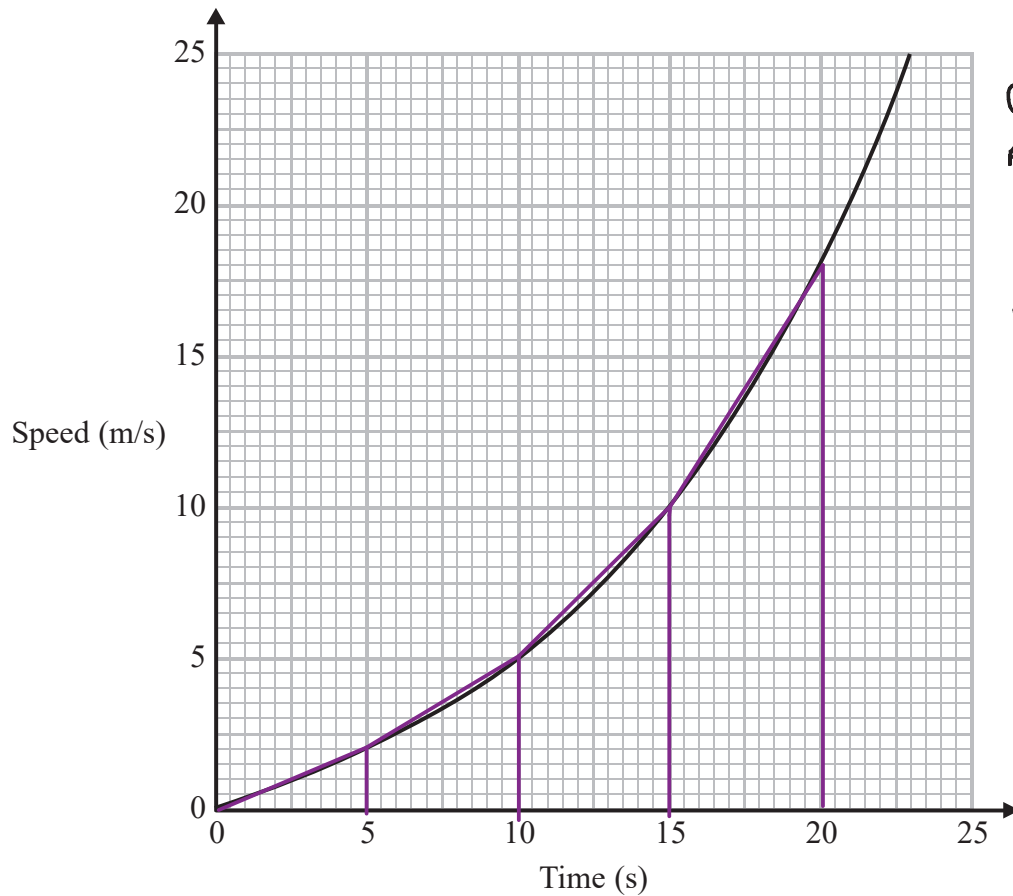


1. Here is a speed-time graph for a train.



0-5s

$$\text{Area} = \frac{1}{2} \times 5 \times 2 \\ = 5$$

5-10s

$$\text{Area} = \frac{1}{2} (2+5) 5 \\ = 17.5$$

10-15s

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

15-20s

$$\text{Area} = \frac{1}{2} (10+18) 5 \\ = 70$$

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

Distance = Area under graph
Area of triangle = $\frac{1}{2}bh$
Area of trapezium = $\frac{1}{2}(a+b)h$

$$5 + 17.5 + 37.5 + 70 = 130 \text{ m}$$

..... 130 ✓ m
(3)

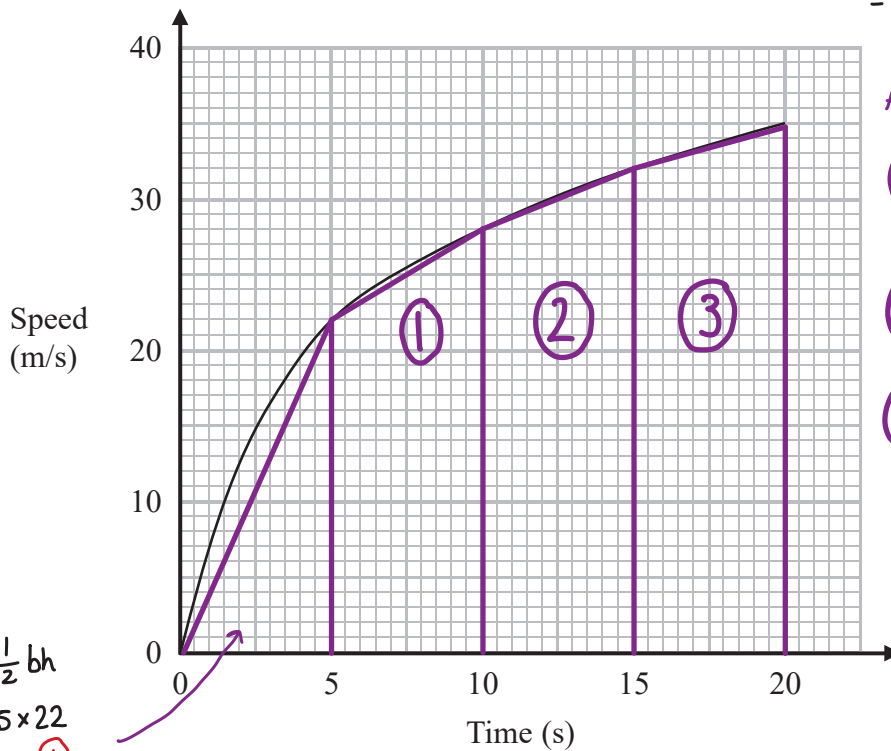
- (b) Is your answer to (a) an underestimate or an overestimate of the actual distance the train travelled?
Give a reason for your answer.

..... Overestimate, because we have also included the area
..... between trapezium/triangle and curve ✓

(1)

(Total for Question is 4 marks)

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



$$d = S \times t \\ = \text{AREA UNDER CURVE}$$

$$\text{Area of trapezium} \\ A = \frac{1}{2}(a+b)h$$

$$\textcircled{1} \quad \frac{1}{2}(22+28) \times 5 \\ = 125$$

$$\textcircled{2} \quad \frac{1}{2}(28+32) \times 5 \\ = 150$$

$$\textcircled{3} \quad \frac{1}{2}(32+35) \times 5 \\ = 167.5$$

$$\Delta \text{ area} = \frac{1}{2}bh \\ = \frac{1}{2} \times 5 \times 22 \\ = 55 \quad \textcircled{1}$$

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

$$\text{Sum of areas:} \\ 55 + 125 + 150 + 167.5 = 497.5 \quad \textcircled{1}$$

$$\dots\dots\dots 497.5 \quad \textcircled{1} \dots\dots\dots \text{metres} \\ \textcircled{3}$$

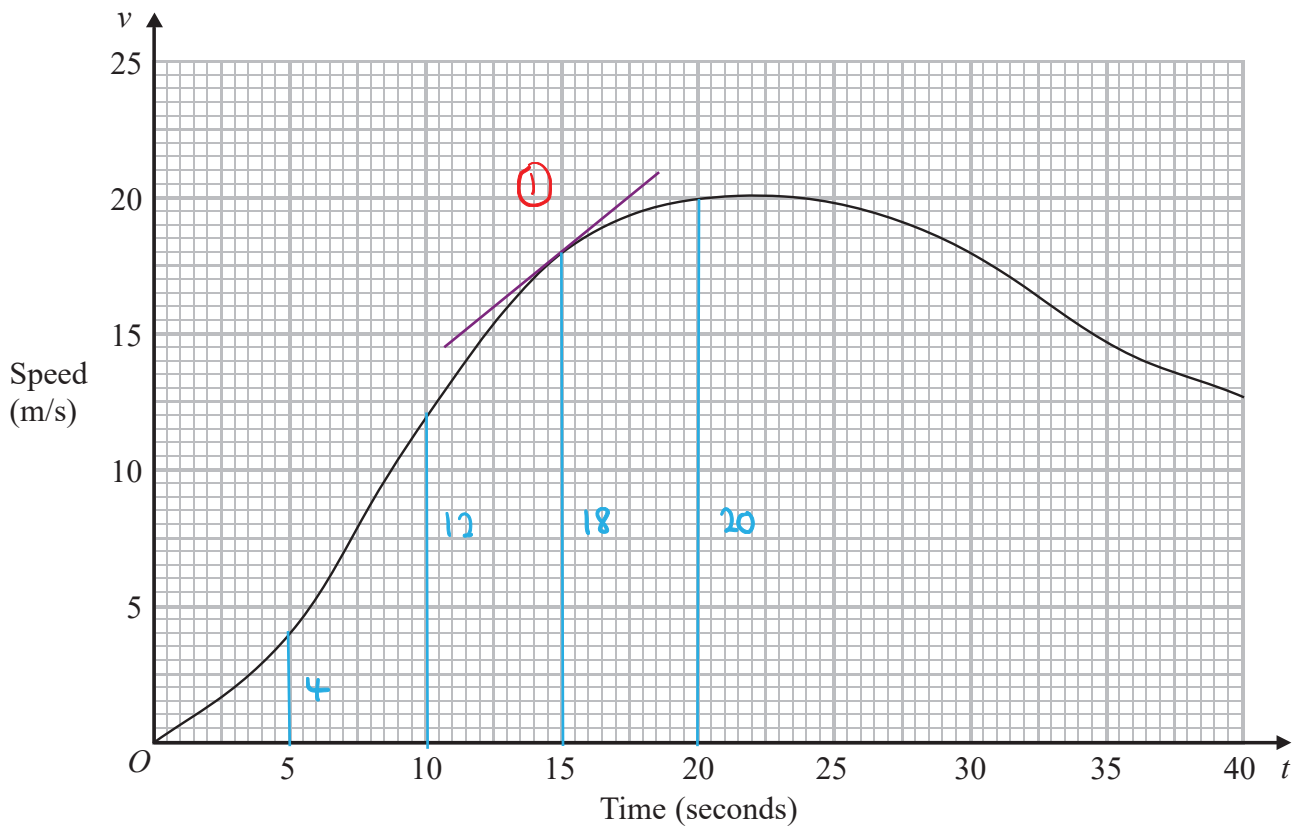
- (b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 20 seconds?
Give a reason for your answer.

Underestimate - There are parts of the area below the graph
which are not included (1)

(1)

3. A car moves from rest.

The graph gives information about the speed, v metres per second, of the car t seconds after it starts to move.



(a) (i) Calculate an estimate of the gradient of the graph at $t = 15$

$$\frac{20 - 16}{17.5 - 12.5} = 0.8$$

①

①

0.8

.....
(3)

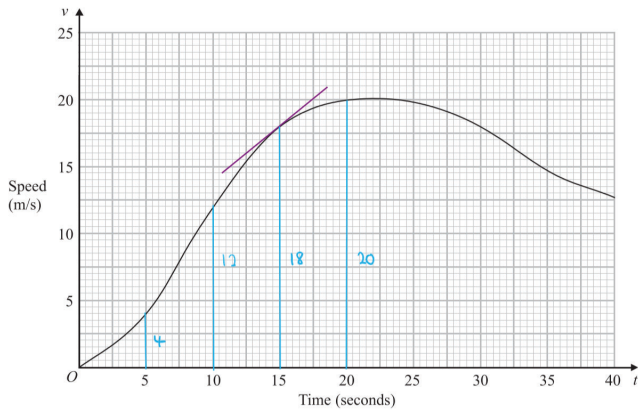
(ii) Describe what your answer to part (i) represents.

Acceleration

①

.....
(1)

- (b) Work out an estimate for the distance the car travels in the first 20 seconds of its journey.
Use 4 strips of equal width.



$$\text{Area of trapezium} = \left(\frac{a+b}{2}\right) h.$$

$$\text{total distance} = 10 + 40 + 75 + 95 \quad (1)$$

$$= \underline{\underline{220 \text{ m}}}$$

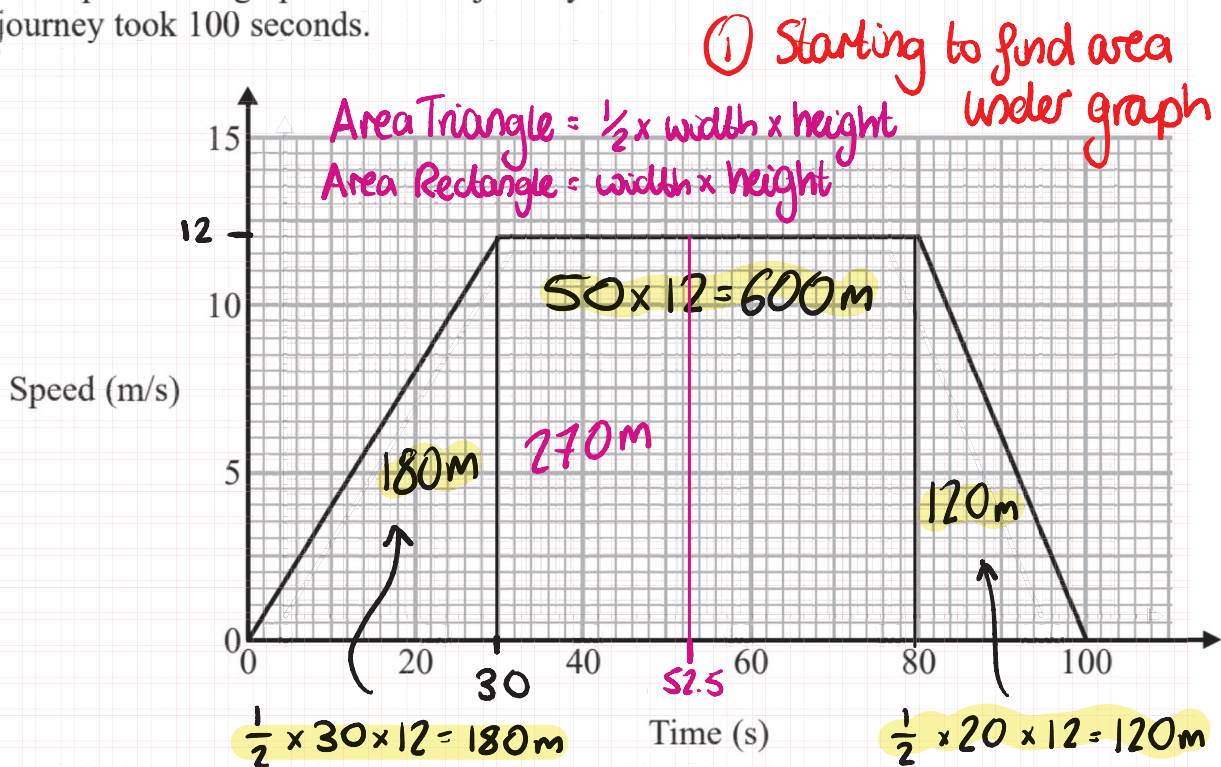
$$\begin{array}{r} (1) \quad 220 \\ \dots\dots\dots \\ (3) \end{array} \text{m}$$

$$\left. \begin{array}{l} \frac{4+0}{2} \times 5 = 10. \quad (1) \\ \frac{12+4}{2} \times 5 = 40. \\ \frac{18+12}{2} \times 5 = 75 \\ \frac{20+18}{2} \times 5 = 95 \end{array} \right\}$$

(Total for Question is 7 marks)

4. Here is a speed-time graph for a train journey between two stations.

The journey took 100 seconds.



- (a) Calculate the time taken by the train to travel half the distance between the two stations. You must show all your working.

For speed-time graph distance is the area under the graph

$$180 + 600 + 120 = 900\text{m} \quad \textcircled{1}$$

$$\frac{900}{2} = 450\text{m}$$

$$450 - 180 = 270\text{m}$$

$$x \times 12 = 270$$

$$\div 12 \quad \div 12$$

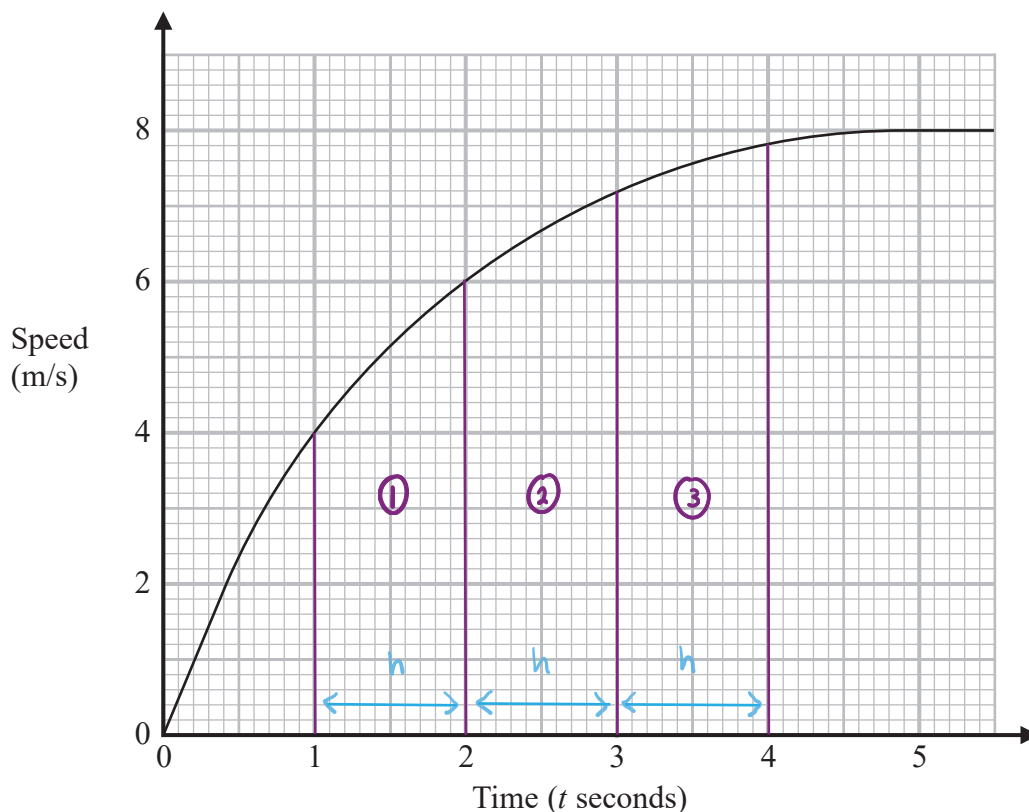
$$x = 22.5 \quad \textcircled{1}$$

$$30 + 22.5 = 52.5\text{s} \quad \textcircled{1}$$

- (b) Compare the acceleration of the train during the first part of its journey with the acceleration of the train during the last part of its journey.

During first part acceleration is positive but last part is negative (deceleration) OR Acceleration is greater during the last part than the first part $\textcircled{1}$

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



- (a) Using 3 trapeziums of equal width, work out an estimate for the area under the graph between $t = 1$ and $t = 4$

$$\text{Area of trapezium} = \left(\frac{a+b}{2} \right) h.$$

$$\textcircled{1} \quad A = \left(\frac{4+6}{2} \right) \times 1 = 5.$$

$$\textcircled{2} \quad A = \left(\frac{6+7.2}{2} \right) \times 1 = 6.6.$$

$$\textcircled{3} \quad A = \left(\frac{7.2+7.8}{2} \right) \times 1 = 7.5$$

Total area :

$$= 5 + 6.6 + 7.5$$

$$= 19.1$$

$$19.1$$

(3)

- (b) What does this area represent?

$$\text{Area} = \text{Speed} \times \text{time} = \underline{\text{distance.}}$$

(1)

(Total for Question is 4 marks)