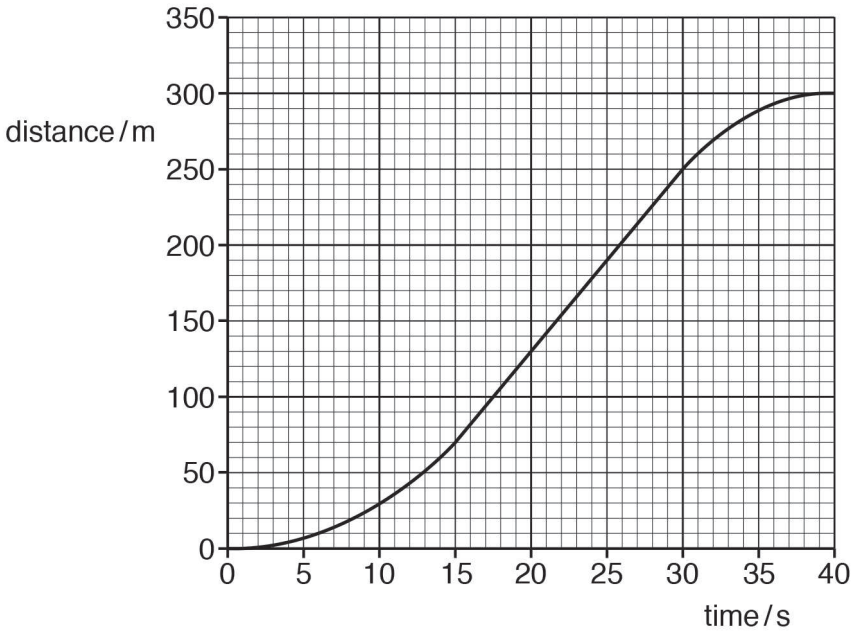


Calculate the average speed for this 40 s journey.

average speed = ... [2]

[Total: 2]

31 The graph is the distance-time graph for the journey of a cyclist.



Describe the motion of the cyclist in the time between:

1. time = 0 and time = 15 s

.....

2. time = 15 s and time = 30 s

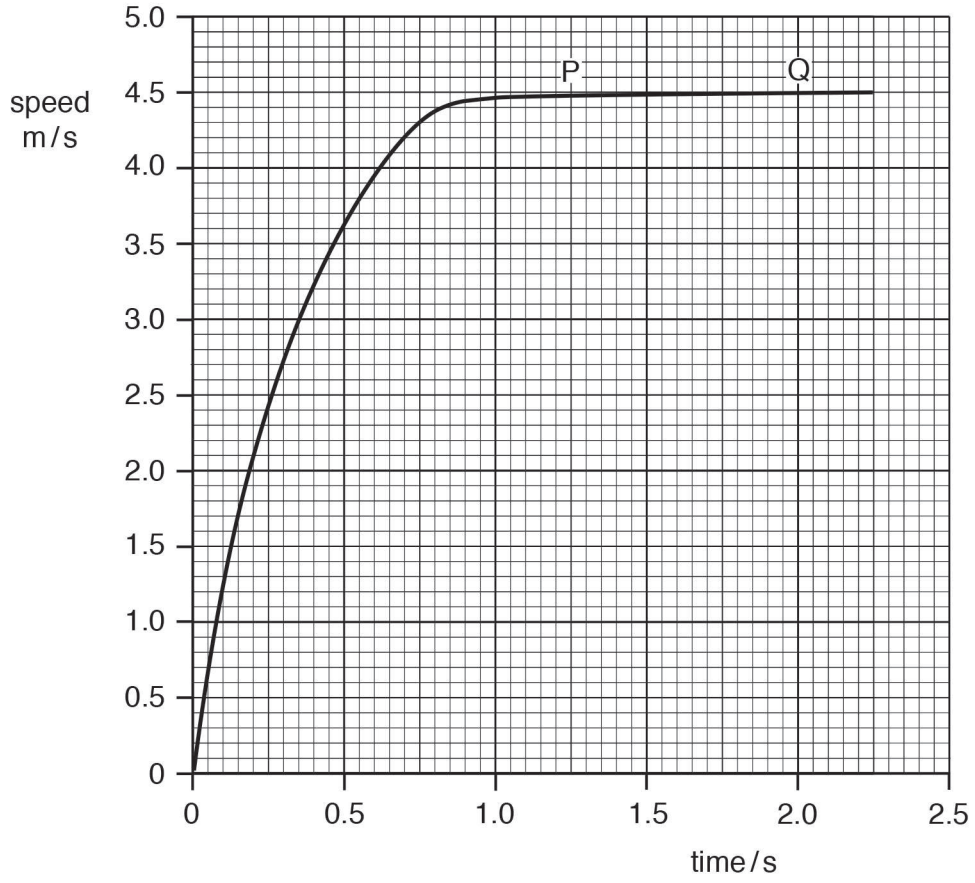
.....

3. time = 30 s and time = 40 s.

..... [3]

[Total: 3]

32 The diagram shows the speed-time graph for a drop of water falling towards the ground.

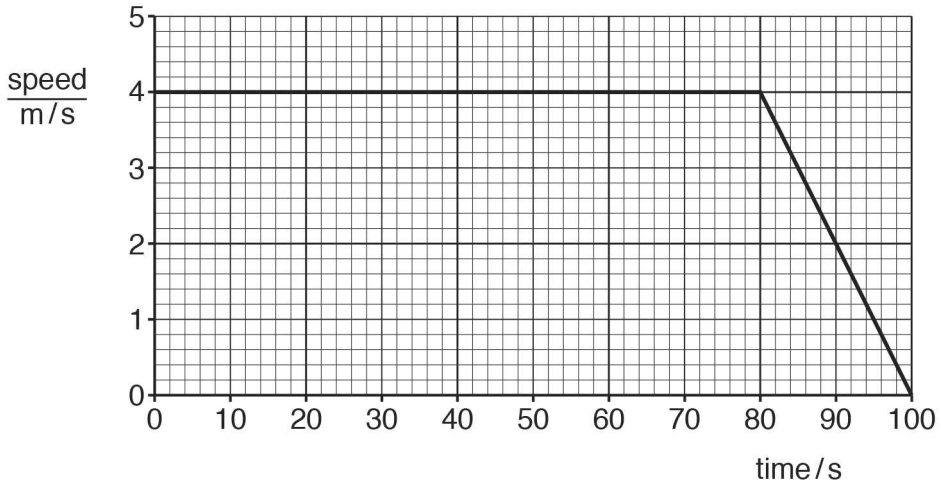


Use the graph to determine the distance fallen by the drop between P and Q.

distance = ... m [3]

[Total: 3]

33 The diagram shows a speed-time graph for a student who is running.



Calculate the distance travelled by the student between 80 s and 100 s.

distance travelled = ...m [3]

[Total: 3]

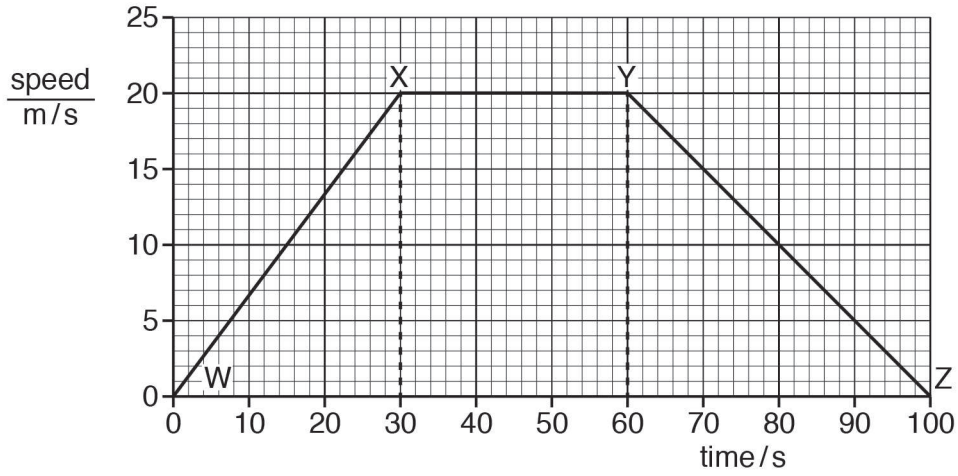
34 An athlete runs 630 m in 130 s on a flat section of a road and then 254 m in 40 s on a downhill slope.

Calculate the average speed for the total distance run by the athlete.

average speed = ...m / s [3]

[Total: 3]

35 A person on roller skates makes a journey. The diagram shows the speed-time graph for the journey.



(a) The graph shows three types of motion.

Complete the table to show when each type of motion occurs. Use the letters shown on the diagram. Add a letter to each of the blank spaces.

The first row is done for you.

motion	start of motion	end of motion
acceleration	W	X
deceleration		
constant speed		

[2]

(b) Calculate the distance travelled between 60 s and 100 s.

distance = ... m [3]

(c) The size of the acceleration is greater than the deceleration.

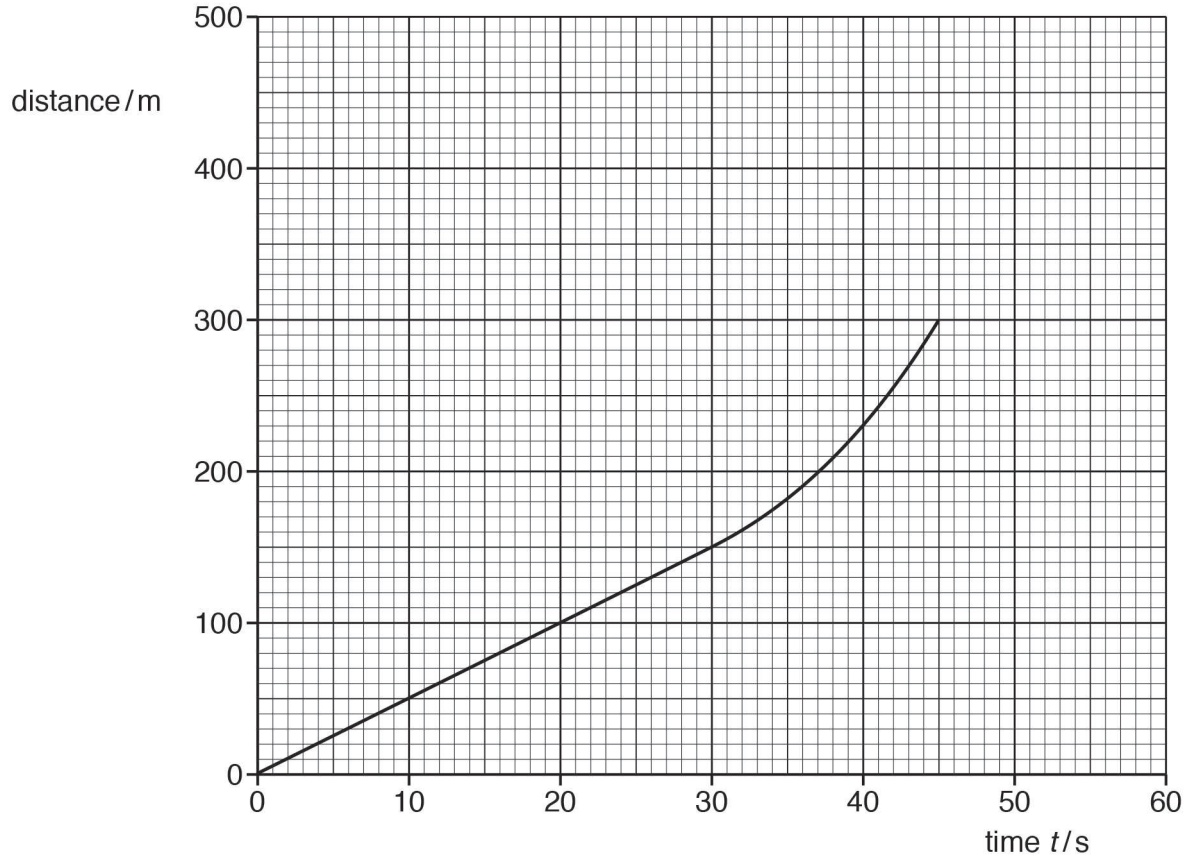
Describe how the speed-time graph shows this.

.....

..... [1]

[Total: 6]

36 The graph is the distance-time graph for a moving car.

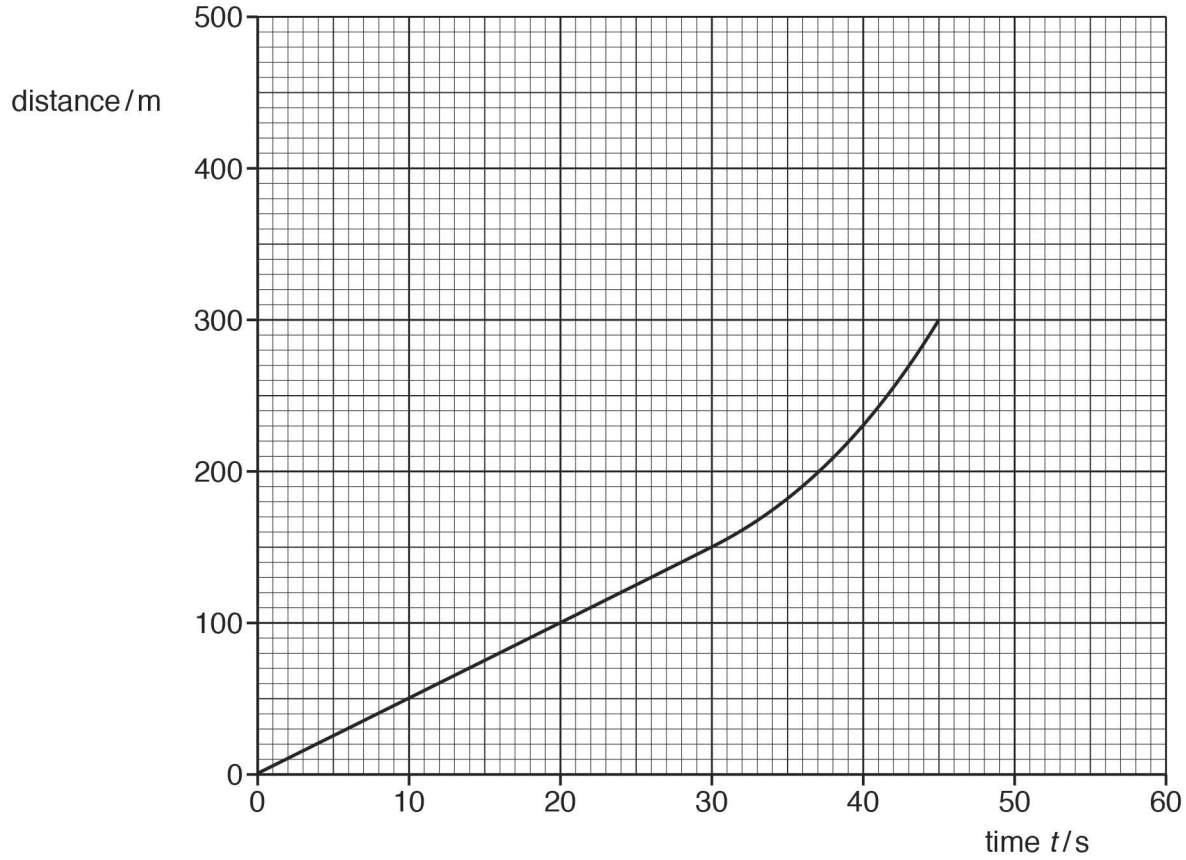


At time t = 45 s, the car starts to decelerate. At time t = 55 s and at a distance of 400 m from the starting point, the car stops. It then remains stationary for 5.0 s.

On the grid, draw a possible continuation of the distance-time graph. [3]

[Total: 3]

37 The graph is the distance-time graph for a moving car.



(a) Determine the speed of the car at time $t = 15\,s$.

speed = ... [2]

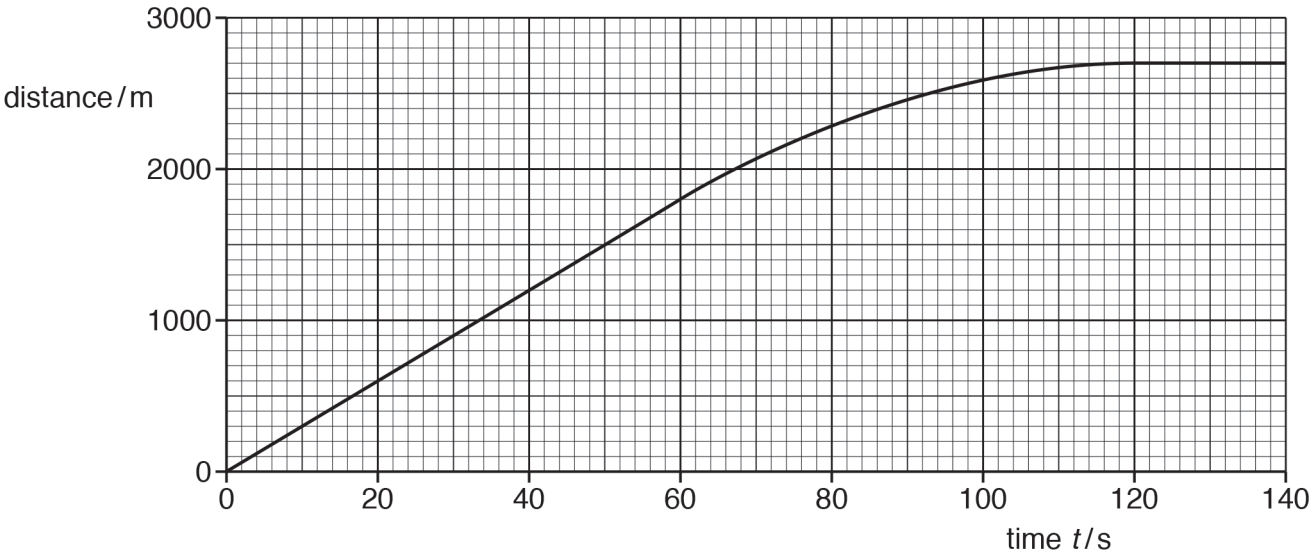
(b) Determine the average speed of the car between time $t = 30\,s$ and time $t = 45\,s$.

average speed = ... [2]

[Total: 4]

38 A lorry is travelling along a straight, horizontal road.

The graph is the distance-time graph for the lorry.



Describe the motion of the lorry between time $t = 60$ s and time $t = 130$ s.

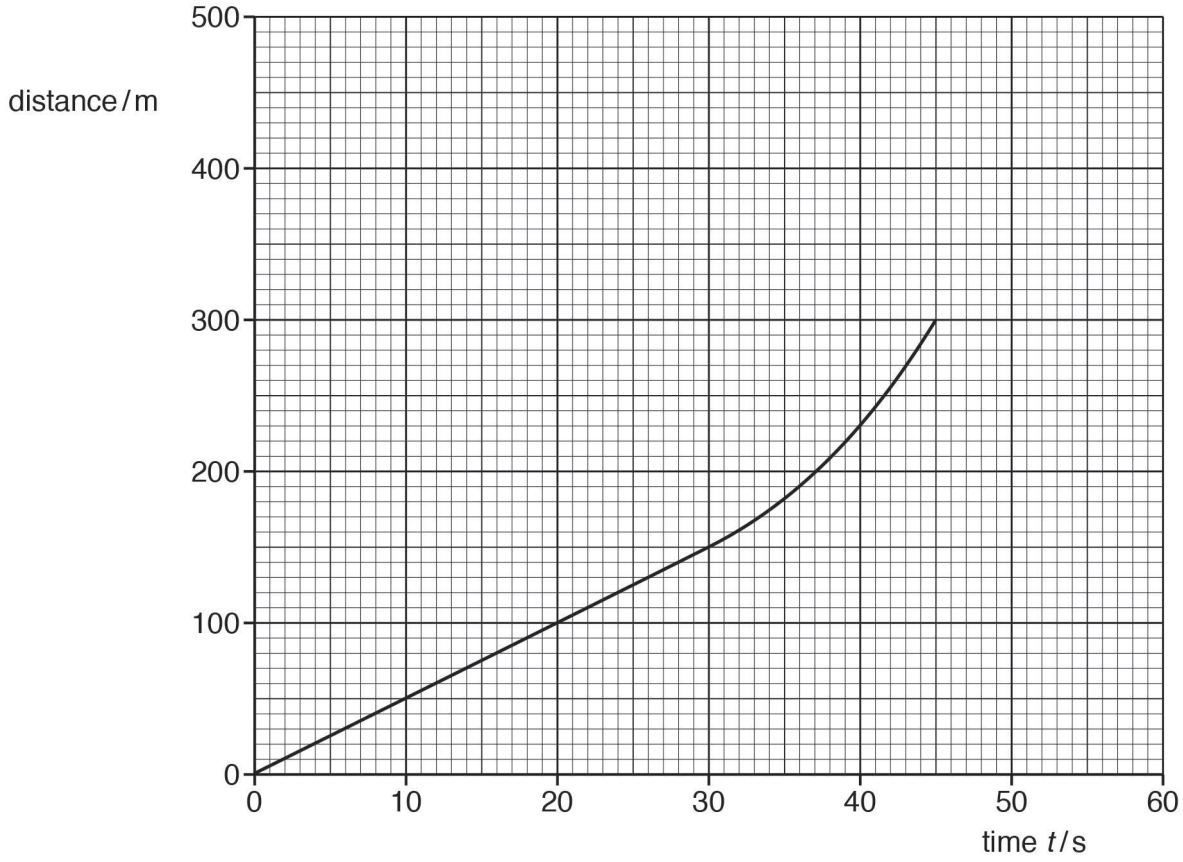
.....

.....

..... [2]

[Total: 2]

39 The graph is the distance-time graph for a moving car.

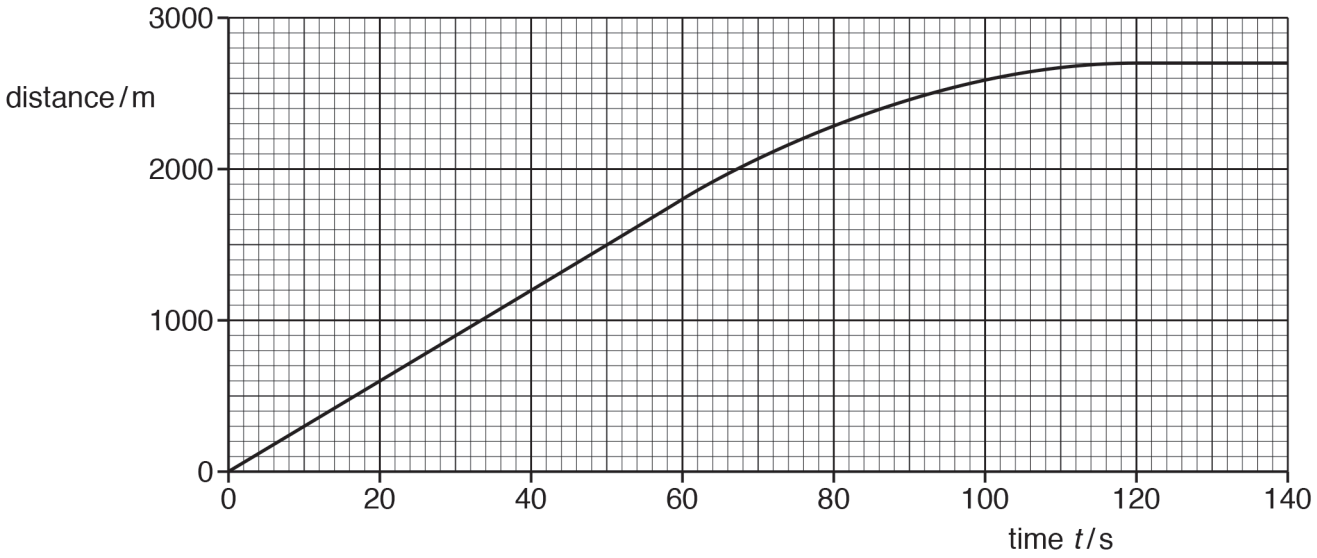


On the graph, mark a point P where the acceleration of the car is zero. [1]

[Total: 1]

40 A lorry is travelling along a straight, horizontal road.

The graph is the distance-time graph for the lorry.



Using the graph, determine the average speed of the lorry between time $t = 60$ s and time $t = 120$ s.

average speed = ... [2]

[Total: 2]