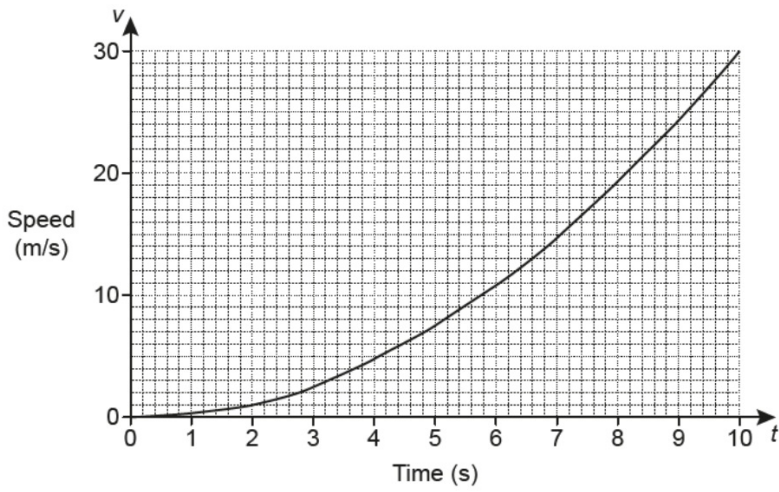


## A73 (H) Velocity-time Graphs - Gradients and Area Under Curves

OCR

15 The graph shows the speed,  $v$  metres per second (m/s), of a car at time  $t$  seconds.

Video created by W Neill

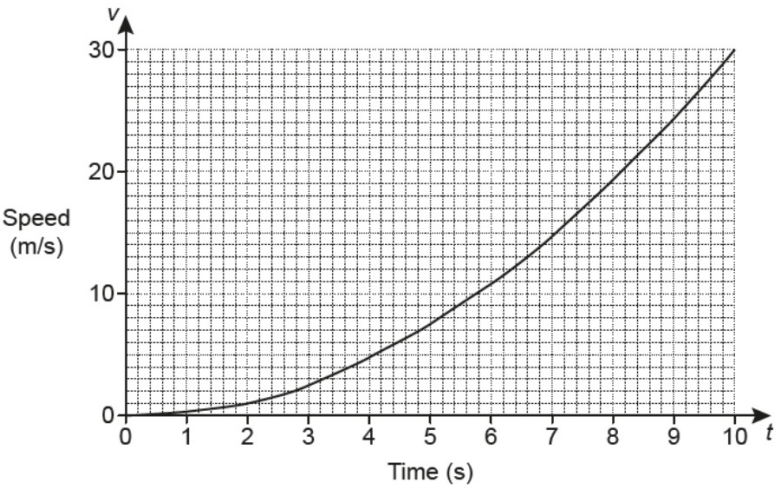


(a) Find the speed of the car at  $t = 7$ .

A73

(a) ..... m/s [1]

Video created by W Neill



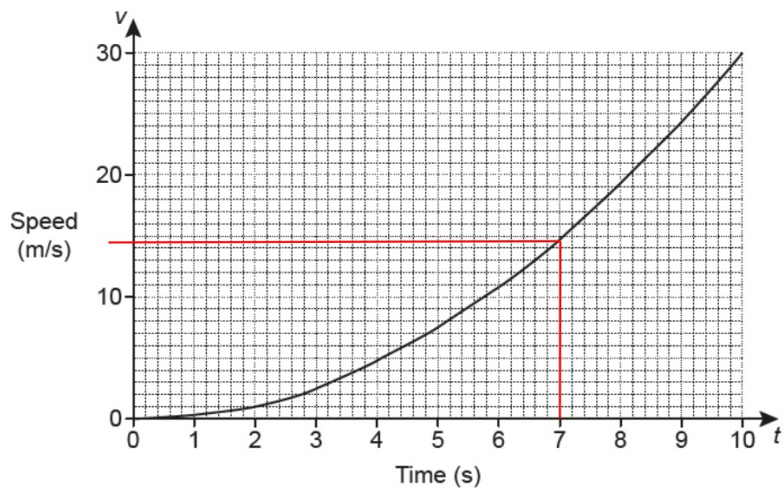
(c) Use the graph to estimate the acceleration at  $t = 7$ .

A73

(c) .....  $\text{m/s}^2$  [3]

15 The graph shows the speed,  $v$  metres per second (m/s), of a car at time  $t$  seconds.

Video created by W Neill

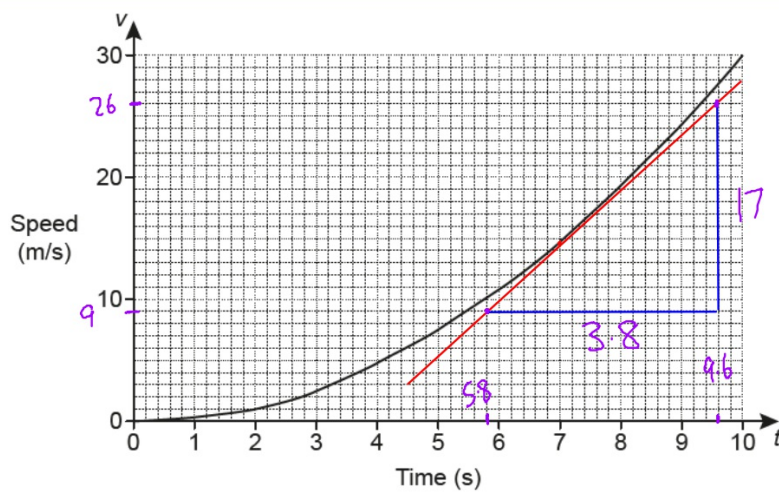


14.5 m/s ✓

(a) Find the speed of the car at  $t = 7$ .

A73

(a) ..... 14.5 ..... m/s [1]



Video created by W Neill

$$\frac{17}{3.8} = 4.47$$

(c) Use the graph to estimate the acceleration at  $t = 7$ .

A73

gradient of line

$$\frac{v}{h}$$

4 → 4.5 ✓

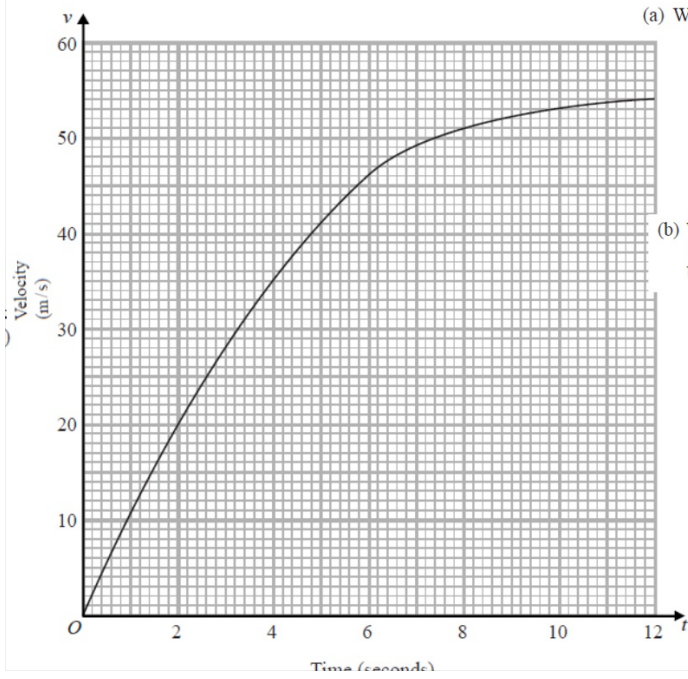
4.47 ✓

(c) .....  $\text{m/s}^2$  [3]

EDEXCEL

20 The graph shows information about the velocity,  $v$  m/s, of a parachutist  $t$  seconds after leaving a plane.

Video created by W Neill



(a) Work out an estimate for the acceleration of the parachutist at  $t = 6$

..... m/s<sup>2</sup>  
(2)

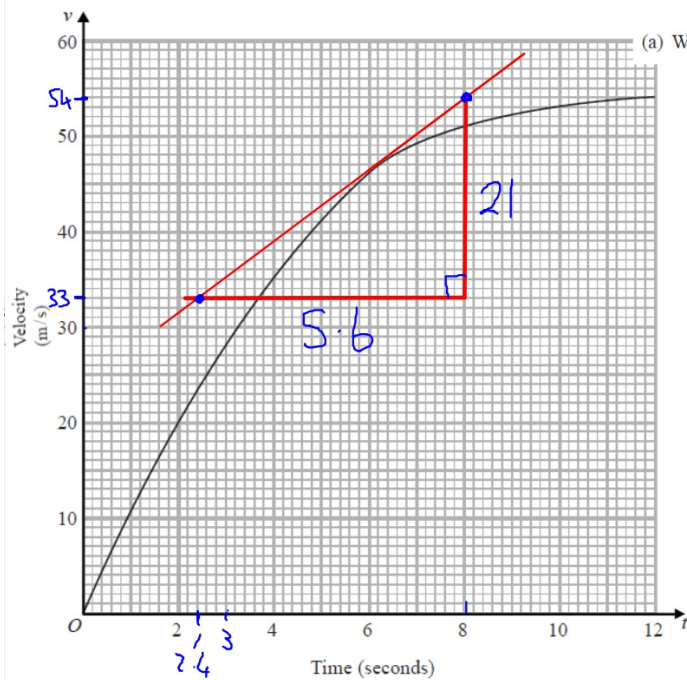
(b) Work out an estimate for the distance fallen by the parachutist in the first 12 seconds after leaving the plane. Use 3 strips of equal width.

..... m  
(3)



20 The graph shows information about the velocity,  $v$  m/s, of a parachutist  $t$  seconds after leaving a plane.

Video created by W Neill



(a) Work out an estimate for the acceleration of the parachutist at  $t = 6$

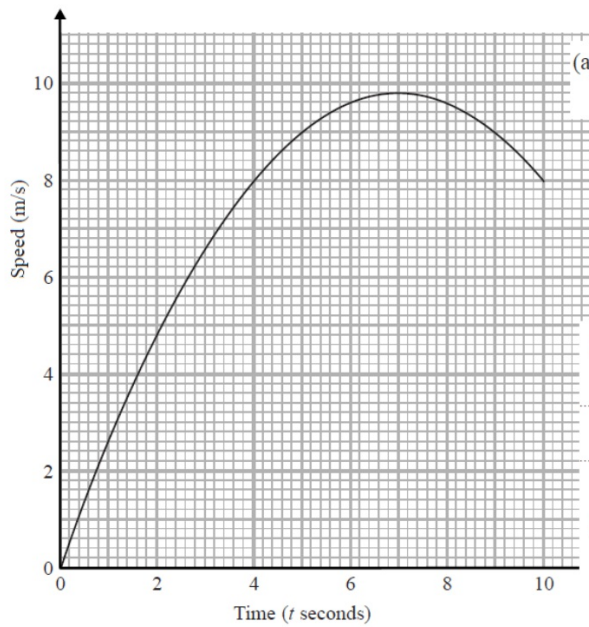
..... m/s<sup>2</sup>  
(2)  
gradient of the line at  $t = 6$

$$\frac{v}{h} = \frac{21}{5.6} = 3.75 \text{ m/s}^2$$

15 Karol runs in a race.

Video created by W Neill

The graph shows her speed, in metres per second,  $t$  seconds after the start of the race.



(a) Calculate an estimate for the gradient of the graph when  $t = 4$   
You must show how you get your answer.

.....  
(3)

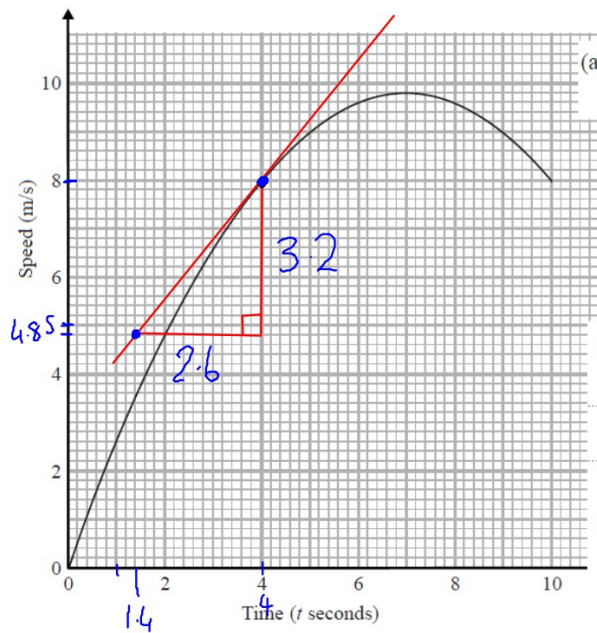
(b) Describe fully what your answer to part (a) represents.  
.....  
.....

(c) Explain why your answer to part (a) is only an estimate.

15 Karol runs in a race.

Video created by W Neill

The graph shows her speed, in metres per second,  $t$  seconds after the start of the race.



- (a) Calculate an estimate for the gradient of the graph when  $t = 4$   
You must show how you get your answer.

$$\frac{\Delta v}{\Delta t} = \frac{3.2}{2.6} = 1.23$$

- (b) Describe fully what your answer to part (a) represents.

acceleration at 4 seconds.

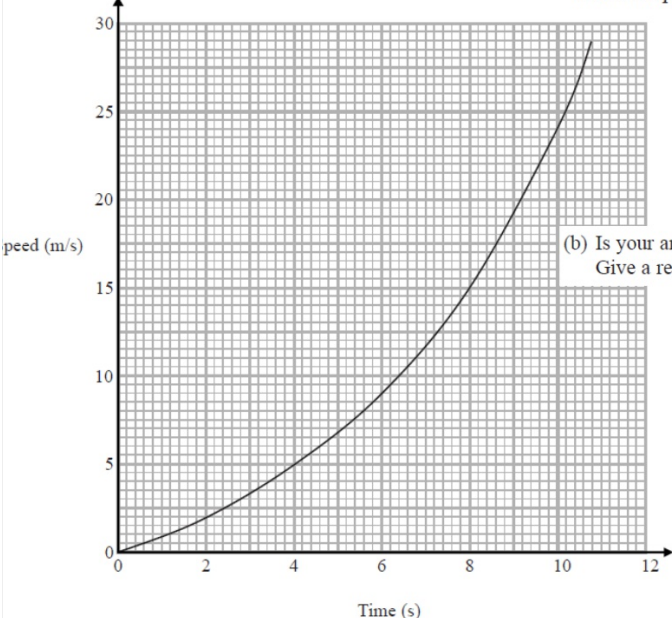
$$1.23 \text{ m/s}^2$$

- (c) Explain why your answer to part (a) is only an estimate.

My tangent may not be perfect.

18 Here is a speed-time graph for a car.

(a) Work out an estimate for the distance the car travelled in the first 10 seconds.  
Use 5 strips of equal width.



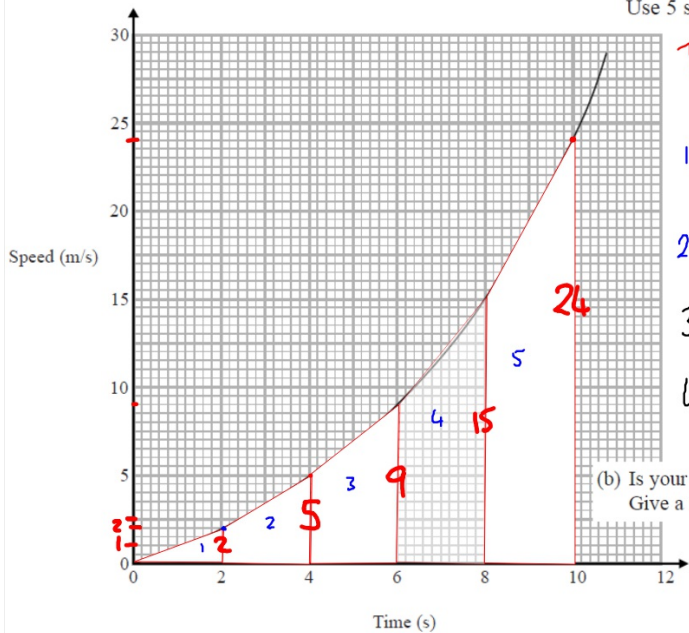
(b) Is your answer to (a) an underestimate or an overestimate of the actual distance?  
Give a reason for your answer.

Video created by W Neill

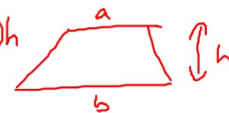
area under a curve

18 Here is a speed-time graph for a car.

(a) Work out an estimate for the distance the car travelled in the first 10 seconds. Use 5 strips of equal width.



Trapezium  $\frac{1}{2}(a+b)h$



1...  $\frac{B \times H}{2} \dots \frac{2 \times 2}{2} = 2$      5...  $\frac{1}{2}(15+24)h = 39$

2...  $\frac{1}{2}(2+5)2 = 7$

3...  $\frac{1}{2}(5+9)2 = 14$      Distance  
2+7+14+24+39

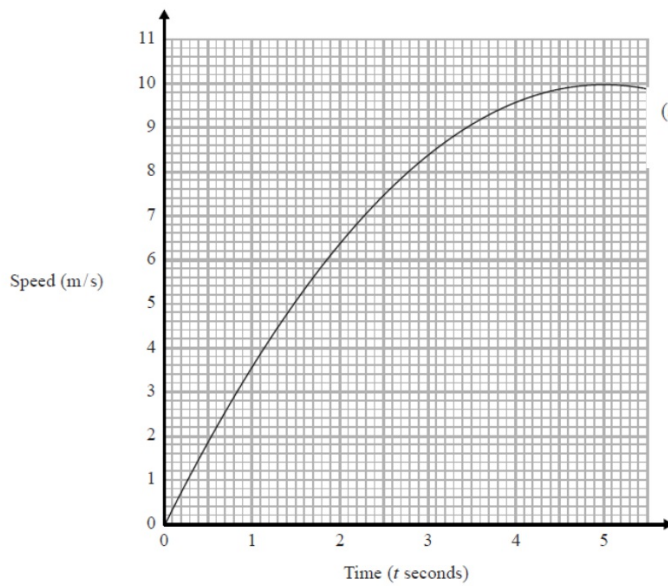
4...  $\frac{1}{2}(9+15)2 = 24$      = 86 metres ✓

(b) Is your answer to (a) an underestimate or an overestimate of the actual distance? Give a reason for your answer.

overestimate, as the trapeziums go slightly above the graph.

17 Here is a speed-time graph showing the speed, in metres per second, of an object  $t$  seconds after it started to move.

Created by W Neill



(a) Use 3 strips of equal width to find an estimate for the area under the graph between  $t = 1$  and  $t = 4$

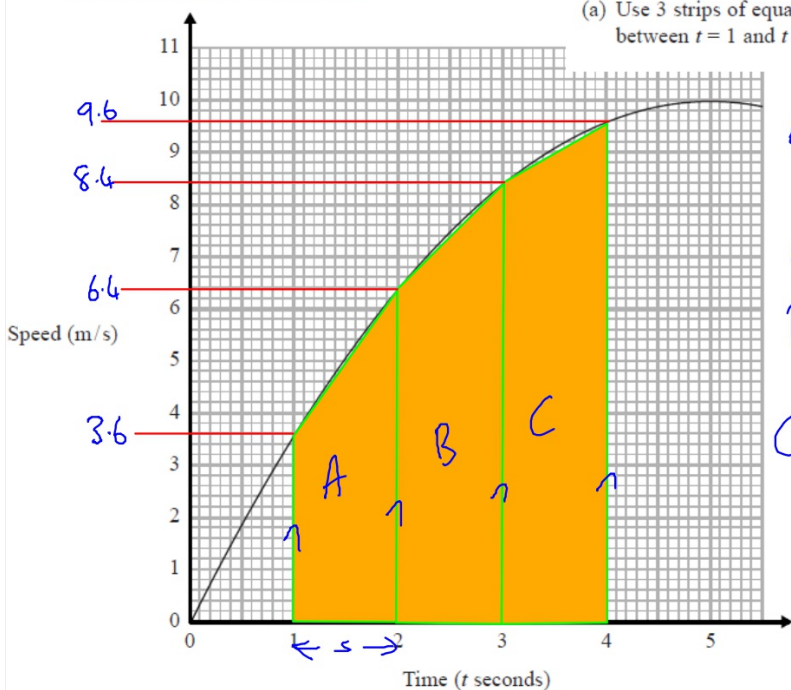
.....  
(3)

17 Here is a speed-time graph showing the speed, in metres per second, of an object  $t$  seconds after it started to move.

Created by W Neill

distance travelled

(a) Use 3 strips of equal width to find an estimate for the area under the graph between  $t = 1$  and  $t = 4$



Area Trapezium  
 $\frac{1}{2}(a+b)h$   
 parallel sides

$$A = \frac{1}{2}(3.6 + 4.6) \times 1 = 5\text{m}$$

$$B = \frac{1}{2}(6.4 + 8.4) \times 1 = 7.4\text{m}$$

$$C = \frac{1}{2}(8.4 + 9.6) \times 1 = 9\text{m}$$

$$\underline{21.4\text{m}}$$



(b) Describe fully what your answer to part (a) represents.

.....

.....

(2)

(c) Explain whether your answer in part (a) gives an underestimate or an overestimate for the area under the graph.

.....

.....

(1)

**(Total for Question 17 is 6 marks)**

---



(b) Describe fully what your answer to part (a) represents.

distance travelled between 1 second and  
4 seconds.

(c) Explain whether your answer in part (a) gives an underestimate or an overestimate for the area under the graph.

Underestimate. Trapezium is slightly under the curve  
so a little piece is missed.

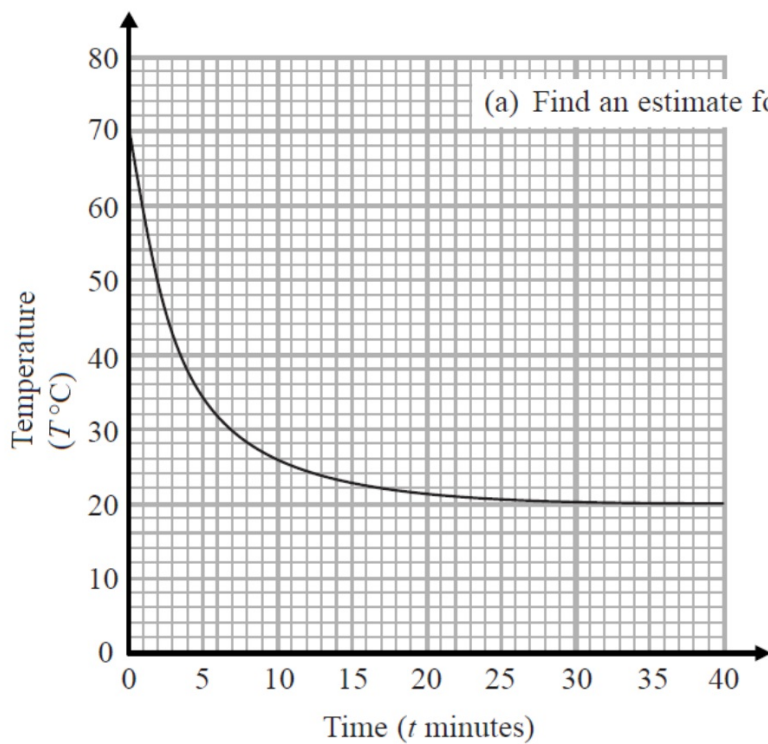
(1)

---

(Total for Question 17 is 6 marks)

Created by W Neill

13 The graph shows the temperature,  $T^{\circ}\text{C}$ , of the coffee in a cup at a time  $t$  minutes.

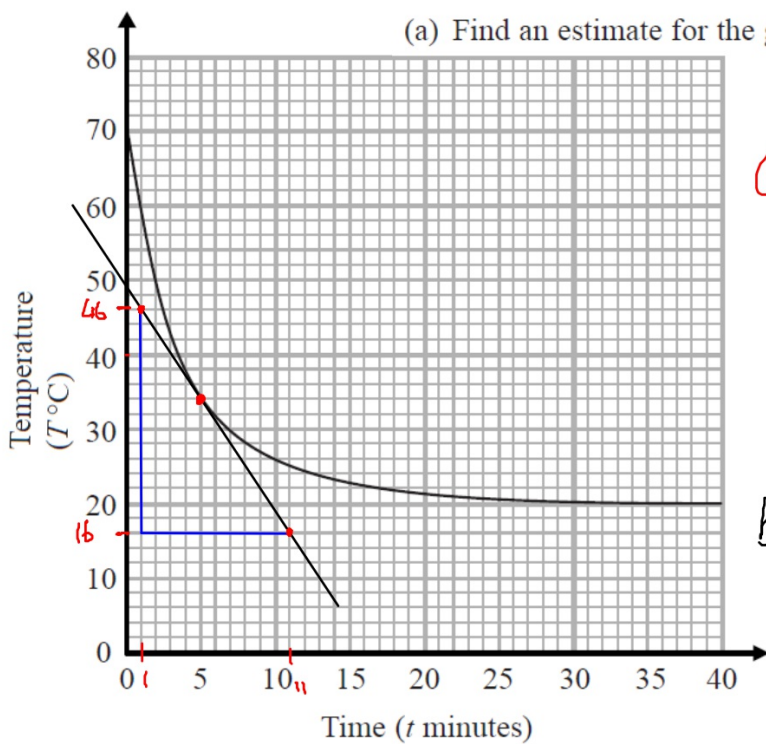


(a) Find an estimate for the gradient of the graph at time 5 minutes.

(b) Explain what this gradient represents.

.....  
.....  
(2)

13 The graph shows the temperature,  $T^{\circ}\text{C}$ , of the coffee in a cup at a time  $t$  minutes.



Gradient  $\frac{v}{h}$

$$\frac{30}{10} = -3$$

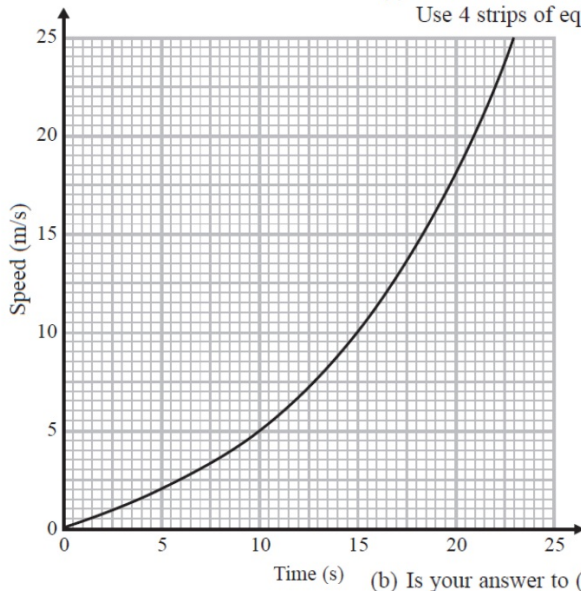
b) Rate of change of the temperature

(b) Explain what this gradient represents.

18 Here is a speed-time graph for a train.

Created by W Neill

(a) Work out an estimate for the distance the train travelled in the first 20 seconds.  
Use 4 strips of equal width.



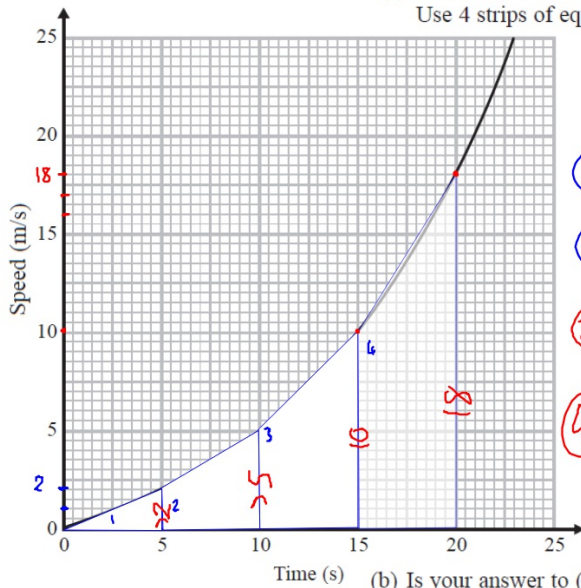
..... m  
(3)

(b) Is your answer to (a) an underestimate or an overestimate of the actual distance the train travelled?  
Give a reason for your answer.

18 Here is a speed-time graph for a train.

Created by W Neill

(a) Work out an estimate for the distance the train travelled in the first 20 seconds. Use 4 strips of equal width.



①  $\frac{B \times H}{2} = \frac{2 \times 5}{2} = 5\text{m}$

②  $\frac{1}{2}(4+6)h = \frac{1}{2}(7)5 = 17.5\text{m}$

③  $\frac{1}{2}(5+10)5 = 37.5\text{m}$

④  $\frac{1}{2}(10+18)5 = 70\text{m}$

130m ✓

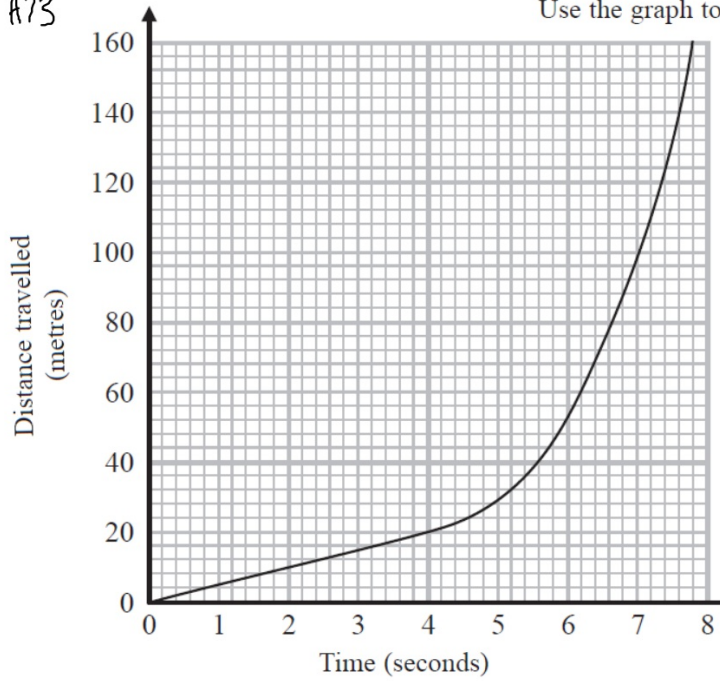
(b) Is your answer to (a) an underestimate or an overestimate of the actual distance the train travelled? Give a reason for your answer.

Overestimate as my trapeziums go slightly above the graph.

14 The distance-time graph shows information about part of a car journey.

A73

Use the graph to estimate the speed of the car at time 5 seconds.



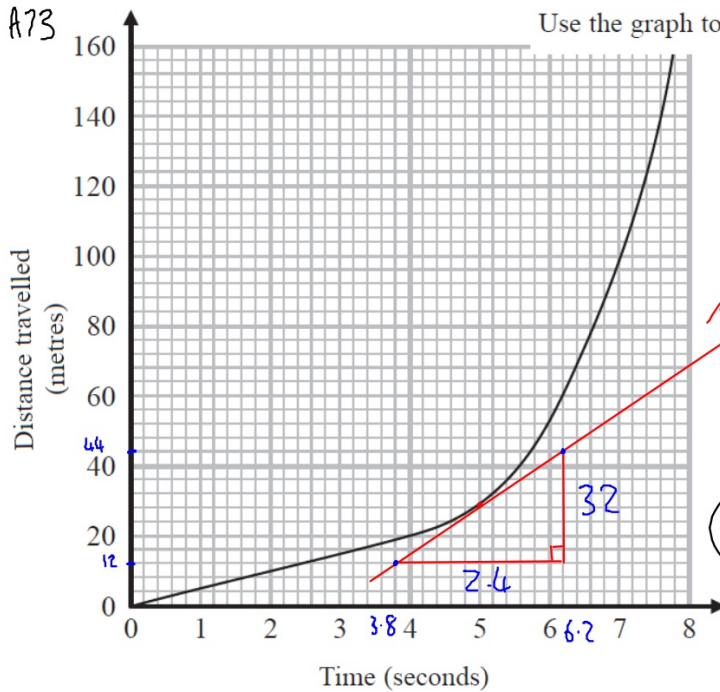
..... m/s

**(Total for Question 14 is 3 marks)**

14 The distance-time graph shows information about part of a car journey.

A73

Use the graph to estimate the speed of the car at time 5 seconds.



Gradient of the tangent

$$\text{Tangent} + \frac{32}{2.4} = 13.3$$

MS → 11-19 ✓

13.3 m/s

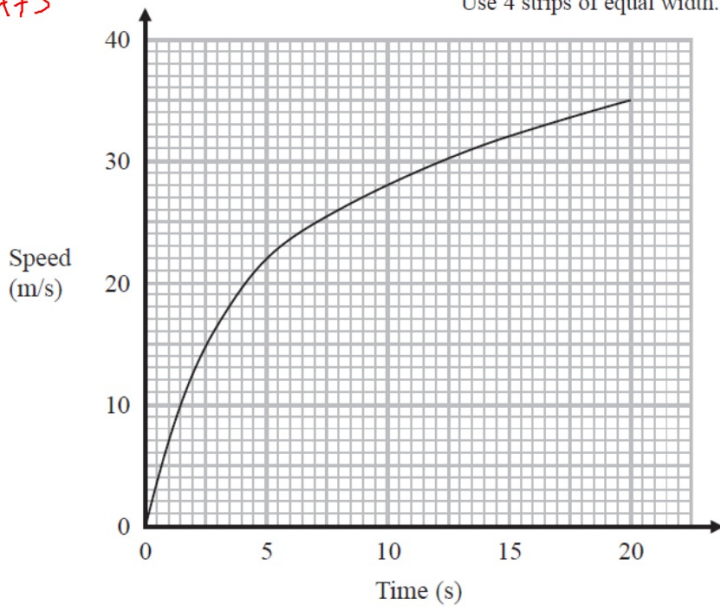
(Total for Question 14 is 3 marks)



15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.

- (a) Work out an estimate for the distance the car travelled in the first 20 seconds. Use 4 strips of equal width.

A73

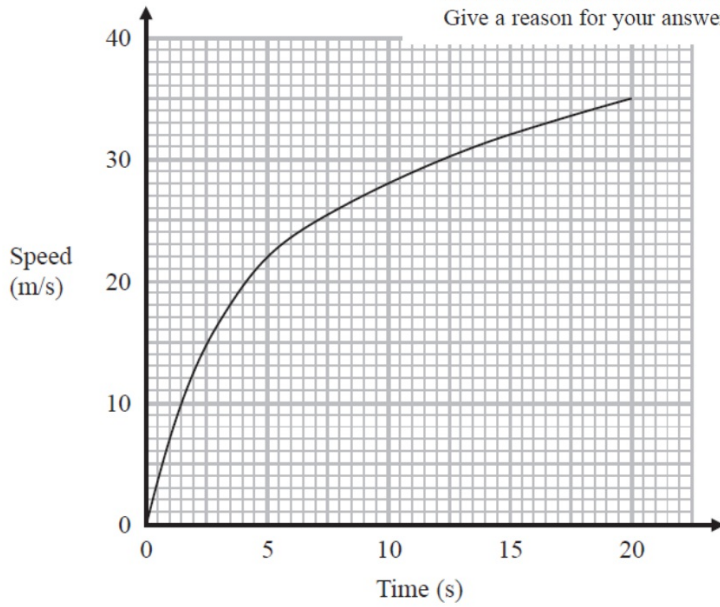


..... metres  
(3)



15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.

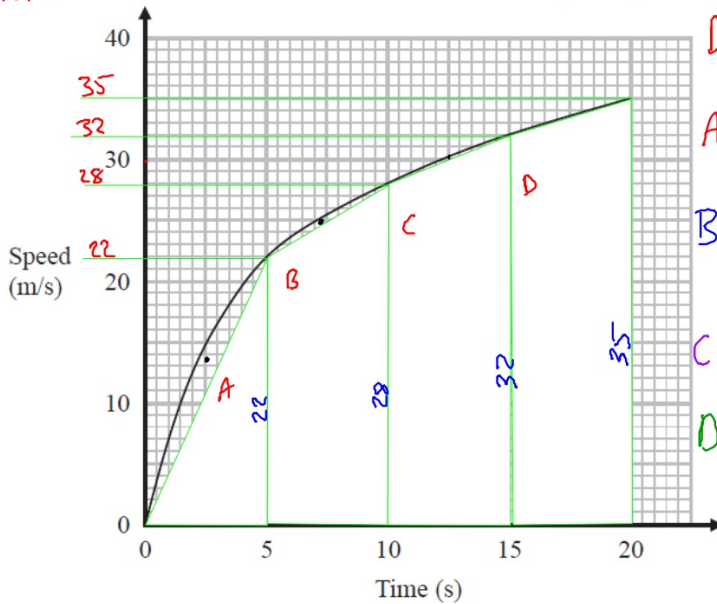
(b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 20 seconds?  
Give a reason for your answer.



15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.

- (a) Work out an estimate for the distance the car travelled in the first 20 seconds. Use 4 strips of equal width.

A73



Distance travelled is Area under curve

$$A = \frac{B \times H}{2} = \frac{22 \times 5}{2} = 55 \text{ metres}$$

$$B = \frac{1}{2}(a+b)h = \frac{1}{2}(22+28)5 = 125 \text{ metres}$$

$$C = \frac{1}{2}(28+32)5 = 150 \text{ metres}$$

$$D = \frac{1}{2}(32+35)5 = 167.5 \text{ metres}$$

$$497.5 \text{ m} \quad (3)$$

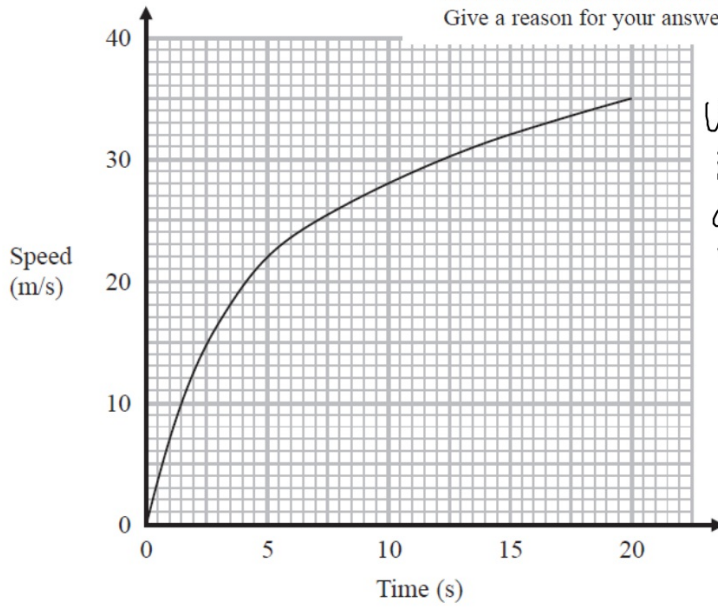
$$488 \rightarrow 507 \text{ m} \checkmark$$

metres

15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.

(b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 20 seconds?

Give a reason for your answer.



Underestimate as there is space remaining under the graph that has not been measured.

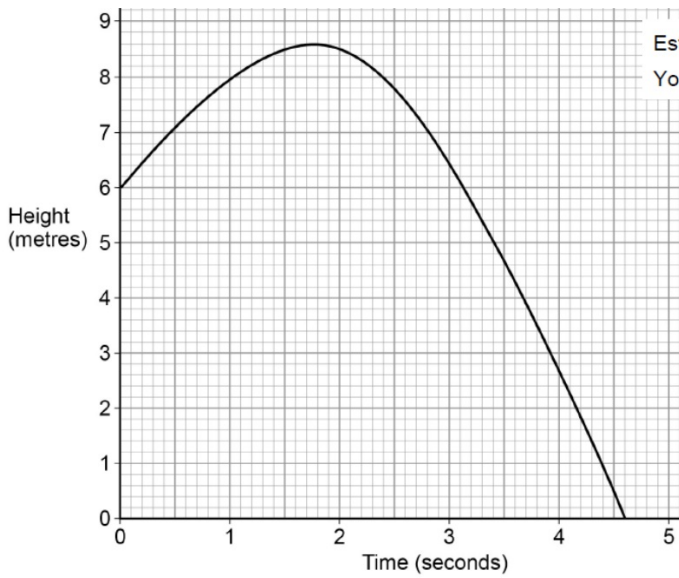
AQA

24

A ball is thrown from a point 6 metres above the ground.

Video created by W Neill

The graph shows the height of the ball above the ground, in metres.



Estimate the speed of the ball, in m/s, after 1 second.

You **must** show your working.

**[2 marks]**

Answer \_\_\_\_\_ m/s

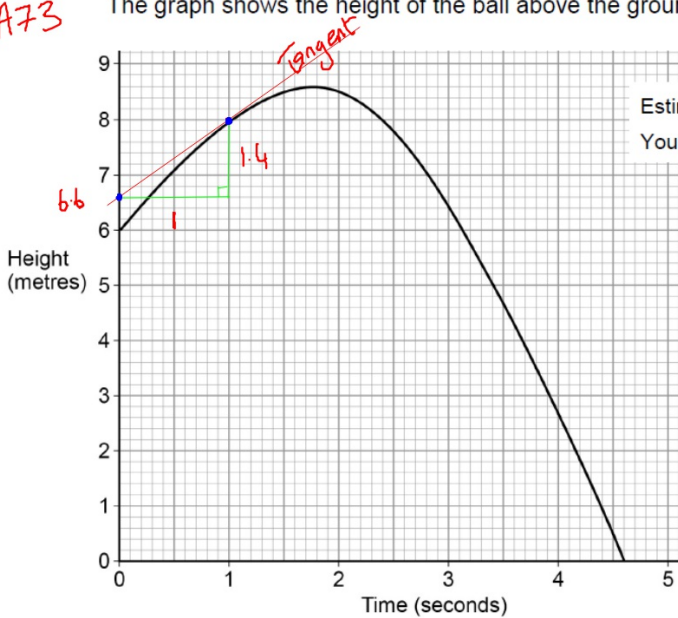
24

A ball is thrown from a point 6 metres above the ground.

Video created by W Neill

A73

The graph shows the height of the ball above the ground, in metres.



Estimate the speed of the ball, in m/s, after 1 second.

You must show your working.

[2 marks]

gradient of tangent.

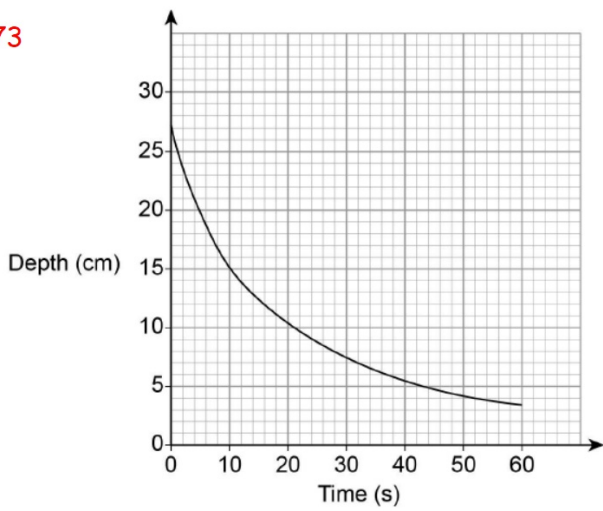
$$\text{gradient} = \frac{v}{h}$$

$$\frac{1.4}{1} = 1.4$$

Answer 1.4 m/s ✓

25 Liquid is leaking out of a container.  
The graph shows the depth of the liquid for 60 seconds.

A73



Answer \_\_\_\_\_ cm/s

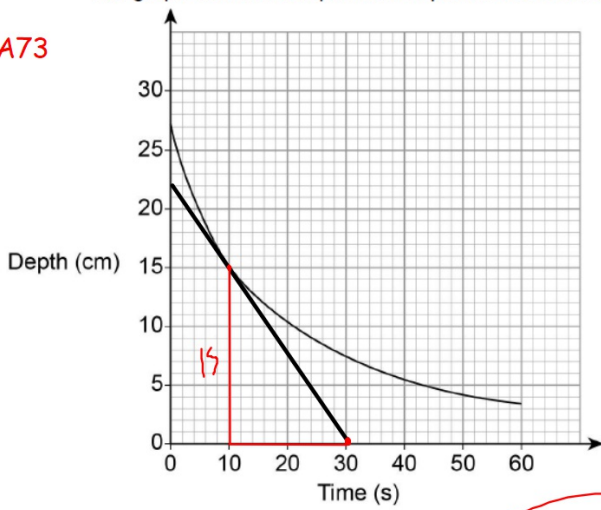
Use the graph to work out an estimate of the rate of decrease of depth at 10 seconds.

You **must** show your working.

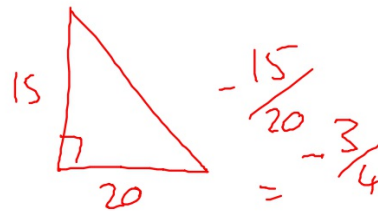
[3 marks]

25 Liquid is leaking out of a container.  
The graph shows the depth of the liquid for 60 seconds.

A73



$$\text{Gradient} = \frac{v}{h} = \frac{15}{20}$$



Answer 3/4 ✓ cm/s

Use the graph to work out an estimate of the rate of decrease of depth at 10 seconds.  
You **must** show your working.

Gradient of tangent

[3 marks]

or -3/4 ✓



24

The speed-time graph shows 20 seconds of a car journey.

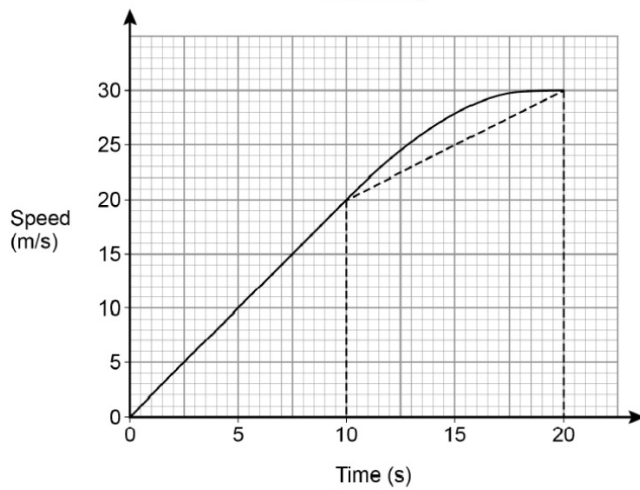
Video created by W Neill

Harry wants to estimate the distance the car travels in this time.

A73

He uses a triangle and a trapezium, as shown, to estimate the area under the graph.

Car journey



Answer \_\_\_\_\_ m

24 (a) Complete Harry's method to estimate the distance the car travels.

[3 marks]

24

The speed-time graph shows 20 seconds of a car journey.

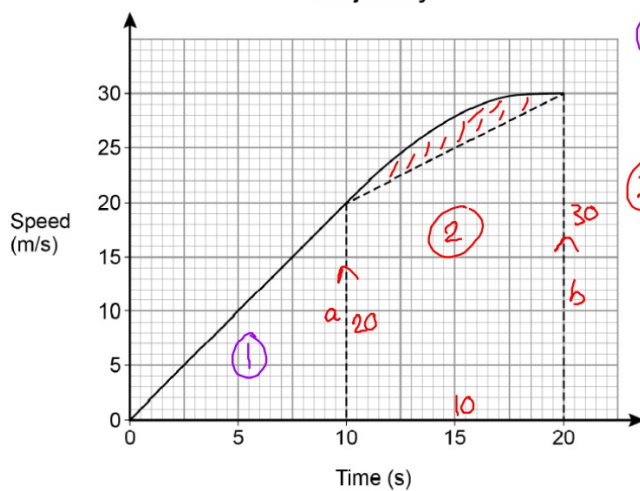
Video created by W Neill

Harry wants to estimate the distance the car travels in this time.

A73

He uses a triangle and a trapezium, as shown, to estimate the area under the graph. = distance

Car journey



$$\textcircled{1} = \frac{B \times H}{2} = \frac{10 \times 20}{2} = 100 \text{ m}$$

$$\textcircled{2} \quad \frac{1}{2}(a+b)h$$
$$\frac{1}{2}(20+30)10$$
$$25 \times 10 = 250 \text{ m}$$

Answer 350m m

24 (a) Complete Harry's method to estimate the distance the car travels.

[3 marks]