EXAM PAPERS PRACTICE

Speed, Distance & Time

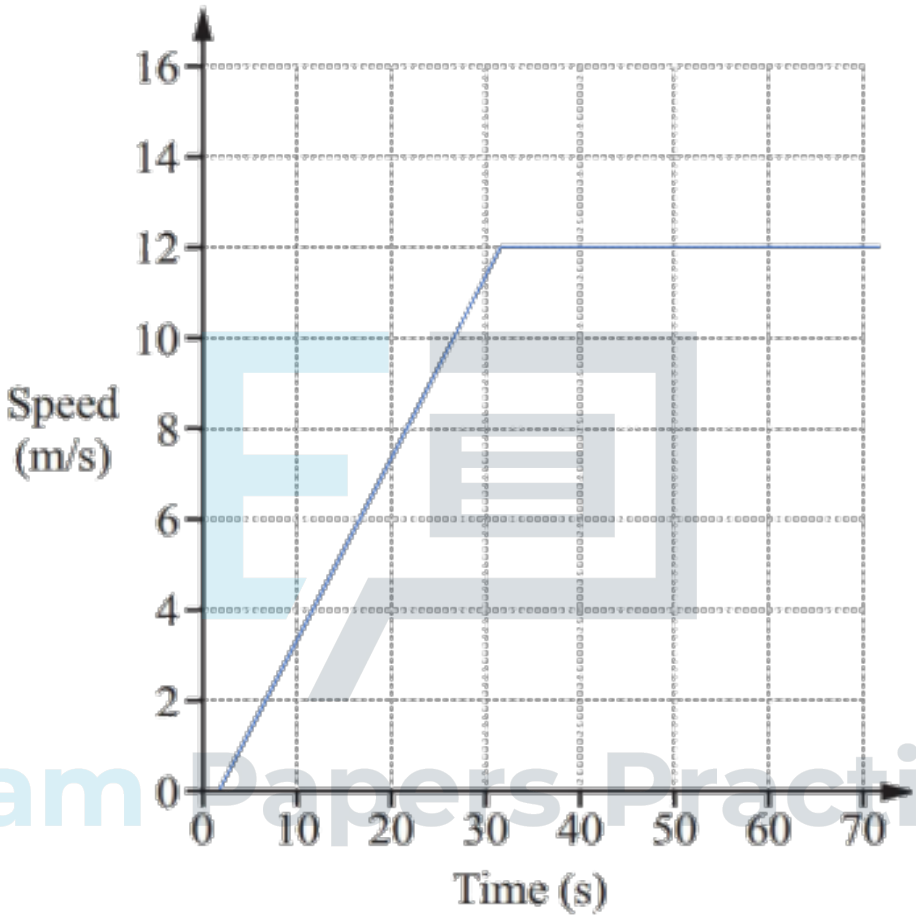
Model Answer

EXAM PAPERS PRACTICE

Question 1

Petra begins a journey in her car.
She accelerates from rest at a constant rate of 0.4 m/s^2 for 30 seconds.
She then travels at a constant speed for 40 seconds.

On the grid, draw the speed-time graph for the first 70 seconds of Petra's journey.



$$\begin{aligned} \text{speed} &= at \\ \text{speed} &= 0.4t \\ 0.4 \times 30 &= 12 \text{ m/s} \end{aligned}$$

Question 2

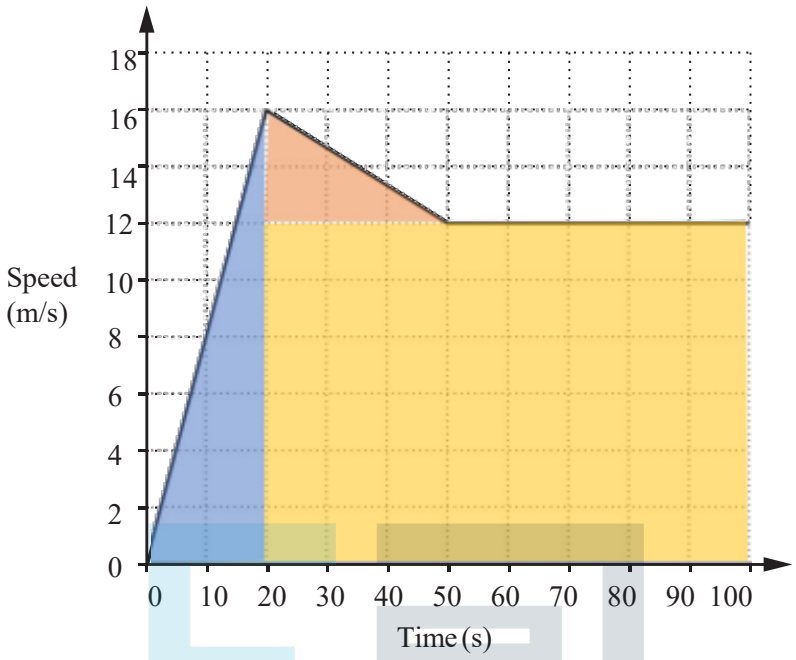
Amar cycles at a speed of 18 km/h.
It takes him 55 minutes to cycle between two villages.

Calculate the distance between the two villages. [2]

$$\text{distance} = \frac{55}{60} \times 18$$
$$= \mathbf{16.5}$$

Question 3

The diagram shows information about the first 100 seconds of a car journey.



(a) Calculate the acceleration during the first 20 seconds of the journey. [1]

$$a = m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{16 - 0}{20 - 0}$$
$$= \frac{4}{5} = \mathbf{0.8}$$

(b) Work out the total distance travelled by the car in the 100 seconds. [3]

$$A = \tfrac{1}{2} \times 20 \times 16 + \tfrac{1}{2} \times 4 \times 30 + 80 \times 12$$
$$= 1180$$

EXAM PAPERS PRACTICE

Question 4

A train travels for m minutes at a speed of x metres per second.

(a) Find the distance travelled, in **kilometres**, in terms of m and x.
Give your answer in its simplest form.

[2]

$\text{Distance} = \text{Speed} \times \text{Time}$

$\text{Distance} = x \times 60 \text{ m metres}$ — Multiply minutes by 60 to get seconds

$\text{Distance} = \frac{x \times 60 \text{ m}}{1000}$ kilometres — Divide metres by 1000 to get kilometres

$\text{Distance} = \mathbf{\frac{3x\text{m}}{50}\,km}$

(b) When $m = 5$, the train travels 10.5 km.

[2]

Find the value of x.

Substitute the values into the equation in (a):

$10.5 = \frac{3 \times x \times 5}{50}$

$10.5 \times 50 = 15x$

$x = \frac{10.5 \times 50}{15}$

$x = 35$ metres per second

EXAM PAPERS PRACTICE

Question 5

A car of length 4.3 m is travelling at 105 km/h.
It passes over a bridge of length 36 m. [3]

Calculate the time, in seconds, it takes to pass over the bridge **completely**.

The car is on the bridge when its front is on the bridge and exits when its rear leaves.
The total distance to travel is therefore
$36 + 4.3 = 40.3m$
Converting the speed into m/s, first we multiply by 1000 to get the units in m/hr

$$\text{Speed } = 105\text{kmh}^{-1} \times 1000$$
$$\text{Speed } = 105000\text{mh}^{-1}$$

Next we have to turn it into m/s

$$\text{Speed } = 105000\text{mh}^{-1} \div (60^2)$$
$$\text{Speed } = \frac{105000}{3600}\ \text{ms}^{-1}$$
$$\text{Speed } = \frac{175}{6}\ \text{ms}^{-1}$$

Using the speed distance time relation

$$\text{speed } = \frac{\text{distance}}{\text{time}}$$
$$\frac{175}{6}ms^{-1} = \frac{40.3m}{\text{time}}$$

Rearrange for time

$$\text{time } = 40.3 \times \frac{6}{175}$$
$$= \underline{\mathbf{1.38}}s(2\text{dp})$$

Question 6

A car travels at 56km/h.

s [4]

Find the time it takes to travel 300 metres.
Give your answer in seconds correct to the nearest second.

First, we convert km/h to m/s.

$$56 \text{ km/h} = 56000 \text{ m/h} = \frac{56000 \text{ m/s}}{3600 \text{ seconds per hour}} = 15.55 \text{ m/s}$$

Then we calculate the time taken

by dividing the distance travelled by the speed

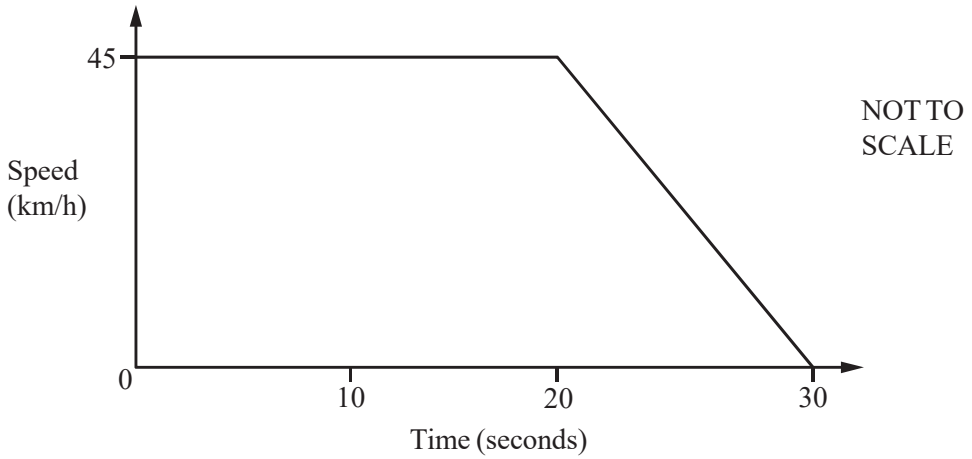
$$\text{Time taken} = \frac{\text{distance}}{\text{speed}} = \frac{300 \text{ m}}{15.55 \text{ m/s}}$$

$$\text{Time taken} = 19.3 \text{ s}$$

Round the answer to the nearest second.

$$\text{Time taken} = 19 \text{ s}$$

Question 7



The diagram shows the speed-time graph of a car.
The car travels at 45 km/h for 20 seconds.
The car then decelerates for 10 seconds until it stops.

(a) Change 45 km/h into m/s.

We convert km/h to m/s.

$$45\,\frac{\text{km}}{\text{h}} = 45000\,\frac{\text{m}}{\text{h}} = \frac{45000\,\frac{\text{m}}{\text{s}}}{3600 \text{ seconds per hour}}$$

$$= \mathbf{12.5}\text{m/s}$$

[2]

(b) Find the deceleration of the car, giving your answer in m/s^2.

$$\text{deceleration} = \frac{\text{change of velocity}}{\text{changle of time}} = \frac{12.5\text{ m/s}}{10\text{ s}}$$

$$= 1.25\text{ ms}^{-2}$$

[1]

(c) Find the distance travelled by the car during the 30 seconds, giving your answer in metres.

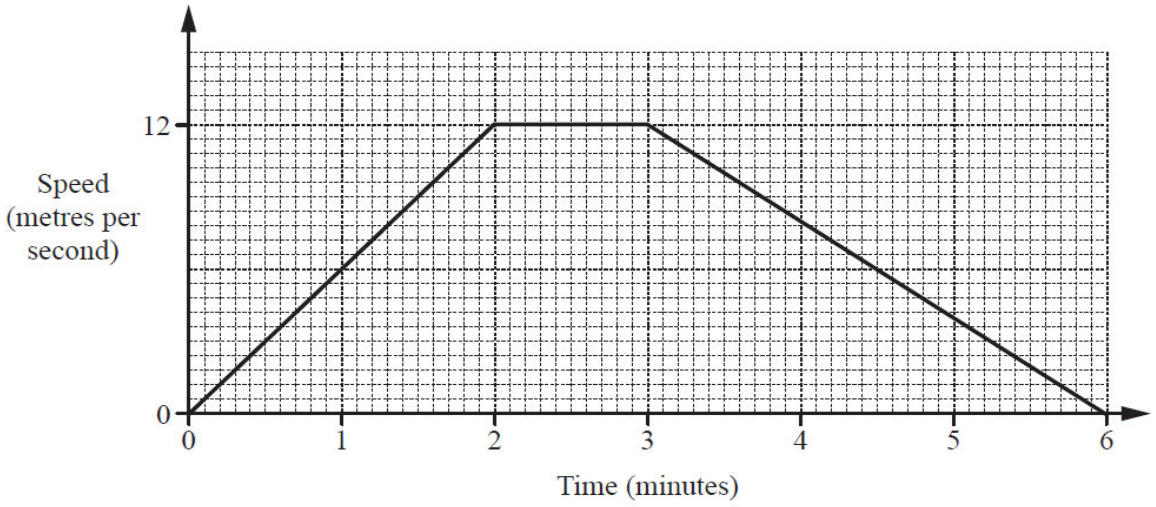
$$\text{distance} = \text{rectange} + \text{triangle}$$

$$\text{distance} = 20\text{ s} \times 12.5\text{ m/s} + \tfrac{1}{2} \times (30\text{ s} - 20\text{ s}) \times 12.5\text{ m/s}$$

$$\text{distance}$$

$$= 312.5\text{ m}$$

[3]



A tram leaves a station and accelerates for 2 **minutes** until it reaches a speed of 12 metres per second. It continues at this speed for 1 minute.
It then decelerates for 3 minutes until it stops at the next station.
The diagram shows the speed-time graph for this journey.

Calculate the distance, in metres, between the two stations.

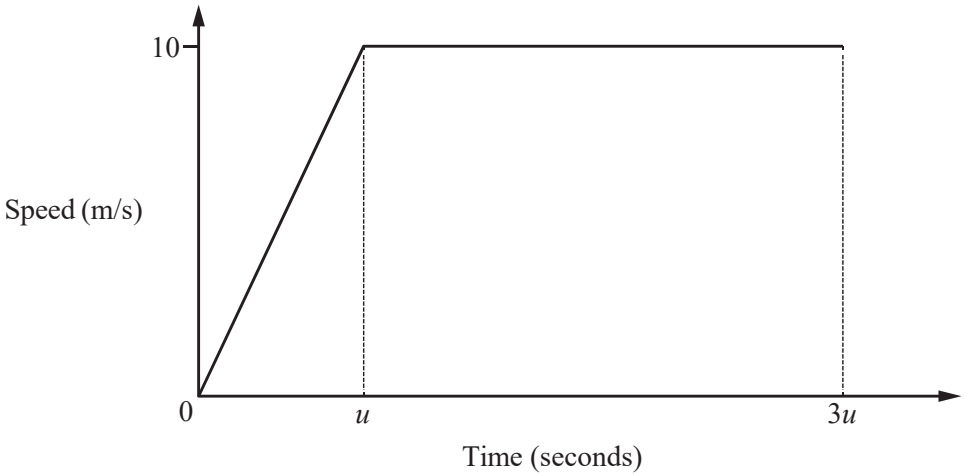
$$\text{distance} = \text{first triangle} + \text{rectangle} + \text{second triangle}$$

$$\text{distance} = \tfrac{1}{2} \times 120\,\text{s} \times 12\,\text{m/s} + (180 - 120)\text{s} \times 12\,\text{m/s} + \tfrac{1}{2} \times (360 - 180)\text{s} \times 12\,\text{m/s}$$

$$\text{distance} = 720\,\text{m} + 720\,\text{m} + 1080\,\text{m}$$

$$\text{distance travelled} = 2520\,\text{m}$$

[3]



NOT TO SCALE

A car starts from rest and accelerates for u seconds until it reaches a speed of 10 m/s.
The car then travels at 10 m/s for $2u$ seconds.
The diagram shows the speed-time graph for this journey.

The distance travelled by the car in the first $3u$ seconds is 125 m.

(a) Find the value of u.

$$u = \frac{125}{25}$$
$$u = 5$$

[3]

(b) Find the acceleration in the first u seconds.

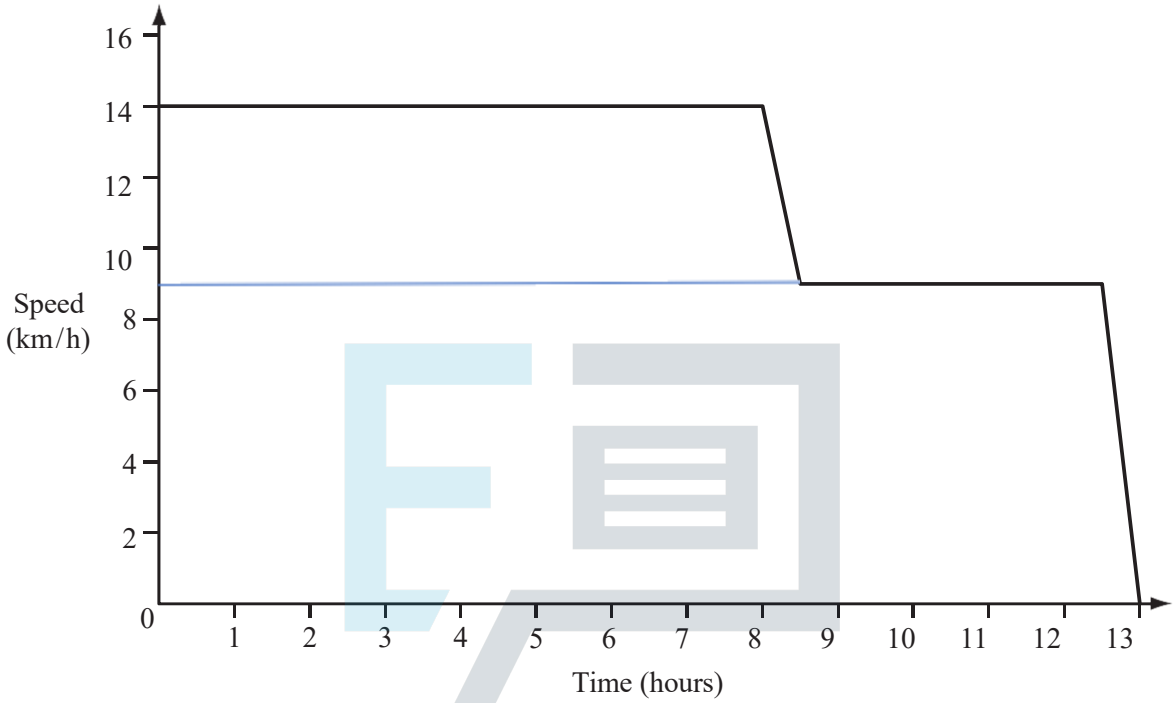
$$\text{Acceleration} = \frac{\text{change of velocity}}{\text{changle of time}} = \frac{10 \text{ m/s}}{5 \text{ s}}$$
$$= 2 \text{ ms}^{-2}$$

[1]

A container ship travelled at 14 km/h for 8 hours and then slowed down to 9 km/h over a period of 30 minutes.

It travelled at this speed for another 4 hours and then slowed to a stop over 30 minutes.

The speed-time graph shows this voyage.



(a) Calculate the total distance travelled by the ship. [4]

$$A = \frac{(a+b)h}{2} \qquad A = \frac{(12.5\text{ h} + 13\text{ h}) \times 9\text{ km/h}}{2}$$

$$A = 114.75\text{ km}$$

$$A = \frac{(8.5\text{ h} + 8\text{ h}) \times 5\text{ km/h}}{2}$$

$$A = \mathbf{41.25}\text{km}$$

$$\text{Total area} = \text{A (big trapezium)} + \text{A (small trapezium)}$$

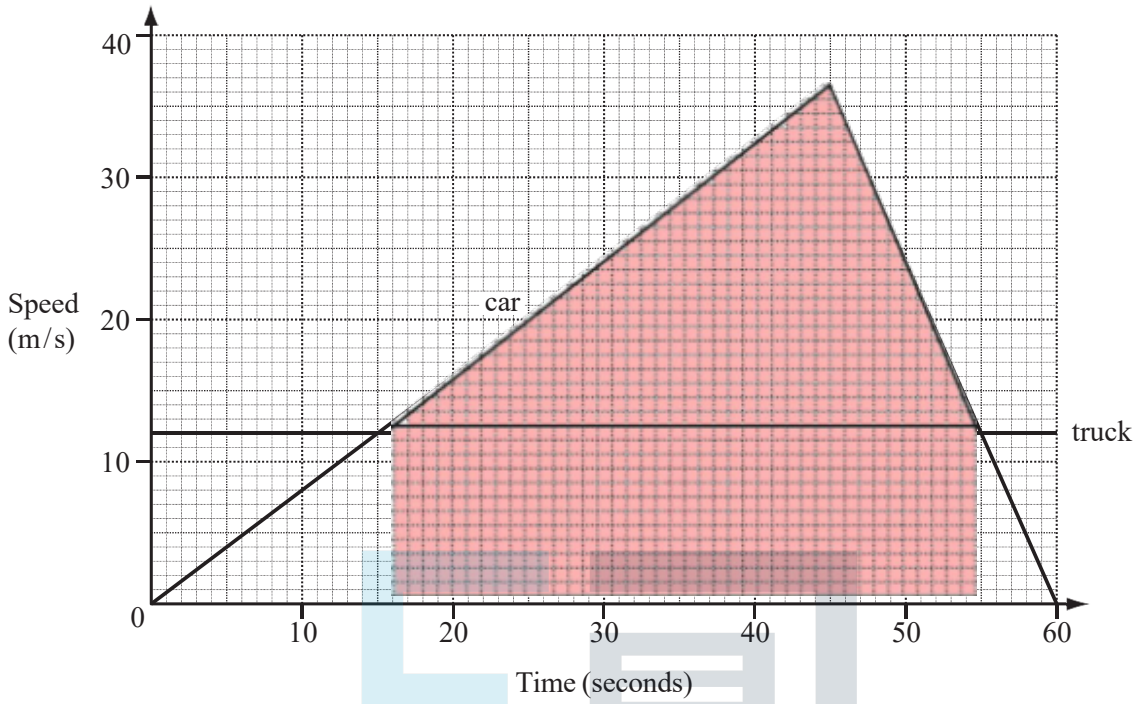
$$\text{Total area} = 41.25\text{ km} + 114.75\text{ km}$$

$$\text{Total area} = 156\text{ km}$$

(b) Calculate the average speed of the ship for the whole voyage. [1]

$$\text{Average speed} = \frac{156\text{ km}}{13\text{ hours}}$$

$$\text{Average speed} = 12\text{ km/h}$$



The graph shows the speed of a truck and a car over 60 seconds.

(a) Calculate the acceleration of the car over the first 45 seconds.

$$\text{Acceleration} \approx \frac{\text{Change in } y}{\text{Change in } x} = \frac{36}{45} = 0.8$$

[2]

(b) Calculate the distance travelled by the car while it was travelling faster than the truck.

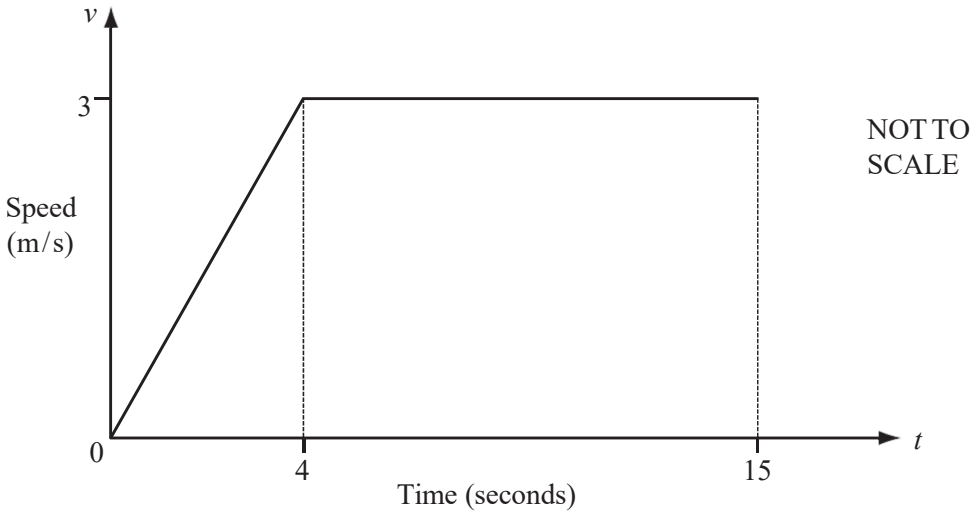
$$\text{Area of triangle} = \tfrac{1}{2} \times \text{base} \times \text{height}$$
$$\text{Area of triangle} = \tfrac{1}{2} \times 40 \times 24 = 480$$

$$\text{Area of rectangle} = \text{width} \times \text{height}$$
$$\text{Area of rectangle} = 40 \times 12 = 480$$

The total area is then 960 , which is the total distance travelled

960 m

[3]



The diagram shows the speed-time graph for 15 seconds of the journey of a cyclist.

(a) Calculate the acceleration of the cyclist during the first 4 seconds. [1]

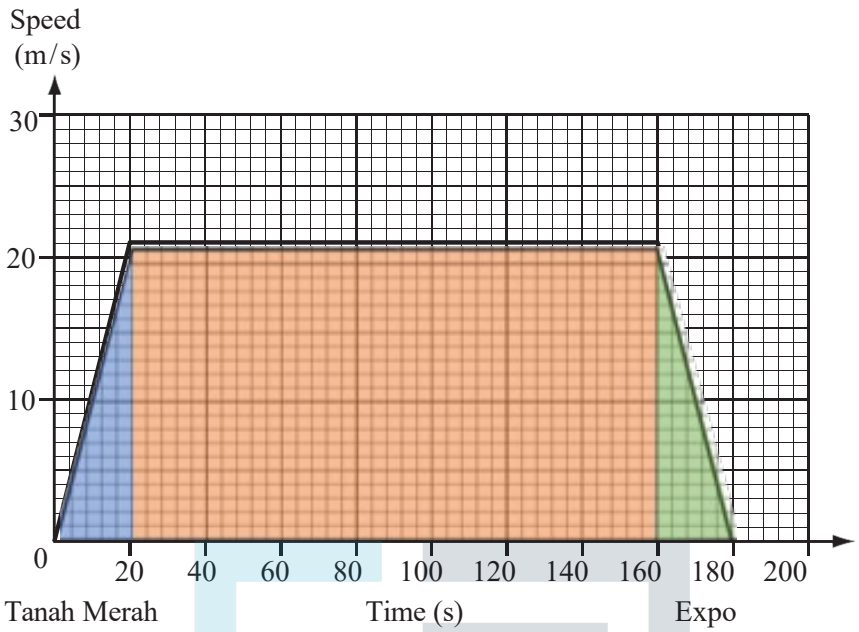
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{3-0}{4-0}$$
$$= \frac{3}{4} = 0.75$$

[3]

(b) Calculate the average speed for the first 15 seconds.

$$d = \frac{1}{2} \times 4 \times 3 + (15 - 4) \times 3$$
$$= 6 + 33$$
$$= 39 \text{ m}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$
$$\rightarrow \text{speed} = \frac{39}{15}$$
$$= 2.6$$



The graph shows the train journey between Tanah Merah and Expo in Singapore.

Work out

(a) the acceleration of the train when it leaves Tanah Merah, [2]

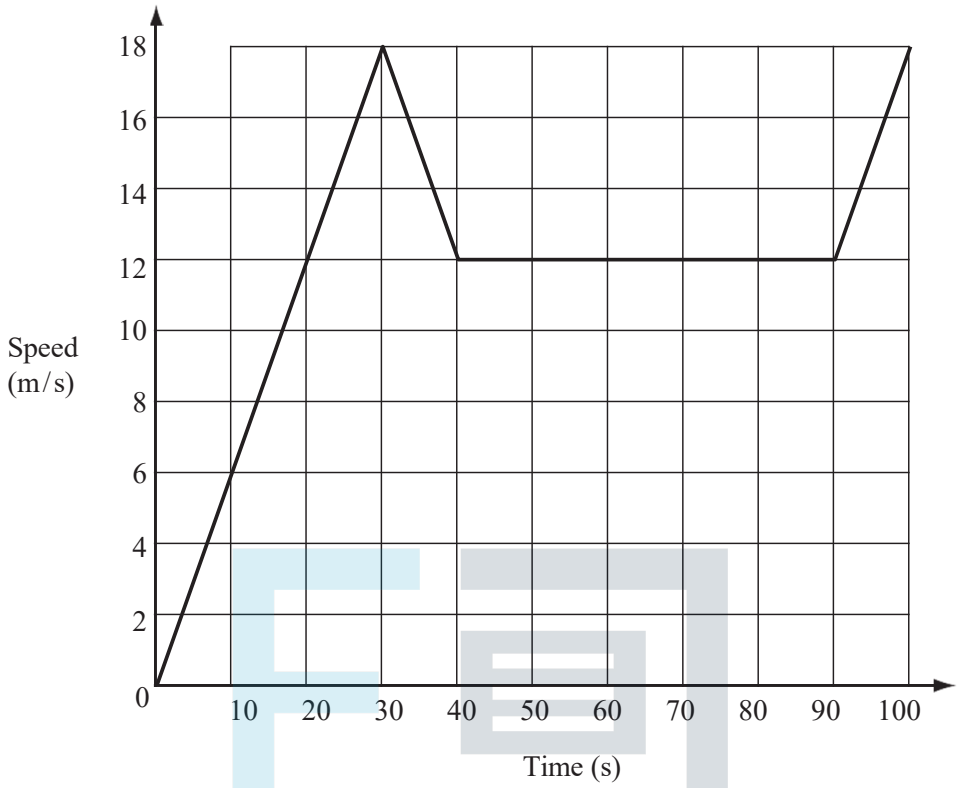
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$\rightarrow a = \frac{21 - 0}{20 - 0}$$
$$= 1.05$$

(b) the distance between Tanah Merah and Expo, [3]

$$d = \tfrac{1}{2}(20)(21) + (160 - 20)(21) + \tfrac{1}{2}(180 - 160)(21)$$
$$= 210 + 2940 + 210$$
$$= 3360$$

(c) the average speed of the train for the journey. [1]

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$
$$= \frac{3360}{180}$$
$$= \mathbf{18.7}$$



The diagram shows part of a journey by a truck.

(a) The truck accelerates from rest to 18 m/s in 30 seconds.
Calculate the acceleration of the truck. [1]

$$\text{Acceleration} = \frac{18\,\frac{\text{m}}{\text{s}} - 0\,\frac{\text{m}}{\text{s}}}{30\text{ s}}$$

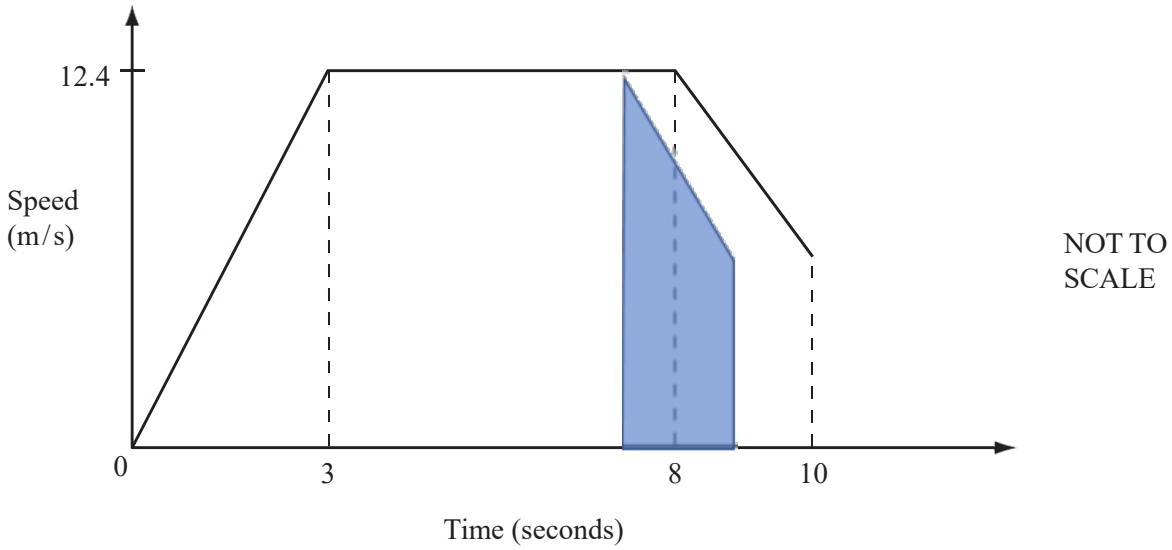
$$\text{Acceleration} = 0.6\text{ m/s}^2$$

(b) The truck then slows down in 10 seconds for some road works and travels through the road works at 12 m/s.
At the end of the road works it accelerates back to a speed of 18 m/s in 10 seconds.
Find the total distance travelled by the truck in the 100 seconds. [3]

$$A = \frac{6 \times 10}{2} = 30\text{ m}$$

$$\text{Total area} = 1080\text{ m} + 3 \times 30\text{ m}$$

$$\text{Total area} = 1170\text{ m}$$



An athlete, in a race, accelerates to a speed of 12.4 metres per second in 3 seconds.
He runs at this speed for the next 5 seconds and slows down over the last 2 seconds as shown in the speed-time graph above.
He crosses the finish line after 10 seconds.
The total distance covered is 100 m.

(a) Calculate the distance he runs in the first 8 seconds. [2]

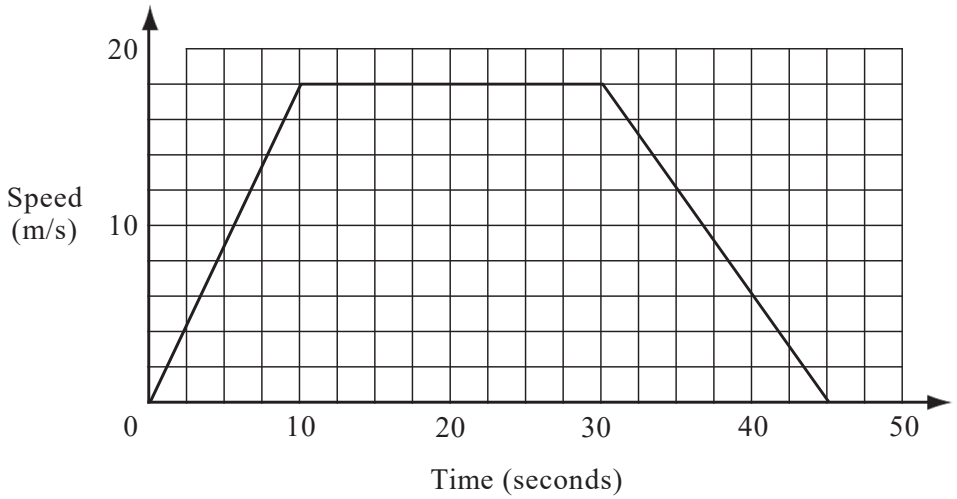
$$\text{Area} = \tfrac{1}{2} \times 12.4 \text{ m/s} \times (8 \text{ seconds} + 5 \text{ seconds})$$
$$\text{Area} = 6.2 \text{ m/s} \times 13 \text{ s}$$
$$\text{Area} = 80.6 \text{ m}$$

Therefore, the distance he runs in the first 8 seconds is 80.6 m.

(b) Calculate his speed when he crosses the finish line. [2]

$$19.4 \text{ m} = \frac{2 \text{ s}(12.4 \text{ m/s} + a)}{2}$$
$$a = 7 \text{ m/s}$$

A cyclist is training for a competition and the graph shows one part of the training.



(a) Calculate the acceleration during the first 10 seconds. [2]

$$\text{Acceleration} = \frac{18}{10} = 1.8 \text{ m/s}^2$$

(b) Calculate the distance travelled in the first 30 seconds. [2]

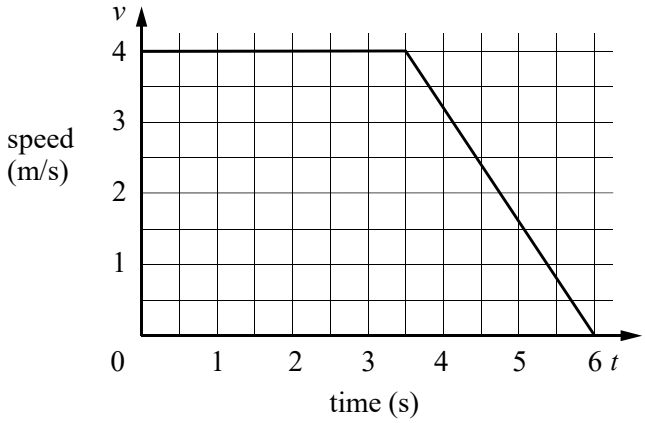
$$\text{Area} = \tfrac{1}{2}(a+b)h = \tfrac{1}{2} \times (20+30) \times 18$$

$$\text{Distance} = \mathbf{450m}$$

(c) Calculate the average speed for the entire 45 seconds. [3]

$$1/2 \times (20+45) \times 18 = 585$$

$$585/45 = 13 \text{ m/s}$$



Ameni is cycling at 4 metres per second.
After 3.5 seconds she starts to decelerate and after a further 2.5 seconds she stops. The diagram shows the speed-time graph for Ameni.
Calculate

(a) the constant deceleration,

$$\text{deceleration} = \frac{4\,\frac{\text{m}}{\text{s}} - 0\,\frac{\text{m}}{\text{s}}}{2.5\ \text{s}}$$

$$\text{deceleration} = 1.6\ \text{m/s}^2$$

[1]

(b) the total distance travelled during the 6 seconds.

$$A = \frac{4(3.5+6)}{2}$$

$$A = 19\ \text{cm}^2$$

[2]

A train journey takes one hour.
The diagram shows the speed-time graph for this journey.

(a) Calculate the total distance of the journey.

Give your answer in kilometres. [3]

159

(b) (i) Convert 3 kilometres / minute into metres / second. [2]

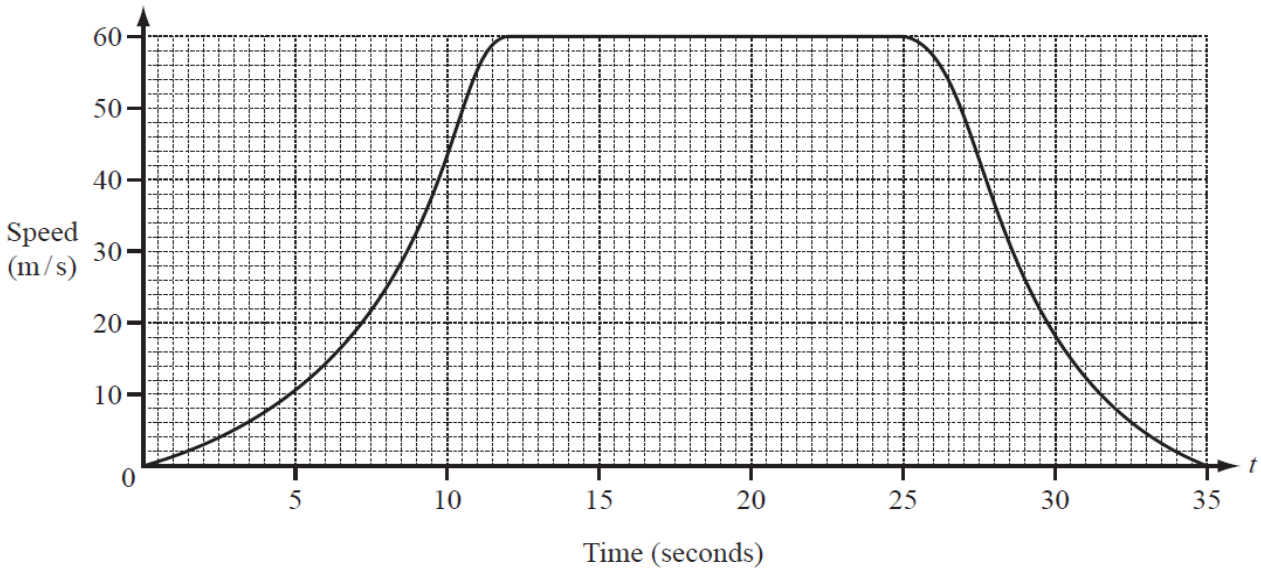
$3 \times (1000/60)$oe

50

(ii) Calculate the acceleration of the train during the first 4 minutes.

Give your answer in metres /second^2. [2]

0.208



The graph shows the speed of a sports car after t seconds.

It starts from rest and accelerates to its maximum speed in 12 seconds.

(a) (i) Draw a tangent to the graph at $t = 7$. [1]

(i) Tangent

(ii) Find the acceleration of the car at $t = 7$.

4.4 to 6

[2]

(b) The car travels at its maximum speed for 13 seconds.

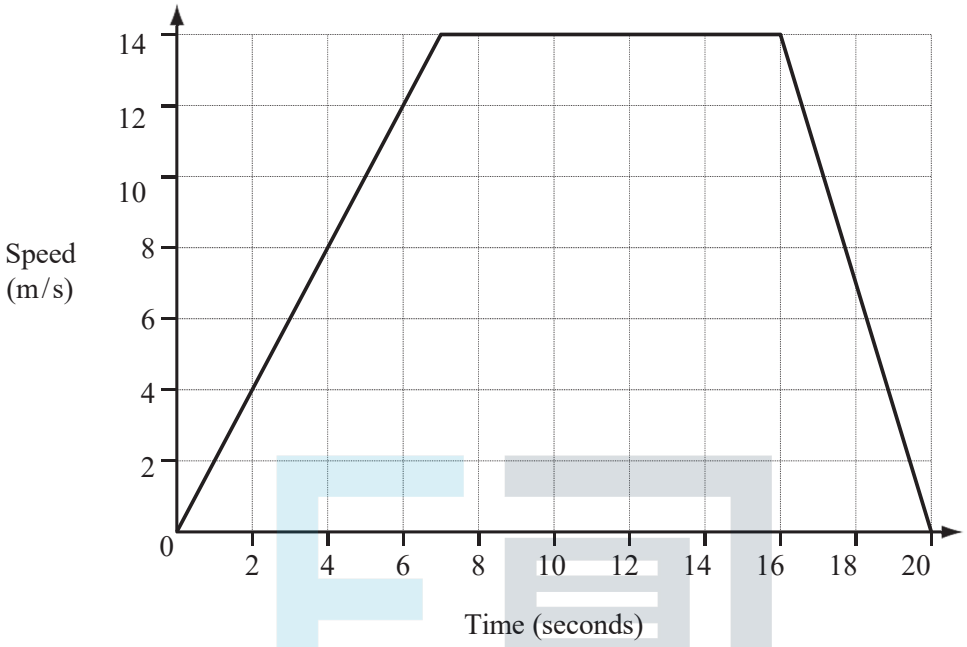
Find the distance travelled by the car at its maximum speed.

780

[2]

An animal starts from rest and accelerates to its top speed in 7 seconds. It continues at this speed for 9 seconds and then slows to a stop in a further 4 seconds.

The graph shows this information.



(a) Calculate its acceleration during the first seven seconds.

$$\frac{14}{7} = 2$$

[1]

(b) Write down its speed 18 seconds after the start.

6.7 to 7.3

[1]

(c) Calculate the total distance that the animal travelled.

$$\begin{aligned}\text{Total Distance} &= \frac{1}{2}(14)(7) + 14(a) + \frac{1}{2}(14)(4) \\ &= 49 + 126 + 28 \\ &= 203\end{aligned}$$

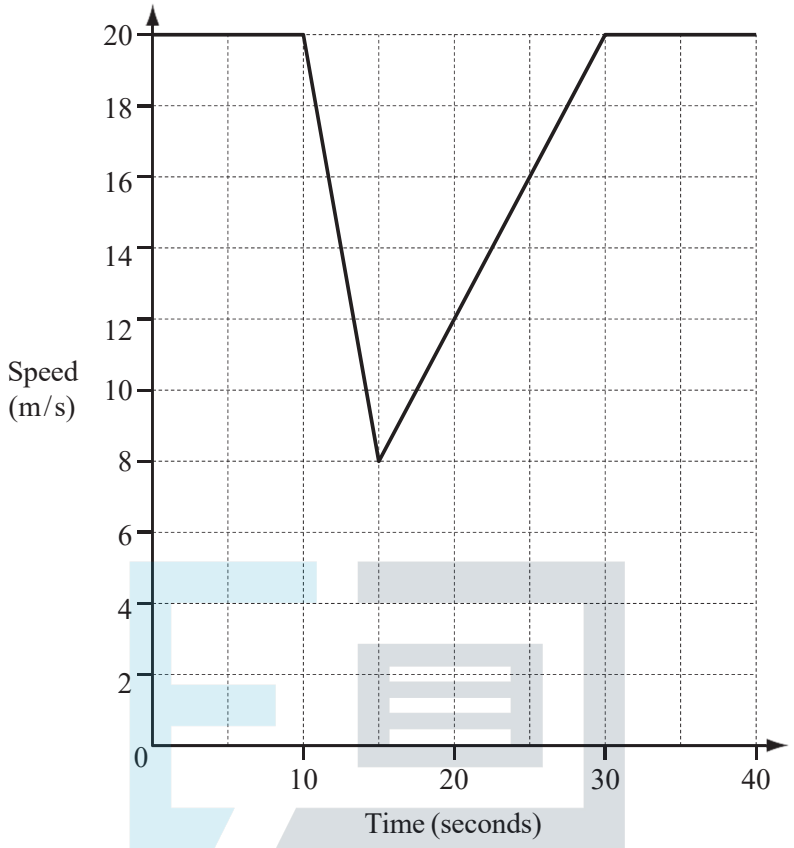
[3]

Question 21

Priyantha completes a 10 km run in 55 minutes 20 seconds.
Calculate Priyantha's average speed in km/h.

10.8 or $10\frac{70}{83}$

[3]



The graph shows 40 seconds of a car journey.

The car travelled at a constant speed of 20 m/s, decelerated to 8 m/s then accelerated back to 20 m/s.

Calculate

(a) the deceleration of the car,

2.4oe

[1]

(b) the total distance travelled by the car during the 40 seconds.

$40 \times 20 - \frac{1}{2} \times 20 \times 12$oe

$= 680$

[3]

A person in a car, travelling at 108 kilometres per hour, takes 1 second to go past a building on the side of the road.

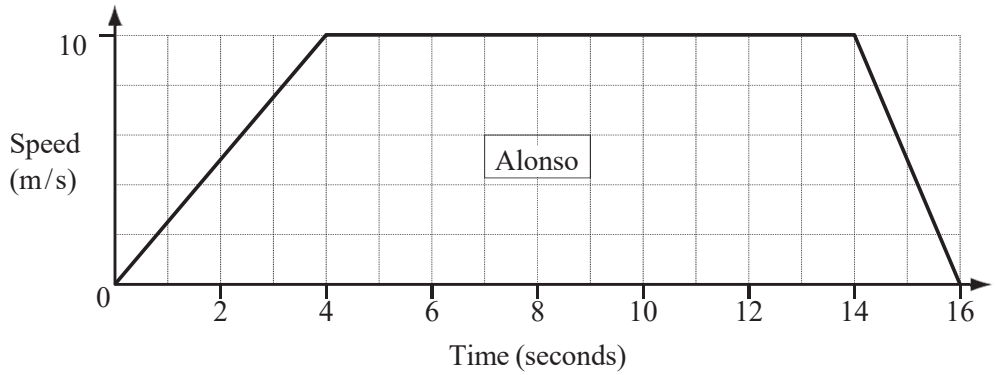
Calculate the length of the building in metres.

$$108 \times 1000/(60 \times 60) = 30$$

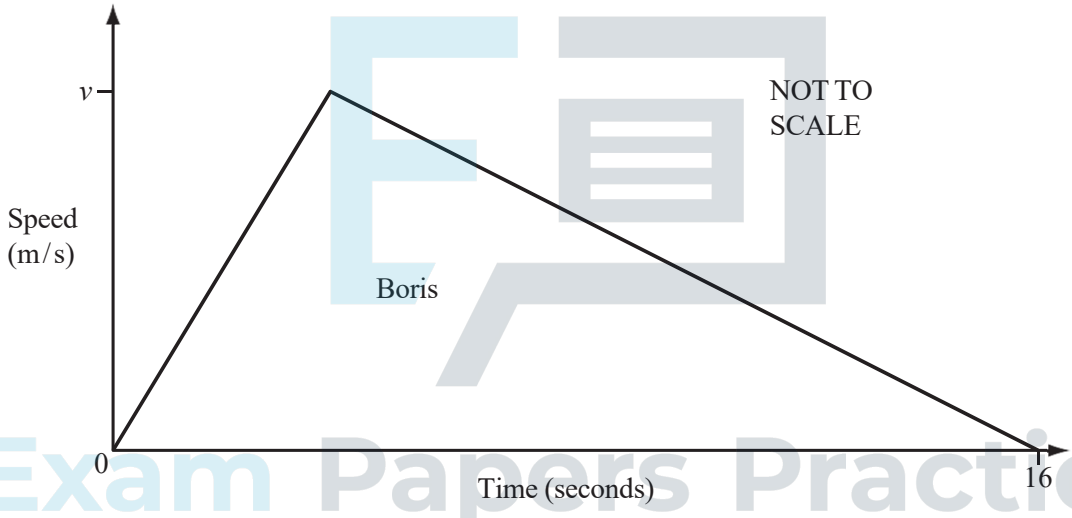
[2]

The graphs show the speeds of two cyclists, Alonso and Boris.

Alonso accelerated to 10 m/s, travelled at a steady speed and then slowed to a stop.



Boris accelerated to his maximum speed, v m/s, and then slowed to a stop.



Both cyclists travelled the same distance in the 16 seconds.

Calculate the maximum speed for Boris.
Show all your working.

$$\text{Distance travelled} = \text{area under the graph}$$

$$\text{Alonso's distance} = \frac{1}{2}(4)(10) + 10(10) + \frac{1}{2}(2)(10)$$
$$= 20 + 100 + 10$$
$$= 130$$

$$\text{Boris' distance} = \tfrac{1}{2}(1B)(v)$$

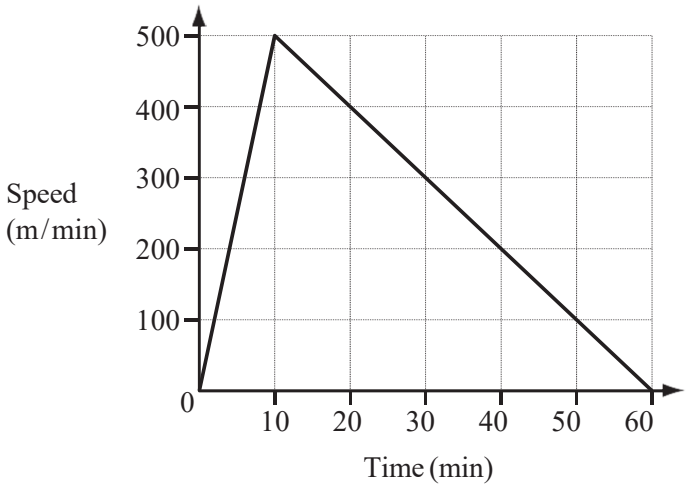
$$\text{Alonso's } \alpha = \textit{Bori's } a$$

$$\tfrac{1}{2}(16)(v) = 130$$

$$8V = 130$$

$$V = 16.25 \rightarrow \text{ speed for Boris}$$

[5]



The diagram shows the speed-time graph for a boat journey.

(a) Work out the acceleration of the boat in metres /minute^2.

$$\frac{500}{10} = 50$$

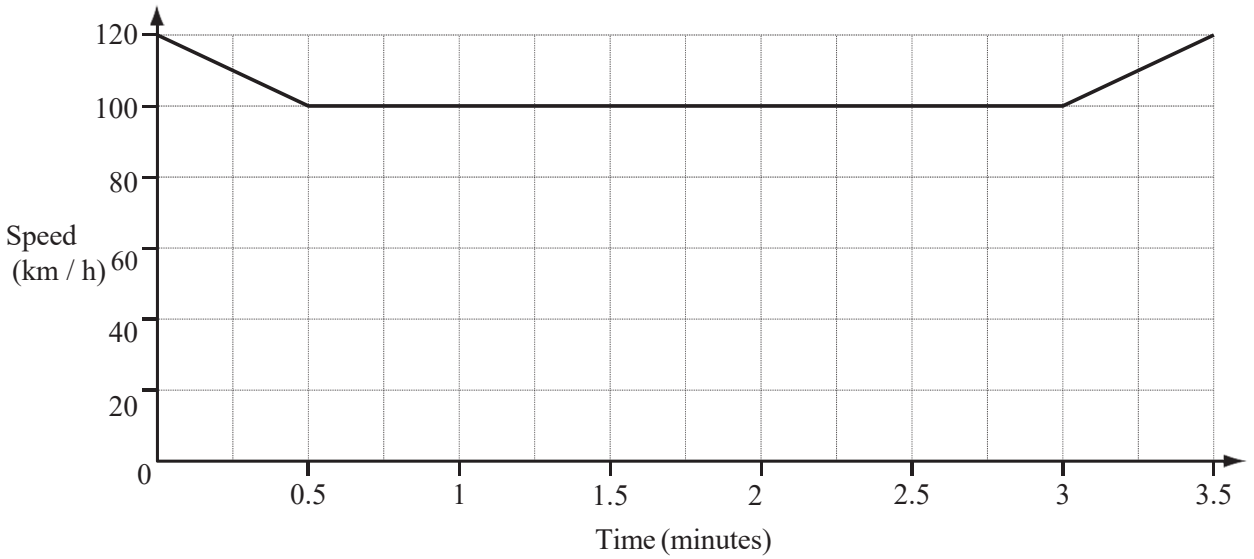
[1]

(b) Calculate the total distance travelled by the boat.
Give your answer in **kilometres**.

$$\begin{aligned}\text{distance} &= \frac{1}{2}(10)(500) + \frac{1}{2}(500)(50) \\ &= 2,500 + 12,500 \\ &= 15,000 \text{ metres}\end{aligned}$$

$$\frac{15,000}{1000} = 15\text{kms}$$

[2]

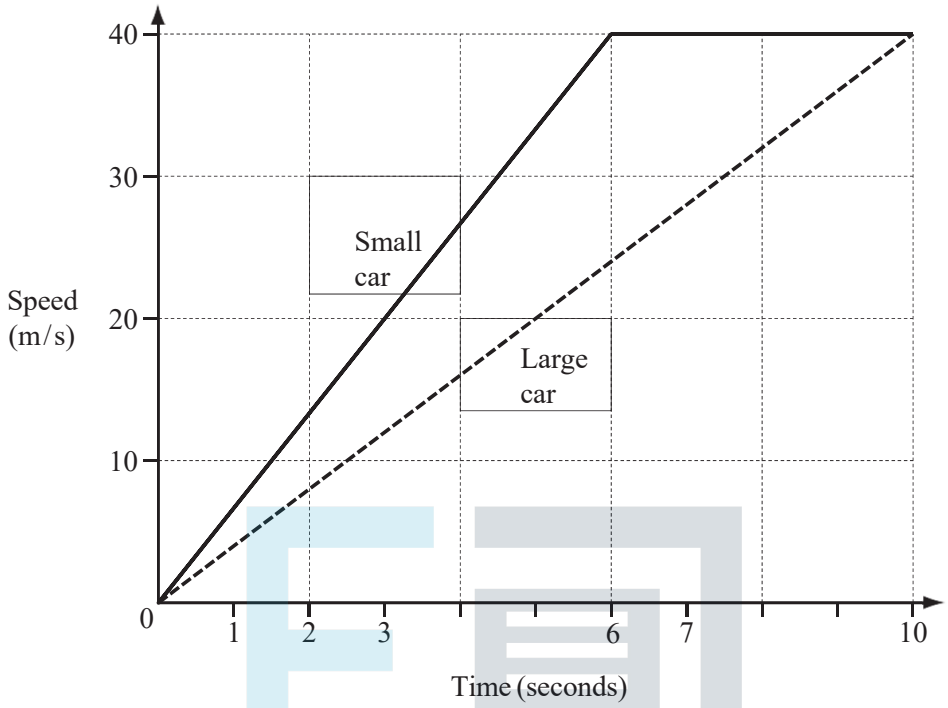


The diagram shows the speed-time graph for part of a car journey.
The speed of the car is shown in kilometres / hour.

Calculate the distance travelled by the car during the 3.5 minutes shown in the diagram.
Give your answer in kilometres.

6(.00)**www**

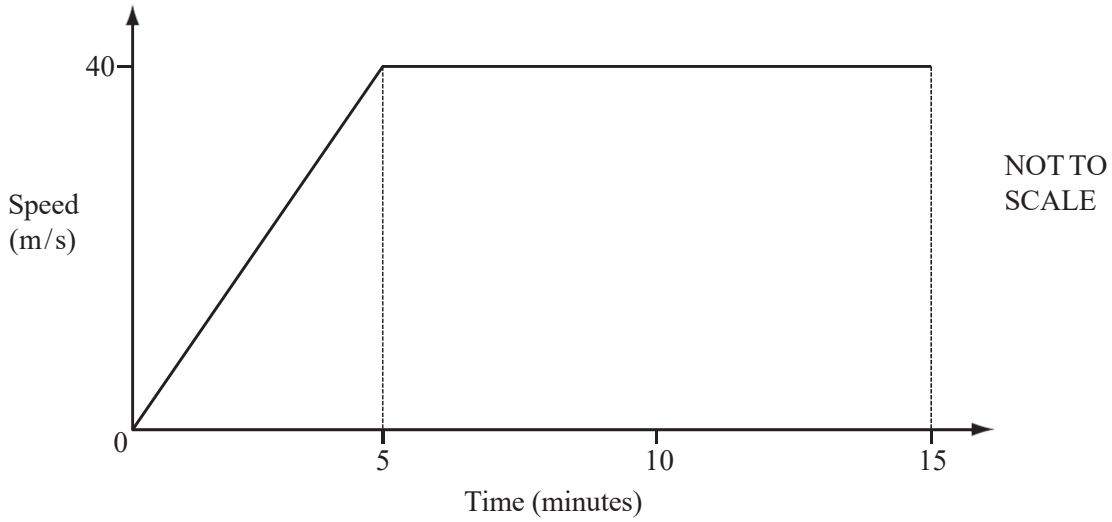
[4]



A small car accelerates from 0 m/s to 40 m/s in 6 seconds and then travels at this constant speed.
A large car accelerates from 0 m/s to 40 m/s in 10 seconds.

Calculate how much further the small car travels in the first 10 seconds. [4]

80 www



The diagram shows the speed-time graph for the first 15 **minutes** of a train journey.
The train accelerates for 5 minutes and then continues at a constant speed of 40 metres/**second**.

(a) Calculate the acceleration of the train during the first 5 minutes.
Give your answer in m/s^2. [2]

$0.133(3\ldots)$ or $\frac{2}{15}$

(b) Calculate the average speed for the first 15 minutes of the train journey.
Give your answer in m/s. [3]

$33\frac{1}{3}$ or 33.3

A train leaves Barcelona at 21 28 and takes 10 hours and 33 minutes to reach Paris.

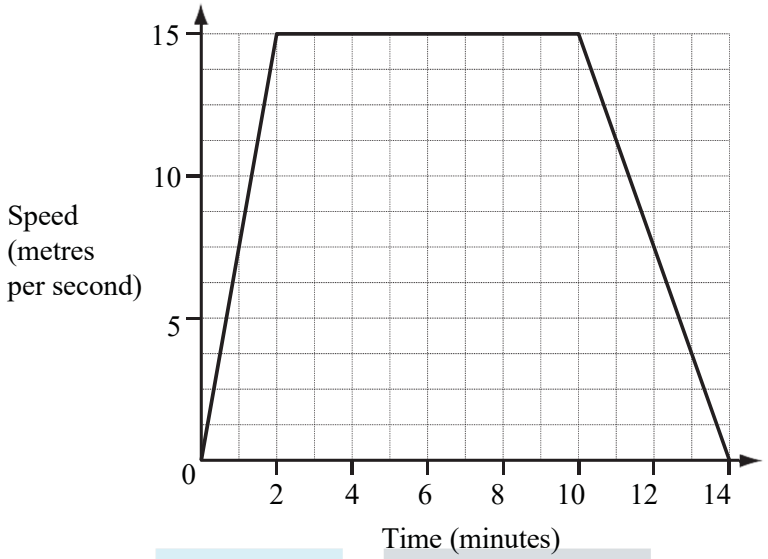
(a) Calculate the time the next day when the train arrives in Paris. [1]

(0)8(.)01(am)

(b) The distance from Barcelona to Paris is 827 km.

Calculate the average speed of the train in kilometres per hour. [3]

78.4 or 78.38 to 78.39



The diagram shows the speed-time graph of a train journey between two stations.
The train accelerates for two minutes, travels at a constant maximum speed, then slows to a stop.

(a) Write down the number of seconds that the train travels at its constant maximum speed. [1]

(b) Calculate the distance between the two stations in metres.

(c) Find the acceleration of the train in the first two minutes.
Give your answer in m/s .

[3]

(a) 480

(b) 9900

(c) 0.125 or $\frac{1}{8}$

2 [2]

A train takes 65 minutes to travel 52 km.

Calculate the average speed of the train in kilometres per hour. [2]

A train travels 52 km in 65 minutes. Its average speed is 48 km/h.

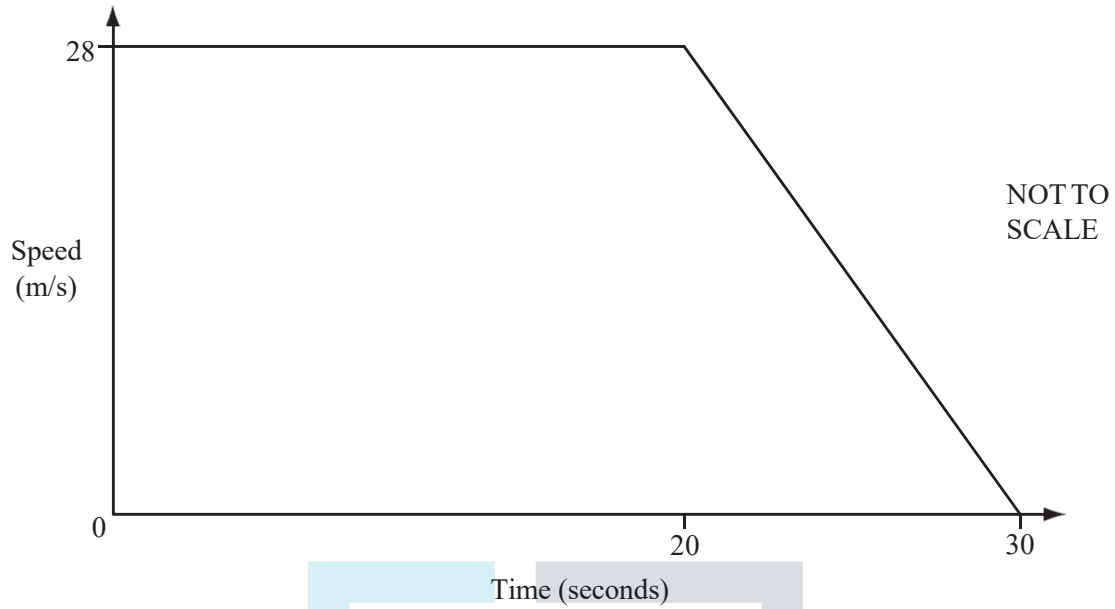
(a) Convert 144km/h into metres per second. [2]

144 km/h * (1000 m/km) ∗ (1 hour /3600 seconds) = 40 m/s
So, 144 kilometers per hour is equal to 40 meters per second.

(b) A train of length 120 m is travelling at 144km/h.
It passes under a bridge of width 20 m.

Find the time taken for the whole train to pass under the bridge.
Give your answer in seconds. [2]

Solution:
1. Convert speed to m/s : 144 km/h * (1000 m/km)/(3600 s) = 40m/s
2. Calculate total distance: Length + width $= 120m + 20m = 140m$
3. Calculate time: Distance / speed $= 140$ m/40 m/s $= 3.5$ s
Answer:
The train takes 3.5 seconds to pass under the bridge.



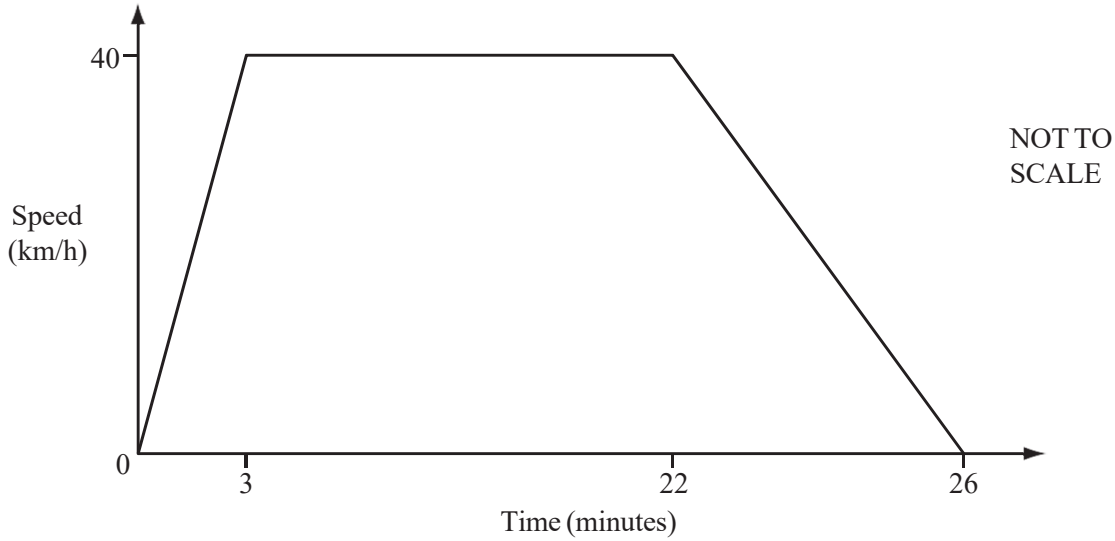
The diagram shows the speed-time graph of a car.
It travels at 28 m/s for 20 seconds and then decelerates until it stops after a further 10 seconds.

(a) Calculate the deceleration of the car. [1]

The slope of the line is 28 m/s/10 seconds = 2.8 m/s^2.

(b) Calculate the distance travelled during the 30 seconds. [3]

700



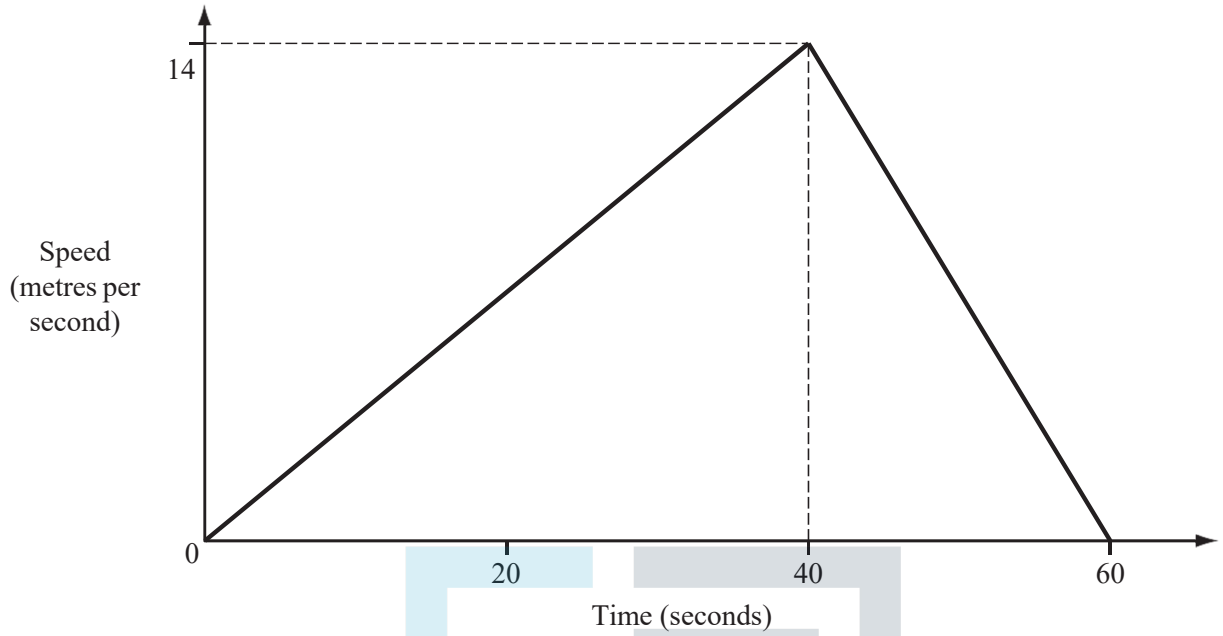
The diagram shows the speed-time graph of a train journey between two stations.

The train accelerates for 3 minutes, travels at a constant maximum speed of 40 km/h, then takes 4 minutes to slow to a stop.

Calculate the distance in kilometres between the two stations. [4]

$$A = 40\left(\frac{3}{60}\right)\left(\frac{1}{2}\right) + 40\left(\frac{19}{60}\right) + 40\left(\frac{4}{60}\right)\left(\frac{1}{2}\right)$$

$$= 15$$



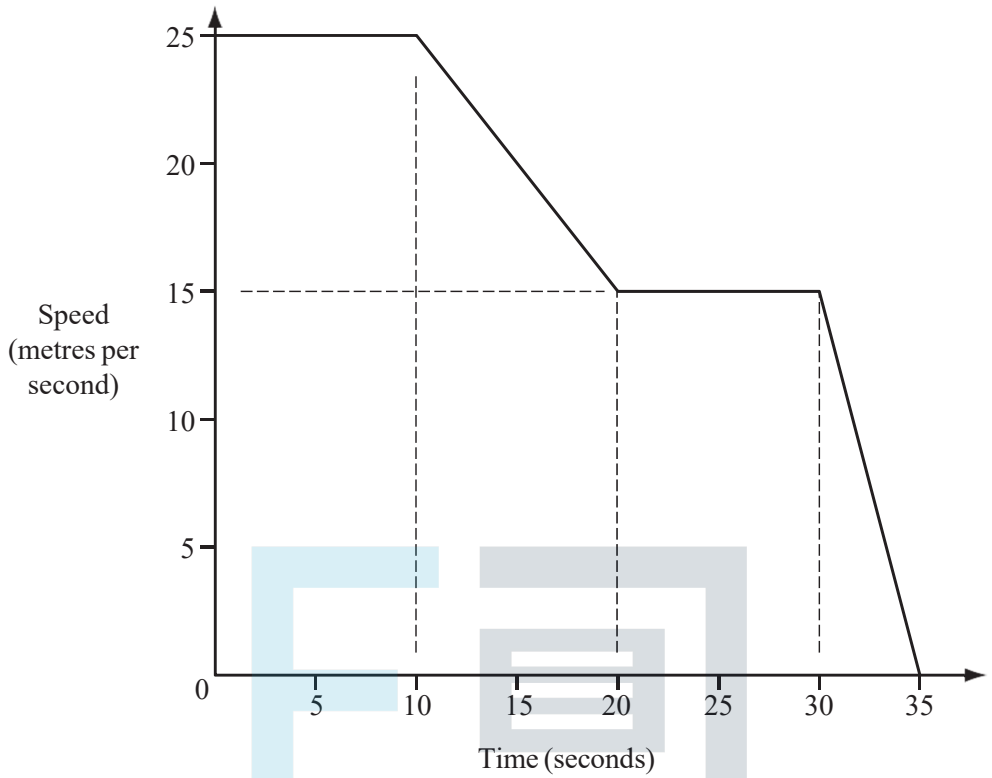
The diagram shows the speed-time graph of a bus journey between two bus stops.
Hamid runs at a constant speed of 4 m/s along the bus route.
He passes the bus as it leaves the first bus stop.
The bus arrives at the second bus stop after 60 seconds.

How many metres from the bus is Hamid at this time?

180 WWW

[3]

Question 35



The diagram shows the speed-time graph for the last 35 seconds of a car journey.

(a) Find the deceleration of the car as it came to a stop.

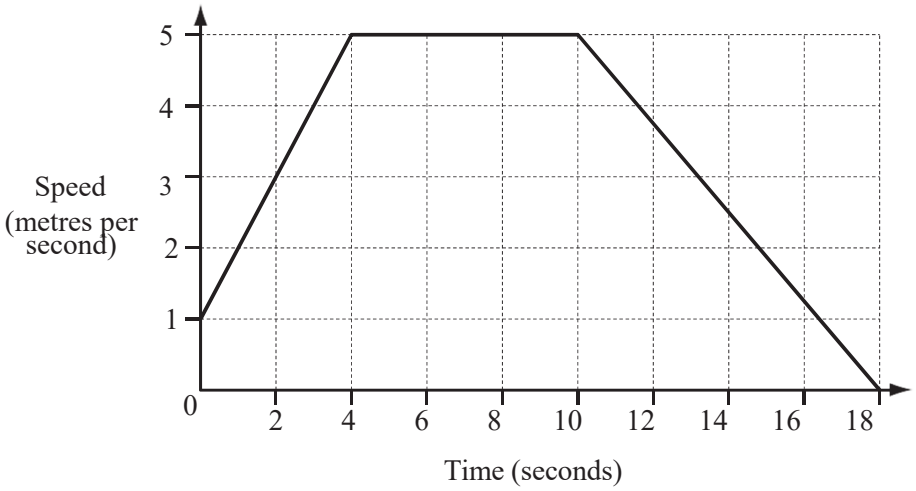
(b) Calculate the total distance travelled by the car in the 35 seconds.

[1]

(a) 3

(b) 637.5

[3]



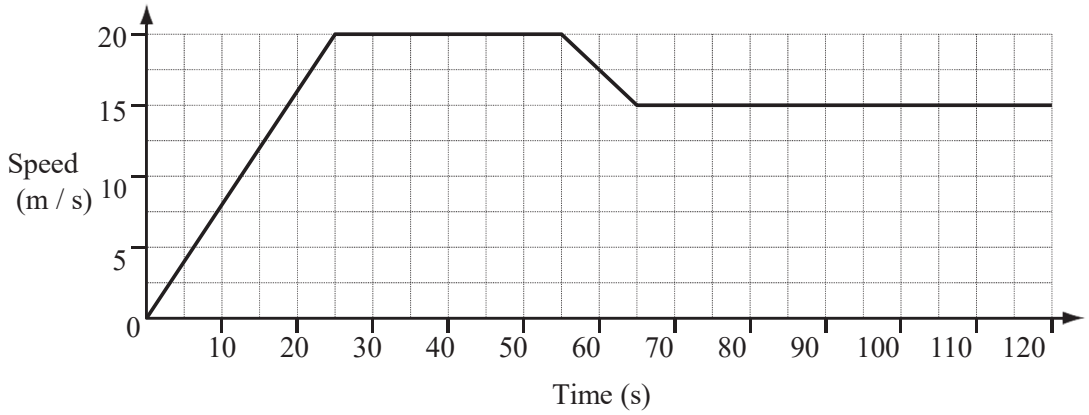
The diagram shows the speed-time graph for the last 18 seconds of Roman's cycle journey.

(a) Calculate the deceleration.

(b) Calculate the total distance Roman travels during the 18 seconds.

(a) 0.625 or 5/8 [1]

(b) 62 [3]



The diagram shows the speed-time graph for the first 120 seconds of a car journey.

(a) Calculate the acceleration of the car during the first 25 seconds.

$$a = v/t$$
$$= 20 \div 25$$
$$= 0.8 \text{ m/s}^2$$

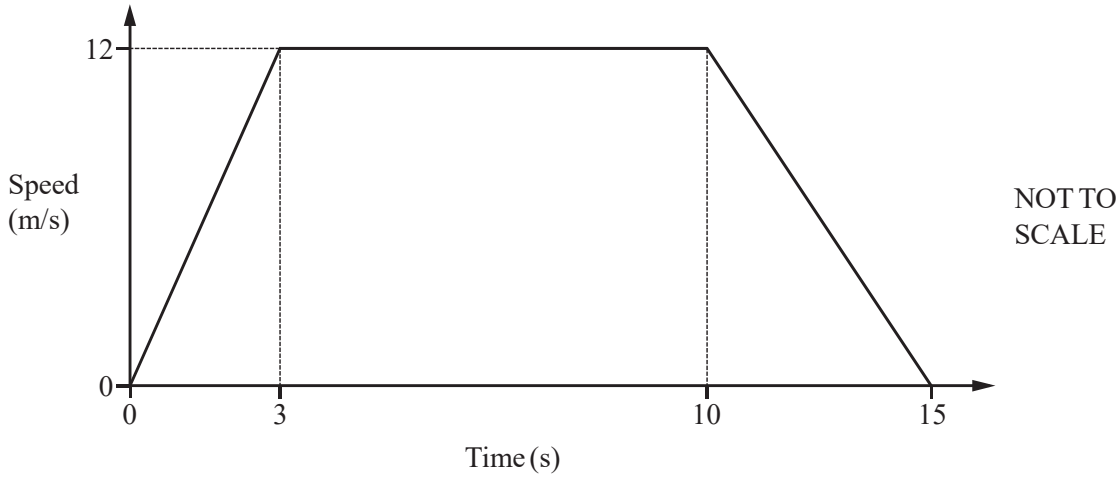
[1]

(b) Calculate the distance travelled by the car in the first 120 seconds.

$$s = s_1 + s_2 + s_3 + s_4 = 250 + 600 + \pi 5 + 825$$
$$= 1850 \text{ m}$$

[4]

Question 38

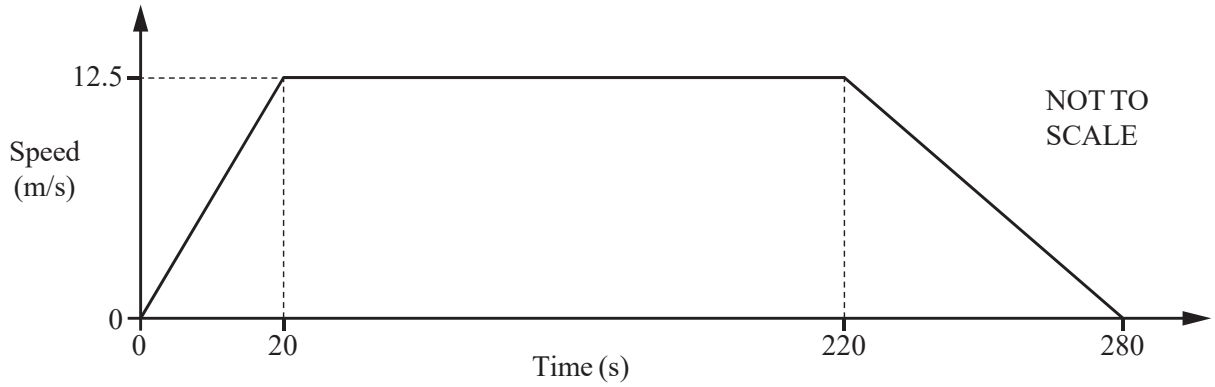


The diagram shows a speed-time graph.

Calculate the total distance travelled. [3]

$$\text{Area} = (10 + 15) * 12/2 = 120 \text{ meters}$$

The diagram shows a speed-time graph for the journey of a car.



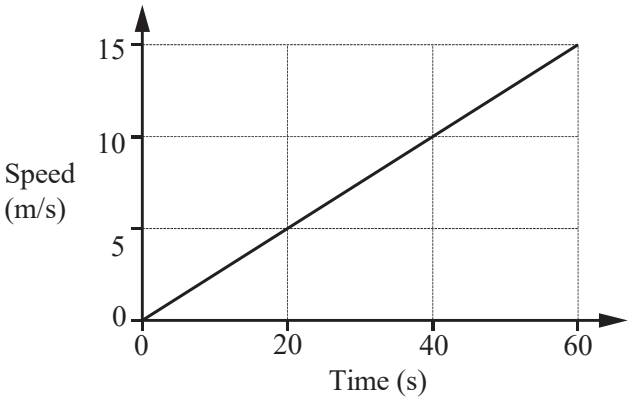
Calculate the total distance travelled. [3]

$12.5 \times \frac{1}{2}(200 + 280)$

3000

Question 40

The speed-time graph shows the first 60 seconds of a train journey.



(a) Find the acceleration of the train. [1]

$$\text{acceleration} = \frac{\Delta velocity}{\Delta \text{ time}}$$

$$\text{acceleration} = \frac{15}{60}$$

$$\text{acceleration} = \frac{1}{4}$$

$$\text{acceleration} = 0.25 \text{ ms}^{-2}$$

(b) Calculate the distance the train has travelled in this time.
Give your answer in kilometres. [3]

The distance is the area under the graph:

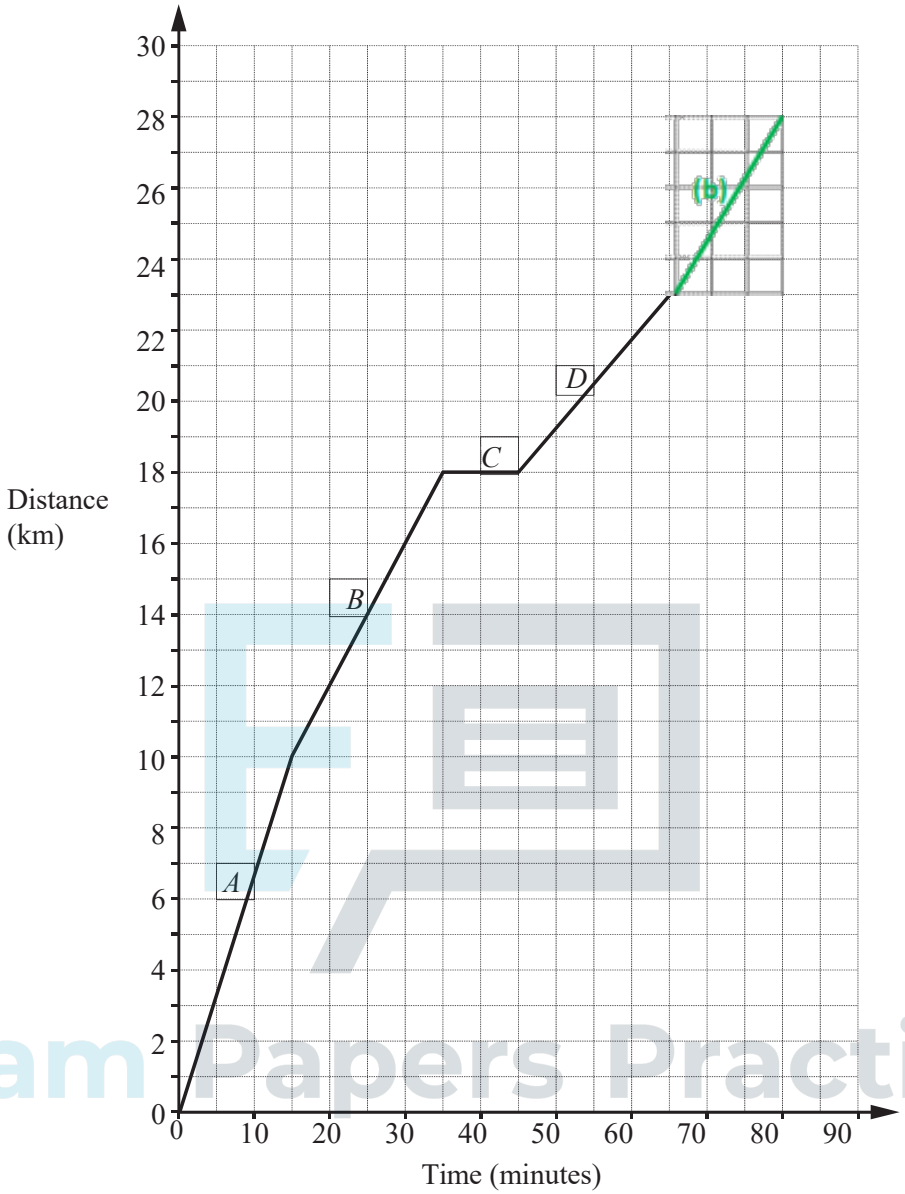
$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Area} = \frac{1}{2} \times 60 \times 15$$

$$\text{Area} = 30 \times 15$$

$$\text{Area} = 450 \text{ m}$$

$$\text{Area} = 0.45 \text{ km}$$



The diagram shows the distance-time graph for the first 65 minutes of a bicycle journey.

(a) There are four different parts to the journey labelled *A*, *B*, *C* and *D*.

Write down the part of the journey with the fastest speed.

[1]

Fastest speed is in Part A

(b) After the first 65 minutes the bicycle travels at a constant speed of 20 km/h for 15 minutes.

Draw this part of the journey on the diagram. [1]

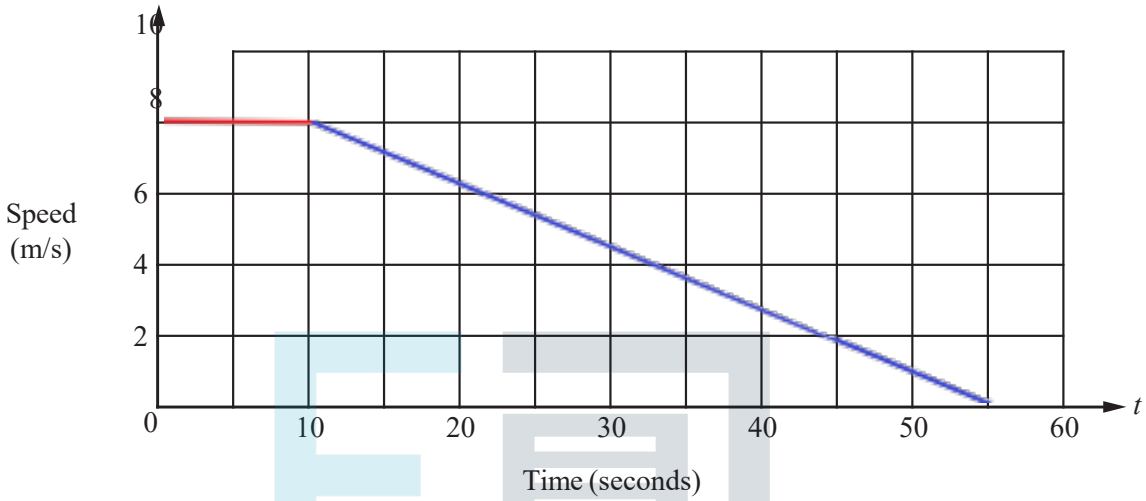
15 minutes is $\frac{1}{4}$ of an hour so the distance travelled is given by:

Distance $=$ Speed $\times$ Time $= 20 \times \frac{1}{4} = 5$ km

Draw a line to $(65 + 15, 23 + 5) = (80, 28)$ on the graph.

A car passes through a checkpoint at time $t = 0$ seconds, travelling at 8 m/s.
It travels at this speed for 10 seconds.
The car then decelerates at a constant rate until it stops when $t = 55$ seconds.

(a) On the grid, draw the speed-time graph.



[2]

(b) Calculate the total distance travelled by the car after passing through the checkpoint.

$$\text{distance} = \text{rectange} + \text{triangle}$$

$$\text{distance} = 10\,\text{s} \times 8\,\text{m/s} + \tfrac{1}{2} \times (55\,\text{s} - 10\,\text{s}) \times 8\,\text{m/s}$$

$$\text{distance} = 260\,\text{m}$$

[3]

A car travels a distance of 1280 **metres** at an average speed of 64 kilometres per hour.

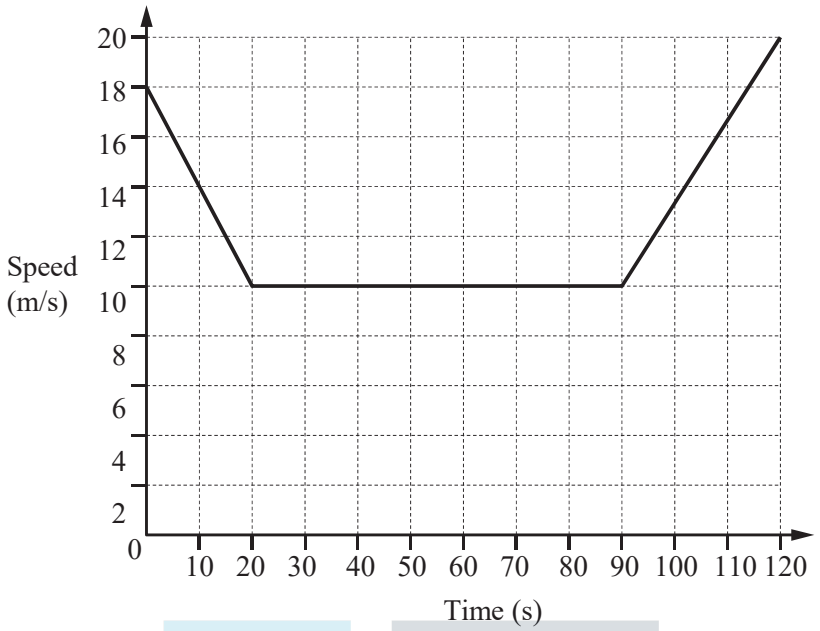
Calculate the time it takes for the car to travel this distance.
Give your answer in **seconds**.

[3]

$$\text{time taken} = \frac{\text{total distance}}{\text{average speed}} = \frac{1.28\ \text{km}}{64\ \text{km/h}}$$

$$\text{time taken} = 0.02\ \text{hours}$$

$$\text{time taken} = \mathbf{72}\ \text{seconds}$$



The diagram shows the speed-time graph for 120 seconds of a car journey.

(a) Calculate the deceleration of the car during the first 20 seconds.

$$\text{deceleration} = \frac{\text{change of velocity}}{\text{changle of time}} = \frac{8\ \text{m/s}}{20\ \text{s}}$$
$$= 0.4\ \text{ms}^{-2}$$

[1]

(b) Calculate the total distance travelled by the car during the 120 seconds.

$$= \tfrac{1}{2} \times 20\ \text{s} \times (10 - 18)\text{m/s} + 120\ \text{s} \times 10\ \text{m/s} + \tfrac{1}{2} \times (120 - 90)\text{s} \times (20 - 10)\text{m/s}$$
$$\text{distance} = 80\ \text{m} + 1200\ \text{m} + 150\ \text{m}$$
$$\text{distance} = 1430\ \text{m}$$

[3]

(c) Calculate the average speed for this 120 second journey.

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time taken}} = \frac{1430\ \text{m}}{120\ \text{s}}$$
$$= 11.9\ \text{m/s}$$

[1]

Fritz drives a distance of 381 km in 2 hours and 18 minutes.
He then drives 75 km at a constant speed of 30 km/h.

Calculate his average speed for the whole journey. [4]

$$\text{total distance} = 381\ \text{km} + 75\ \text{km} = 456\ \text{km}$$

$$\text{time taken (second part)} = \frac{75\ \text{km}}{30\ \text{km/h}}$$

$$\text{time taken (second part)} = 2.5\ \text{h}$$

$$\text{time taken (first part)} = 2h18\,\text{min} = \left(2 + \frac{18}{60}\right)\ \text{hours} = \left(2 + \frac{3}{10}\right)\ \text{hours} = 2.3\ \text{hours}$$

$$\text{average speed} = \frac{\text{total distance}}{\text{total time taken}}$$

$$\text{average speed} = \frac{456}{2.3+2.5}$$

$$\text{average speed} = 95\ \text{km/h}$$