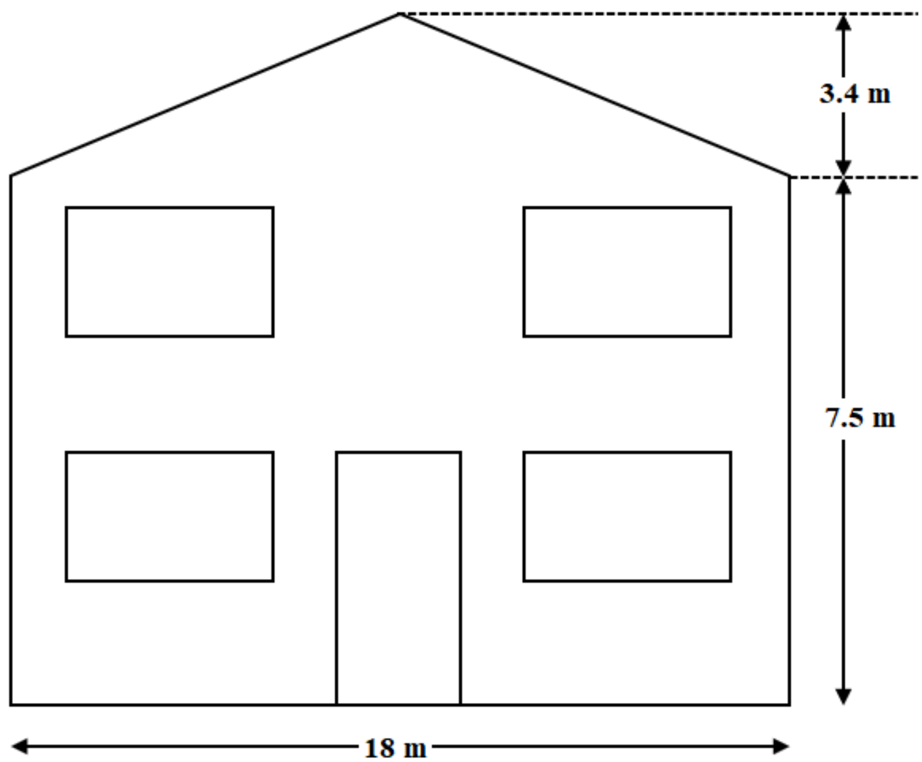
CSEC MATHEMATICS JANUARY 2023 PAPER 3

1. The diagram below shows the front view of Pinky's house, which includes four windows and a door.



(a) **(i)** Calculate the TOTAL surface area of the front view of Pinky's house, inclusive of the windows and doors.

SOLUTION:
Data: Diagram showing a front view of Pinky's house, which includes four windows a door.
Required to calculate: The total surface area of Pinky's house, inclusive of the windows and doors.
Calculation:
We divide the compound shape into two regions, A and B, as shown in the diagram below.

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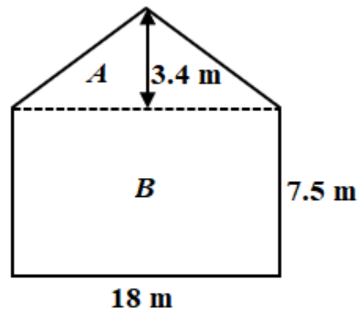

Area of triangle, $A = \frac{3.4 \times 18}{2}\ \text{m}^2$

$= 30.6\ \text{m}^2$

Area of rectangle, $B = (18 \times 7.5)\ \text{m}^2$

$= 135\ \text{m}^2$

$\therefore$ Area of the front view of Pinky's house = Area of A + Area of B

$= (30.6 + 135)\ \text{m}^2$

$= 165.6\ \text{m}^2$

(ii) The windows and the door are made of shatterproof glass. The door is 1.2 m wide and 2.8 m high. Each of the four windows is 1.8 m wide and 1.4 m high.

Determine the MINIMUM amount of glass needed for the door and the four windows.

SOLUTION:
Data: The door has dimensions 2.8 m by 1.2 m. Each of the four windows has dimensions 1.8 m by 1.4 m. Both the door and the windows are made with shatterproof glass.
Required to determine: The minimum amount of glass needed to make the door and the four windows.
Solution:

Area of the door $= (1.2 \times 2.8)\ \text{m}^2$

$= 3.36\ \text{m}^2$

Area of all four windows $= 4(1.8 \times 1.4)\ \text{m}^2$

$= 10.08\ \text{m}^2$

Hence, the minimum amount of glass needed is $= (3.36 + 10.08)\ \text{m}^2$

$= 13.44\ \text{m}^2$

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(iii) Pinky covers the front of her house, excluding the door and the four windows, with decorative wall tiles.

Calculate the area she covers with tiles.

SOLUTION: The front of the house, excluding the door and four windows, will be covered with tiles.
Required to calculate: The area to be covered with tiles.
Calculation:
The area to be covered with tiles

$= \text{Total front area} - \text{Area occupied by doors and windows}$

$= (165.6 - 13.44)\ \text{m}^2$

$= 152.16\ \text{m}^2$

(b) Pinky paints one of the walls of the house which has an area of 53 m^2. One litre of paint covers an area of 4.5 m^2. Paint is sold in 2.5 litre tins, each costing \$24.75. Pinky buys the LEAST number of tins of paint needed to paint this wall.

Calculate the cost of the paint required to paint the wall.

SOLUTION:
Data: Pinky decides to paint a wall of area 53 m^2. One litre of paint covers 4.5 m^2 of wall and paint is sold in 2.5 litre tins at a cost of \$24.75 each.
Required to calculate: The cost of the least number of tins of paint needed to paint this wall.
Calculation:
Area of wall $= 53\ \text{m}^2$

One tin of paint covers $(2.5 \times 4.5)\ \text{m}^2$

$$\text{Number of tins required} = \frac{53}{2.5 \times 4.5} = \frac{53}{11.25} = 4.7$$

Since the paint is sold in 2.5 litre tins, the least number of tins that need to be bought $= 5$ tins (the nearest integer value that is greater than 4.7).

$\therefore$ The cost of the paint will be $\$24.75 \times 5 = \$123.75$

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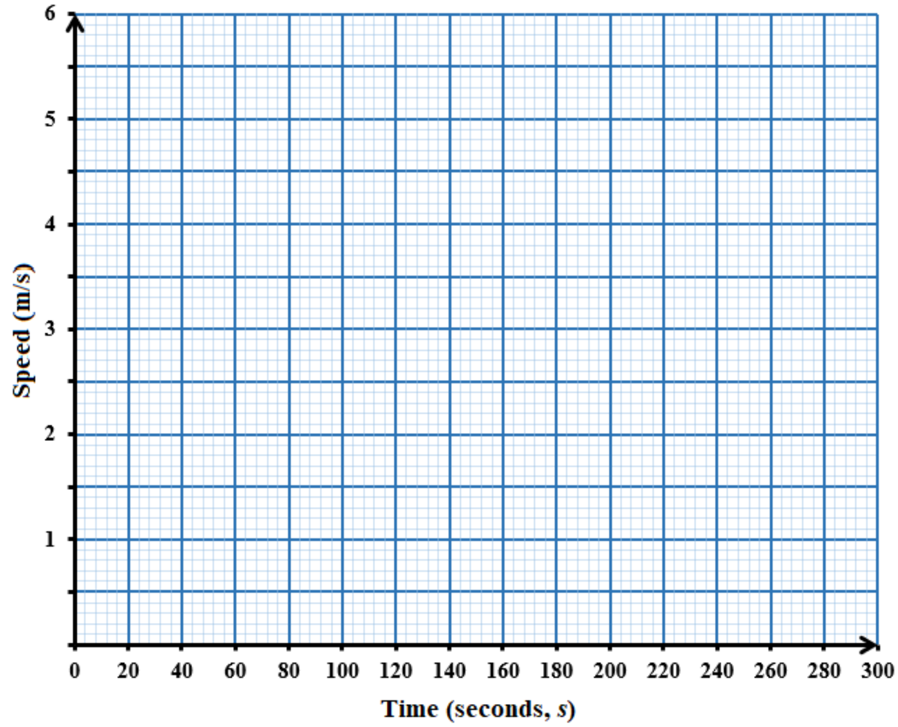
2. (a) Lela cycles along a path for 5 minutes. She starts from rest, and accelerates at a constant rate until she reaches a speed of 5 m/s after 100 seconds. She continues cycling at 5 m/s for 2 minutes and 40 seconds. She then decelerates at a constant rate until she stops.

(i) On the grid below, draw a speed-time graph to show Lela's journey.



SOLUTION:
Data: Lela cycles along a path for 5 minutes. She starts from rest, and accelerates at a constant rate until she reaches a speed of 5 m/s after 100 seconds. She continues cycling at 5 m/s for 2 minutes and 40 seconds. She then decelerates at a constant rate until she stops.
Required to draw: A speed-time graph to show Lela's journey.
Solution:
At rest, the speed is 0 ms^{-1}.
In the first 100 seconds, the acceleration is constant, hence this branch is a straight line.
A constant speed of 5 ms^{-1} for 160 s is shown by a horizontal branch (gradient $= 0 \Rightarrow$ acceleration $= 0$ ms^{-2})
The deceleration takes place over $300 - 260 = 40$ seconds and since it is constant, this branch is a straight line with a negative gradient.

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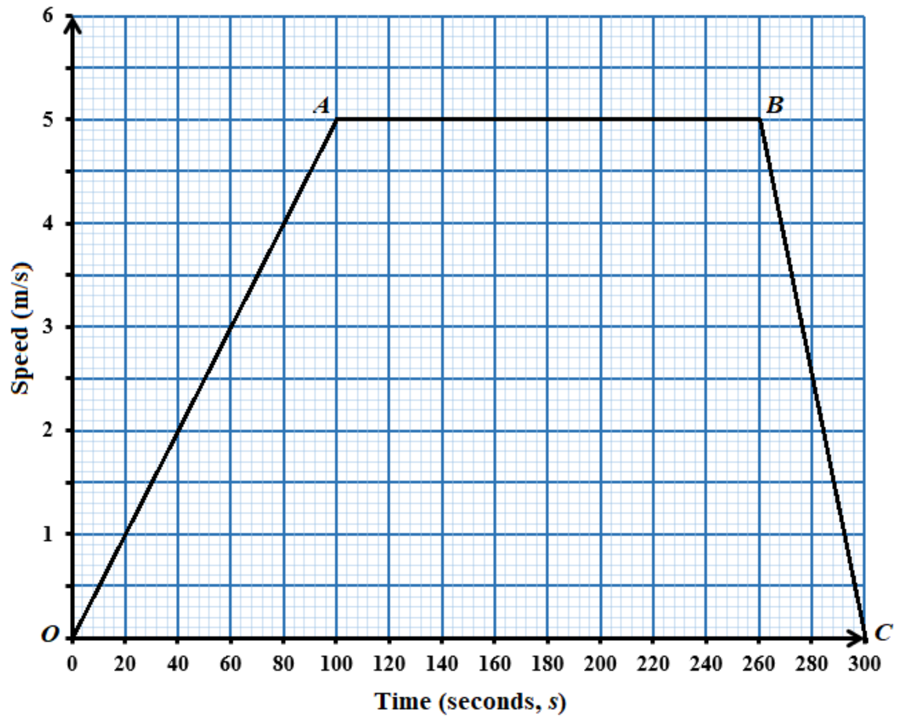
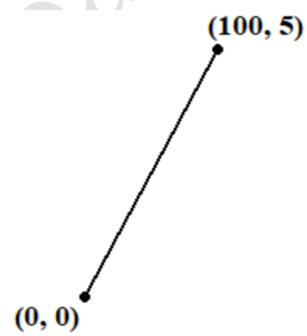


(ii) Determine Lela's acceleration.

SOLUTION:
Required to determine: Lela's acceleration.
Solution:



Acceleration $= \text{Gradient of the branch } OA$

$$= \frac{5-0}{100-0} \text{ ms}^{-2}$$

$$= \frac{1}{20} \text{ ms}^{-2}$$

(iii) Calculate Lela's average speed for the entire journey.

SOLUTION:
Required to calculate: Lela's average speed for the entire journey.

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Calculation:

Total distance covered $=$ Area under the graph $=$ Area of $OABC$

$$= \frac{1}{2}(160+300)\times 5$$

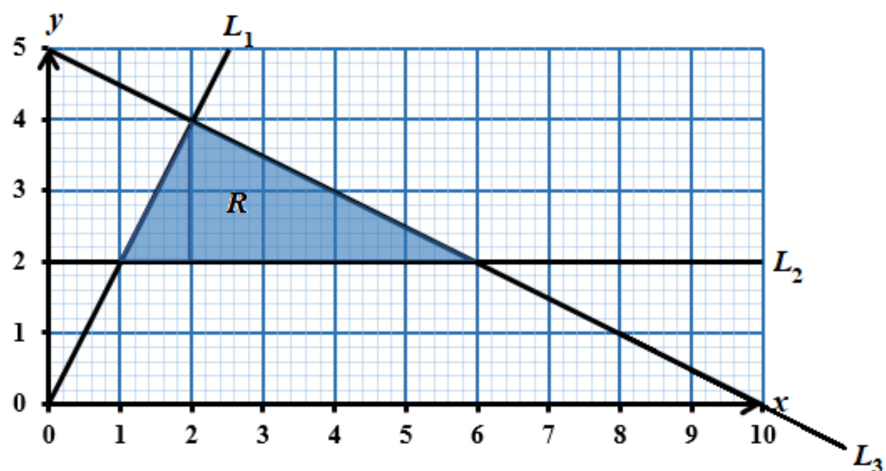
$$= 1150 \text{ m}$$

Average speed $= \dfrac{\text{Total distance covered}}{\text{Total time taken}}$

$$= \frac{1150}{300} \text{ ms}^{-1}$$

$$= 3\frac{5}{6} \text{ ms}^{-1}$$

(b) The diagram below shows the graph of 3 lines, L_1, L_2 and L_3 and the shaded region, *R*, which represents the common region for the 3 inequalities associated with the lines L_1, L_2 and L_3, that define *R*.



The table below shows some of the equations of the lines L_1, L_2 and L_3 and the respective inequalities that define the shaded region *R*.

Line	**Equation of Line** (in the form $y = mx + c$)	**Inequality associated with Line**
	$y = 2x$	
		$2y < 10 - x$

Complete the table above by inserting the missing information.

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SOLUTION:

Data: Diagram of the graphs of three lines, L_1, L_2 and L_3 and a shaded region R that satisfies three inequalities associated with the lines , L_1, L_2 and L_3. An incomplete table showing some of the equations of L_1, L_2 and L_3 and the respective inequalities associated with them.

Required to complete: The table given

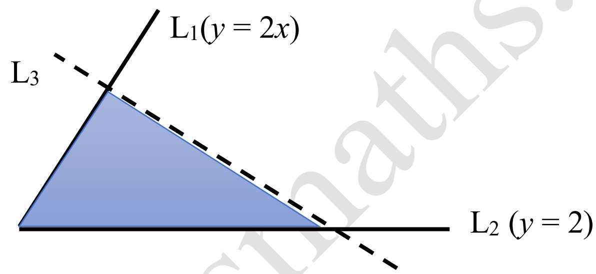
Solution:

Consider L_1

Choose two points (0, 0) and (2, 4) on L_1

Gradient $= \frac{4-0}{2-0} = 2$

L_1 cuts the y-axis at 0. Hence the equation of L_1 is $y = 2x$.



The shaded region represents the inequality $y \leq 2x$ (assuming that the shaded region includes the line)

Consider L_2:

L_2 is a horizontal that cuts the y – axis at 2.

The equation is $y = 2$.

The shaded region is above the line $y = 2$ and represents inequality $y \geq 2$ (assuming that the shaded region includes the line)

Consider L_3:

The inequality associated with the line is given as $2y < 10 - x$. Hence, the equation of the line is $2y = 10 - x$.

The completed table looks like:

Line	Equation of Line (in the form $y = mx + c$)	Inequality associated with Line
L_1	$y = 2x$	$y \leq 2x$
L_2	$y = 2$	$y \geq 2$
L_3	$2y = 10 - x$	$2y < 10 - x$

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