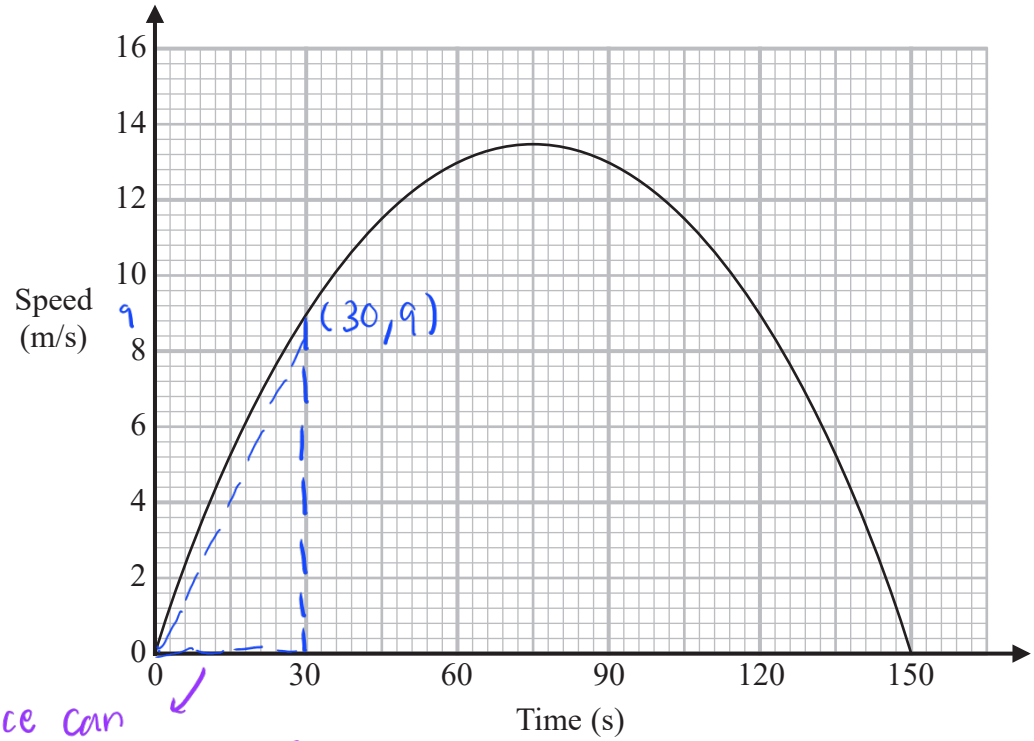
1 Here is a speed-time graph for a car.



Distance can be estimated by finding the area of the triangle

(a) Work out an estimate for the distance the car travelled in the first 30 seconds.

Distance = 0.5 x 9 m/s x 30 s (1)

= 135 m (1)

Area of triangle = $\frac{1}{2} \times h \times l$

135 ..... m

(2)

(b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 30 seconds?
Give a reason for your answer.

Underestimate. Because area between triangle and curve are not included. (1)

(1)

Julian used the graph to answer this question.

Work out an estimate for the acceleration of the car at time 60 seconds.

Here is Julian's working.

$$\text{acceleration} = \text{speed} \div \text{time}$$

$$= 13 \div 60$$

$$= 0.21\dot{6} \text{ m/s}^2$$

Julian's method does not give a good estimate of the acceleration at time 60 seconds.

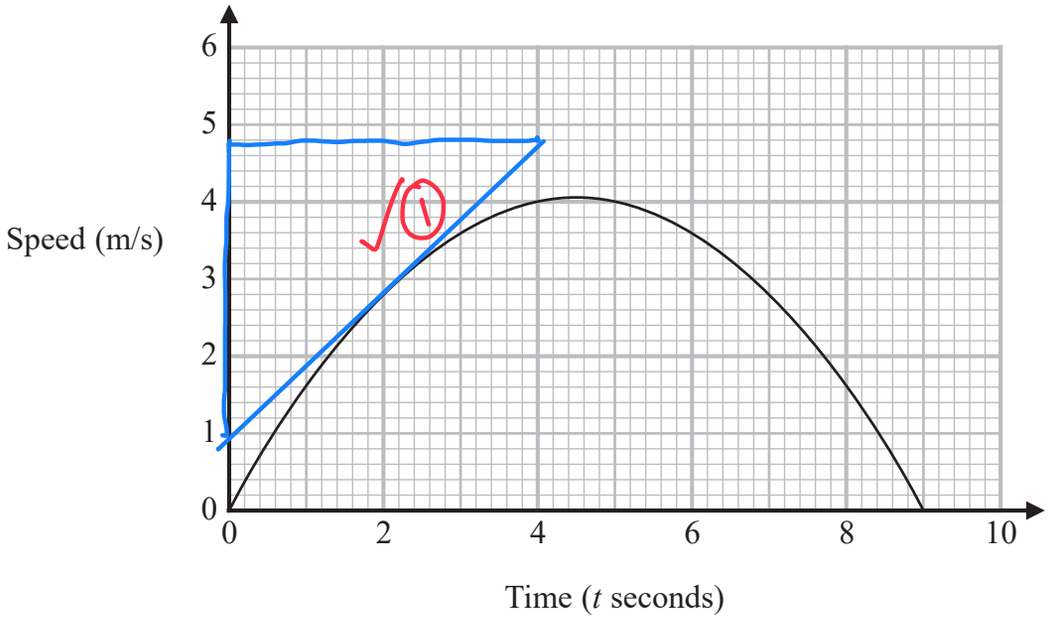
(c) Explain why.

His method only gives average acceleration. He needs to find the tangent at 60 seconds and the gradient of the tangent is the estimate of acceleration. (1)

(1)

(Total for Question 1 is 4 marks)

2 Here is a speed-time graph.



(a) Work out an estimate of the gradient of the graph at $t = 2$

tangent at $t=2$

$$\frac{\text{change in } y}{\text{change in } x} = \frac{4.8 - 1}{4 - 0} = 0.95 \quad \checkmark①$$

$\checkmark①$

0.95

(3)

(b) What does the area under the graph represent?

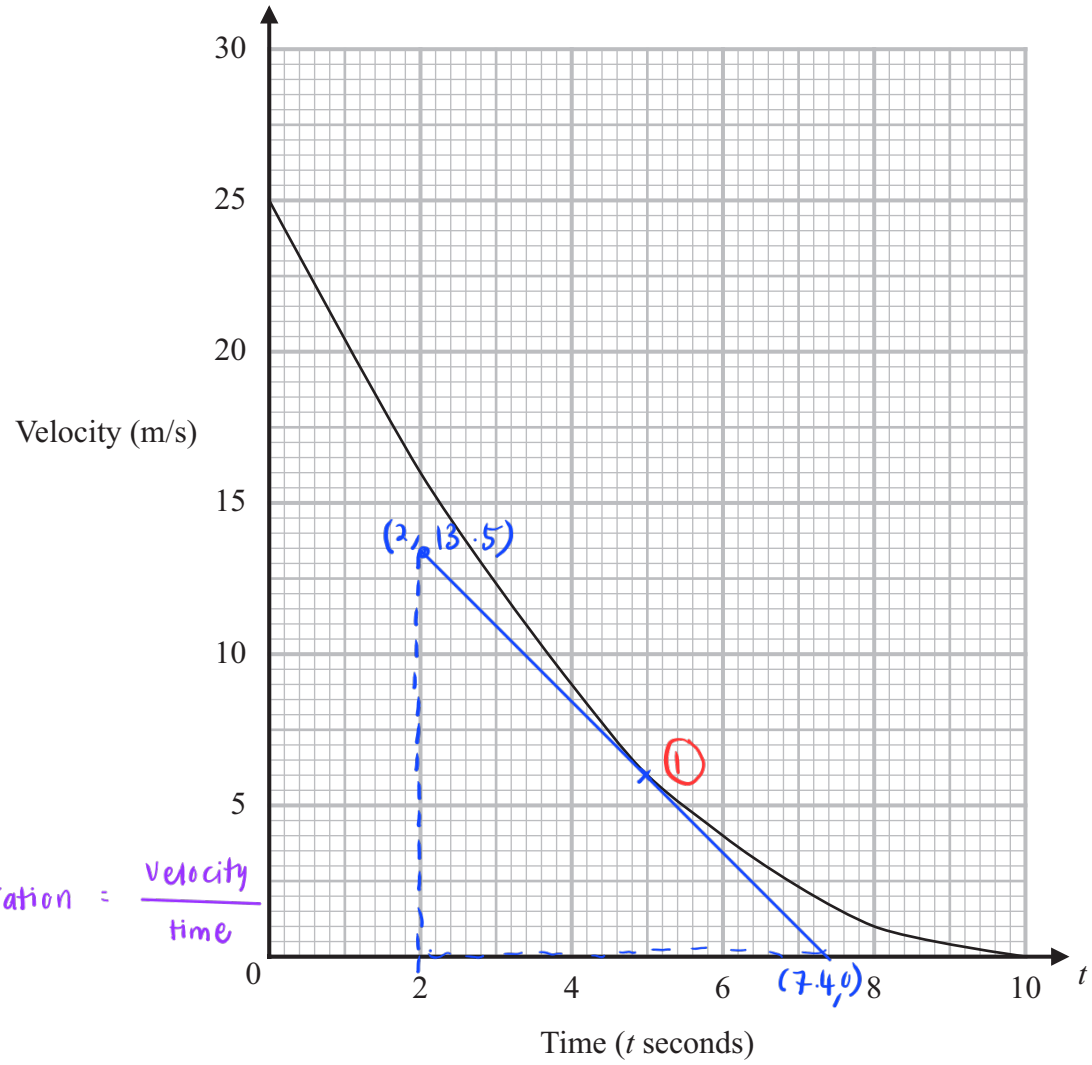
speed × time = distance travelled

$\checkmark①$

(1)

(Total for Question 2 is 4 marks)

3 The graph shows the velocity of a car, in metres per second, t seconds after it starts to slow down.



(a) Calculate an estimate for the acceleration of the car when $t = 5$
You must show all your working.

gradient of tangent when t = 5,

$m = \frac{13.5 - 0}{2 - 7} = \frac{13.5}{-5}$ (1)

$= -2.7$ (1)

-2.7

..... m/s^2

(3)

(b) Work out an estimate for the distance the car travels in the first 6 seconds after it starts to slow down.
Use 3 strips of equal width.

distance = area under the graph

from $t=0$ to $t=2$: $\frac{1}{2} \times 2 \times (25+16) = 41$ m (1)

from $t=2$ to $t=4$: $\frac{1}{2} \times 2 \times (16+9) = 25$ m

from $t=4$ to $t=6$: $\frac{1}{2} \times 2 \times (9+4) = 13$ m

(1)

Total distance travelled = $(41 + 25 + 13) = 79$ m (1)

79 ..... m

(3)

(Total for Question 3 is 6 marks)