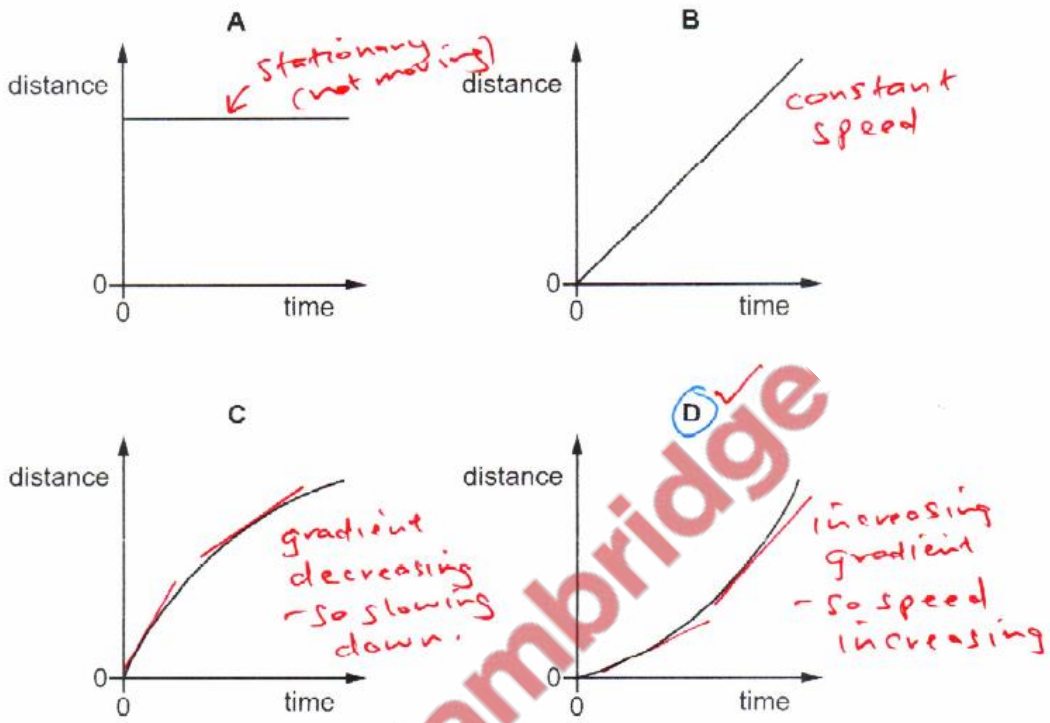
Motion – 2021 IGCSE 0625

1. Nov/2021/QPaper_12,21/No.2

The diagrams show distance–time graphs for four objects.

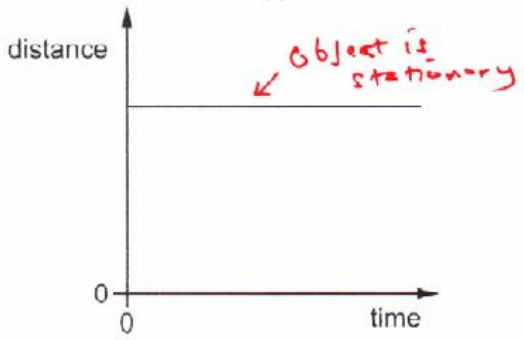
Which graph represents an object moving with an increasing speed?



2. Nov/2021/QPaper_12&22/No.2

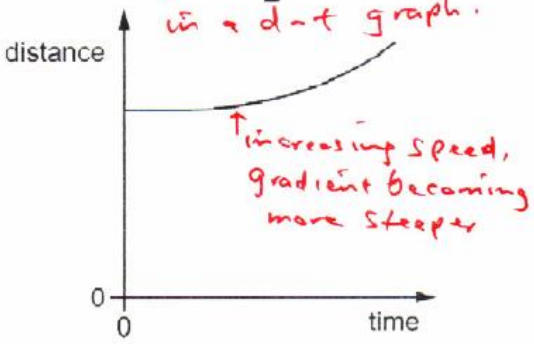
Which graph represents an object that is moving at constant speed?

A



Object is stationary

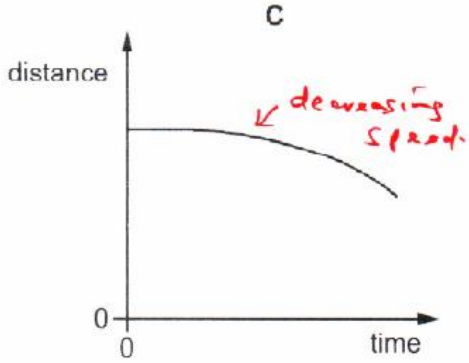
B



↑ gradient should be constant in a d-t graph.

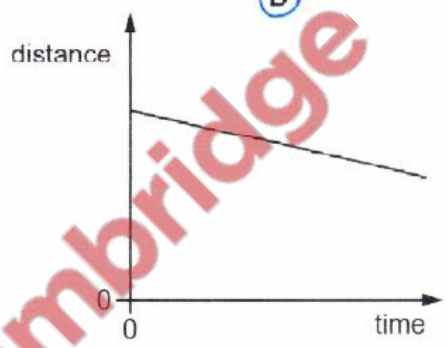
↑ increasing speed, gradient becoming more steeper

C



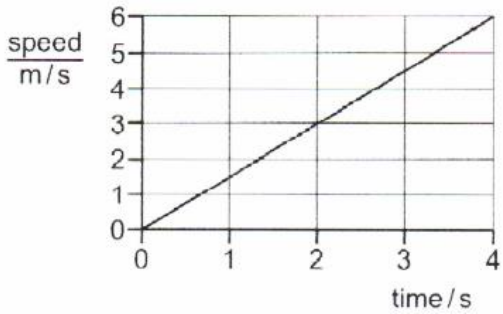
decreasing speed

D ✓



3. Nov/2021/QPaper_13&23/No.2

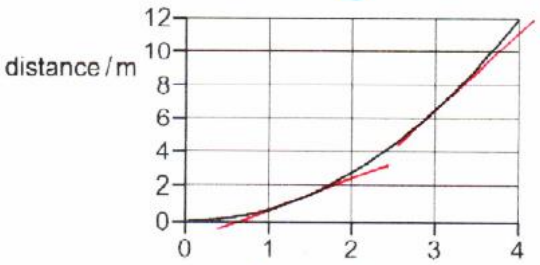
The graph shows how the speed of a car varies with time at the start of a journey.



Speed - time graph
- Speed increases with time

Which distance–time graph represents the motion of the car over the same time period?

A ✓

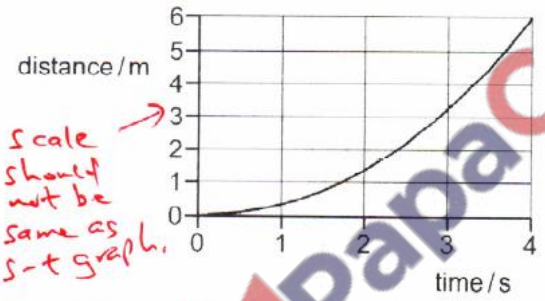


gradient becomes more steeper.

B

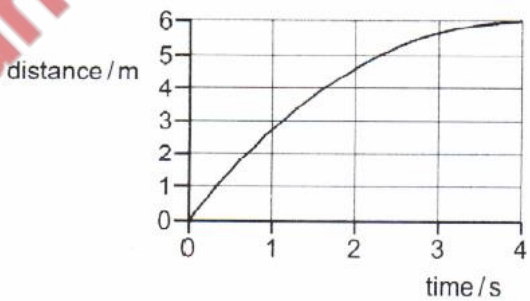
- gradient becomes less steeper.

C



Scale should not be same as s-t graph.

D



- In distance time graph, speed is calculated from gradient.
- So gradient will increase with time

4. Nov/2021/QPaper_31/No.2

A slope is made by resting one end of a plank of wood on a block, as shown in Fig. 2.1.

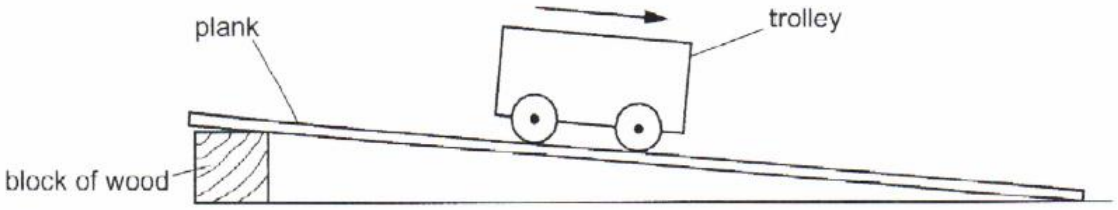


Fig. 2.1

Two students each use a digital stop-watch to measure the time for a small trolley to roll down the full length of the slope.

Fig. 2.2 shows the times on the stop-watches.

student 1

time = 6.14 s

student 2

time = 6.28 s

Fig. 2.2

(a) **(i)** On the line next to each stop-watch, write the time it shows. [1]

(ii) Calculate the average time for the trolley to roll down the slope.

6.14
+ 6.28
12.42

12.42 / 2 = 6.21 s

average time = 6.21 s [2]

(iii) The students want the same trolley to take more time to roll down the plank.

Suggest how the students alter the arrangement in Fig. 2.1.

reduce the angle of slope. (Smaller gradient) [1]

(b) A different trolley travels 1.2 m down the slope in a time of 7.8 s.

Calculate the average speed of the trolley.

av. Speed = distance / time

= 1.2 m / 7.8 s

= 0.15 m/s

average speed = 0.15 ..... m/s [3]

(c) The trolley travels down a different slope. Fig. 2.3 shows the speed–time graph.

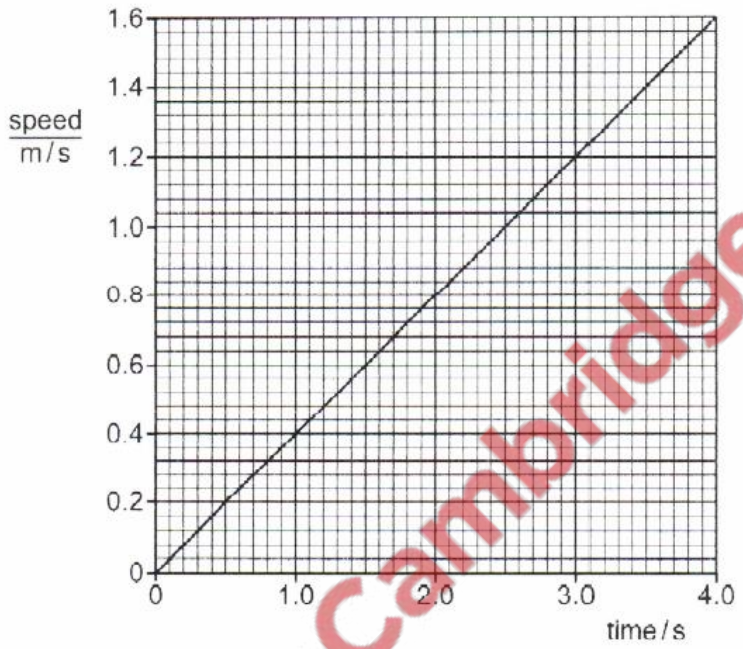


Fig. 2.3

Calculate the distance travelled by the trolley between time = 0 and time = 4.0 s.

distance = area under the graph

Area = $\frac{1}{2}$ × 4.0 × 1.6

= 3.2 m

distance travelled = 3.2 ..... m [3]

[Total: 10]

5. Nov/2021/QPaper_32/No.1

A cyclist travels to a friend's house.

Fig. 1.1 shows the distance–time graph of the journey.

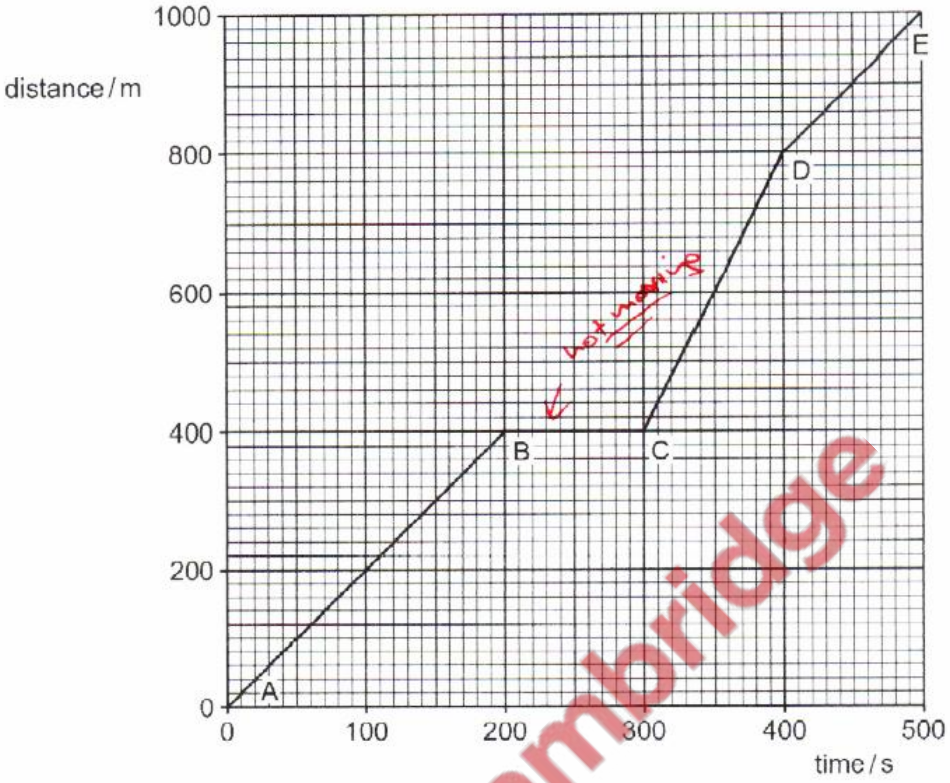


Fig. 1.1

(a) Determine the distance travelled by the cyclist between points C and E.

1000 − 400 = 600 m

distance travelled = 600 m [2]

(b) Describe the motion, if any, of the cyclist between points B and C. Stationary. [1]

(c) State the section, AB, BC, CD or DE, of the graph in which the speed of the cyclist is the fastest. Give a reason for your answer.

calculated from gradient in d–t graph.

section of graph CD

reason has steepest gradient [2]

(d) Calculate the average speed of the cyclist between points A and E. Include the unit in your answer.

Av. Speed = distance / time

= 1000 m / 520 s

= 2 m/s

average speed = 2.0 unit m/s [4]

[Total: 9]

6. Nov/2021/QPaper_33/No.1

Fig. 1.1 shows a plant pot falling from an upstairs balcony. The plant pot has a constant acceleration as it falls.

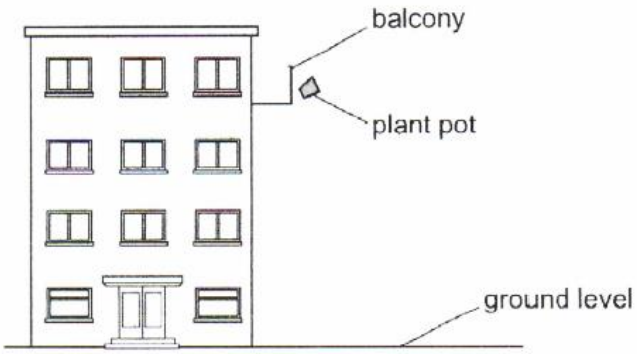


Fig. 1.1

(a) State the cause of the acceleration.

Gravitational force. ..... [1]

(b) Fig. 1.2 shows the speed–time graph for the falling plant pot. The plant pot hits the ground at time = 1.8 s.

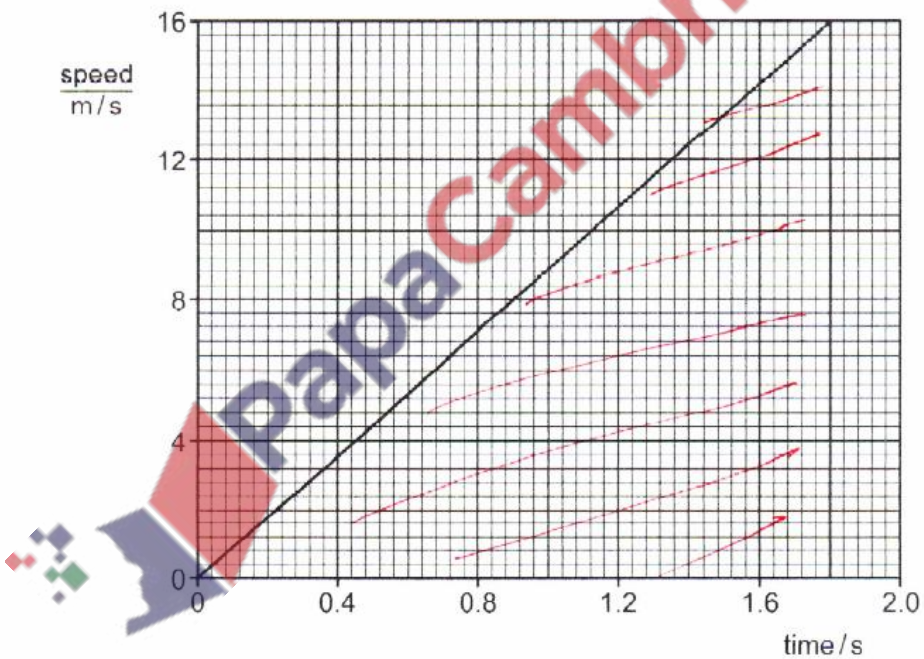


Fig. 1.2

Determine the height of the balcony above the ground using the information shown in Fig. 1.2.

height = area under graph.

Area = $\frac{1}{2} \times 1.8 \times 16$

= 14.4 m.

≈ 14 m (to 2 S.f).

height = 14 ..... m [3]

[Total: 4]

7. Nov/2021/QPaper_42/No.1

Fig. 1.1 shows a space rocket accelerating away from a launch pad.

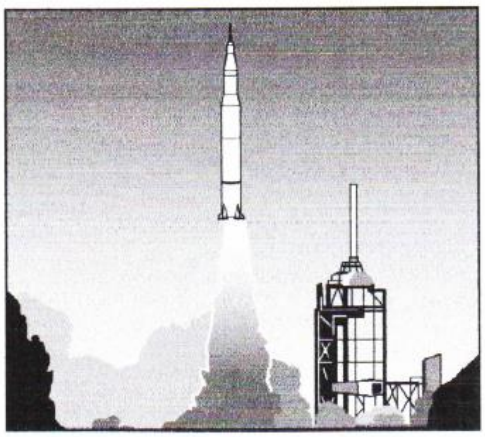


Fig. 1.1

Fig. 1.2 is a speed–time graph for the first 30 s of the rocket's flight.

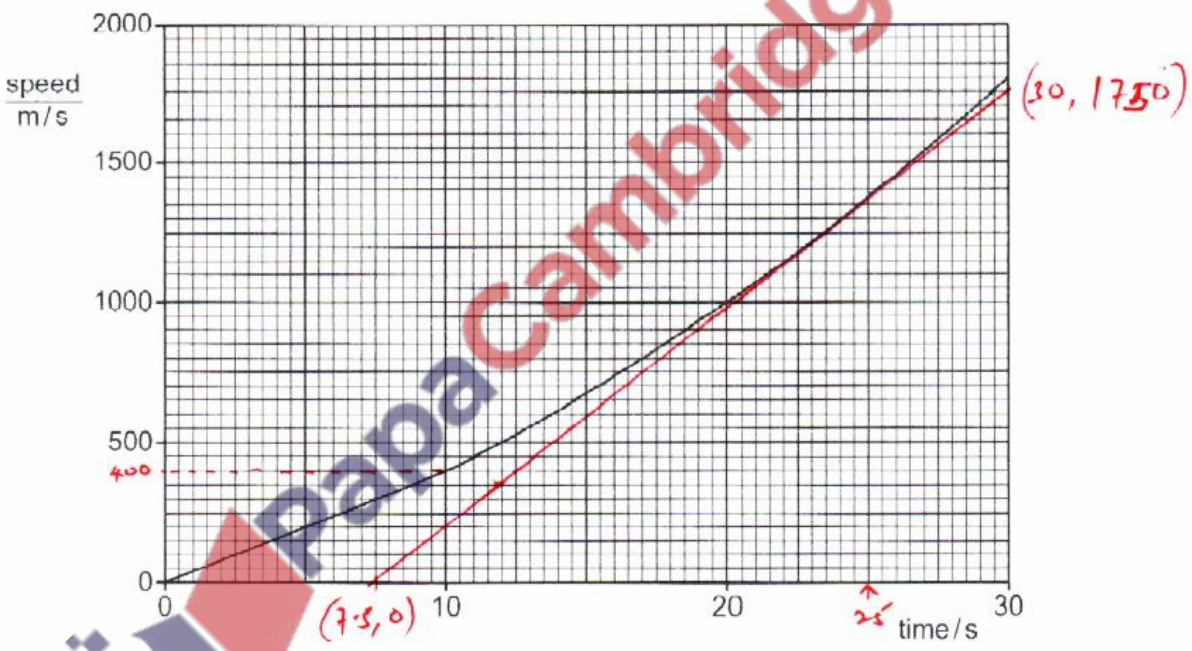


Fig. 1.2

(a) Describe how the acceleration of the rocket changes between time = 10 s and time = 30 s.

- acceleration is increasing
- Gradient of graph is becoming more steeper. [1]

(b) By drawing a tangent to the graph, determine the acceleration of the rocket at time = 25 s.

(30, 1750), (7.5, 0)

acceleration = gradient of tangent

$= \frac{1750 - 0}{30 - 7.5}$

$= 77.77$

$\therefore$ acc $= 78\ m/s^2$

acceleration = 78 m/s [2]

(c) Determine the distance travelled by the rocket between time = 0 and time = 10 s.

Area under graph = triangle

$= \frac{1}{2} \times 10 \times 400$

$= 2000\ m$

distance = 2000 m [2]

[Total: 5]

8. Nov/2021/QPaper_43/No.1

A ship sails in a straight line between two ports.
Fig. 1.1 shows the speed–time graph of the ship for the first 100 minutes of its journey between the two ports.

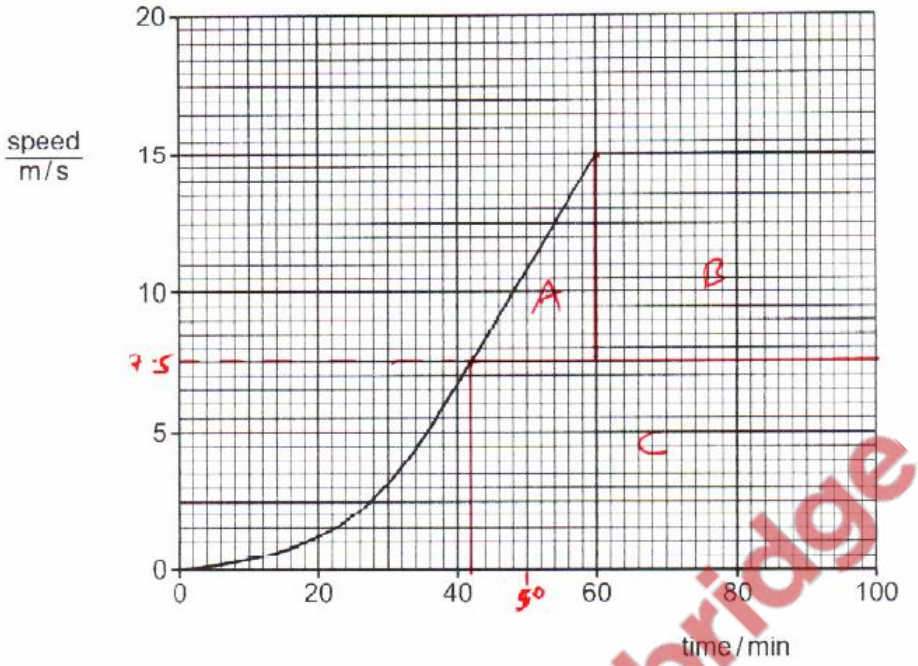


Fig. 1.1

(a) Calculate the maximum acceleration during the first 100 minutes of the ship's journey.

↑ The steepest part of the graph.

acc = gradient

$= \frac{15 - 7.5}{(60 - 42) \times 60}$

$= \frac{7.5}{(18 \times 60)}$

$= \frac{7.5}{1080}$

acc = 0.0069 m/s²

maximum acceleration = 0.0069 m/s² [2]

(b) Calculate the total distance travelled by the ship between time = 42 min and time = 100 min.

↑ Area under graph

Area of A $= \frac{1}{2} \times 18 \times 7.5 \times 60 = 4050$

Area of B = l × w
= 40 × 7·5 × 60
= 18,000 m²

Area of C = 58 × 7·5 × 60
= 26,100 m

Sum up = 4050 + 18000 + 26,100
= 48,150 m.
≈ 48 km

distance travelled = 48 km. [3]

(c) At a time not shown on the graph, the acceleration of the ship is $0.0087\,m/s^2$. The total mass of the ship and its passengers is 2.3×10^7 kg.

(i) Calculate the resultant force on the ship.

$R.F = m \times a.$

$= 2.3 \times 10^7 \times 0.0087$

$= 200,100\,N.$

$\approx 2.0 \times 10^5\,N$

force = $2.0 \times 10^5\,N.$ [2]

(ii) Explain why the force on the ship due to the ship's engine is greater than the value you calculated in **(c)(i)**.

- There is a backward force due to water resistance acting on the ship. [1]

[Total: 8]