



General Certificate of Secondary Education
November 2024

Centre Number

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Candidate Number

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Mathematics

Unit M4
(With calculator)

Higher Tier

[GMC41]



GMC41

TUESDAY 19 NOVEMBER, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Questions which require drawing or sketching should be completed using an HB pencil. All working **must** be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.

You **may** use a calculator for this paper.

Answer **all twenty-two** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

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Formula Sheet

Volume of prism = area of cross section \times length



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



Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$

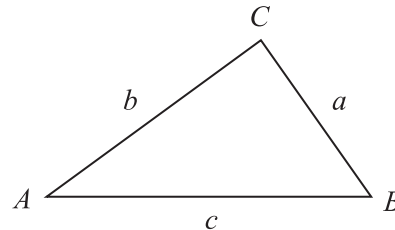


Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$



In any triangle ABC



Quadratic Equation

The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sine Rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$



1 Anne invested £18 000 in an account paying 4% per annum compound interest.

After how many years will the value of her investment exceed £20 200?

Show your working out clearly.

Answer _____ [3]



2 x is a **two-digit** number.

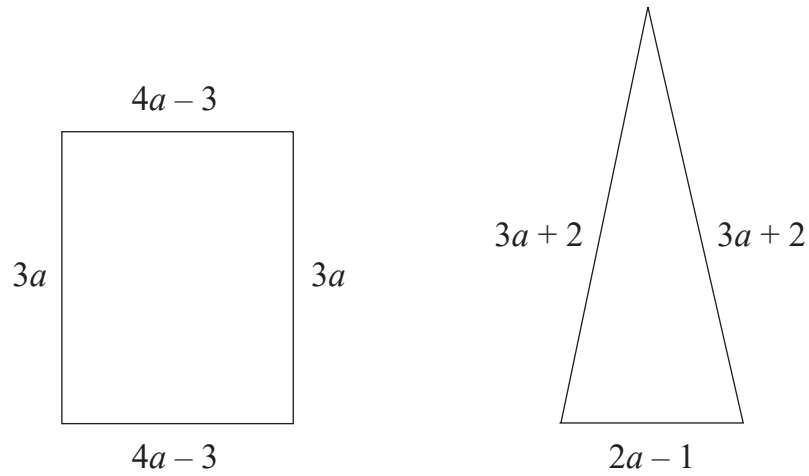
The LCM (lowest common multiple) of x and 55 is 110

Find a possible value of x

Answer _____ [2]



3 The rectangle and triangle drawn below have the **same perimeter**.



Work out the value of a , showing your method clearly.

Answer $a =$ _____ [4]

[Turn over



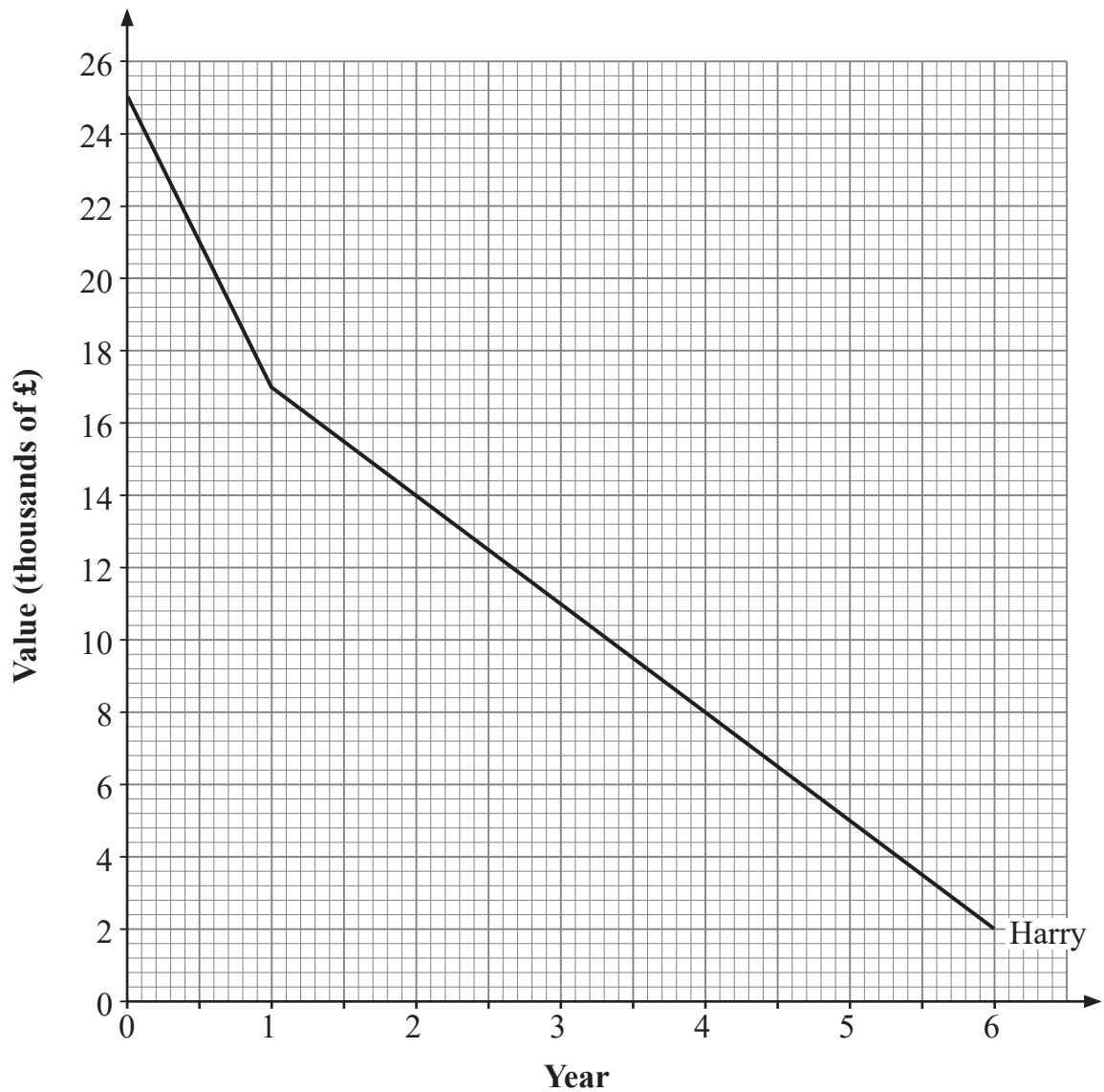
4 Six years ago, Harry and Jane each bought a new car.

Harry bought his car for £25 000

In the first year, it decreased in value by £8 000

After that, it decreased in value by £3 000 each year.

A graph showing the value of Harry's car each year is shown below.



Jane bought her car for £19 000

In the first year, it decreased in value by £5 000

After that, it decreased in value by £2 000 each year.



(a) On the grid opposite, draw a graph showing the value of Jane's car each year. [2]

(b) Use the graph you have drawn to write down the year when Harry's car and Jane's car had the same value.

Answer Year _____ [1]

5 A doormat is in the shape of a semicircle with diameter 82 cm.

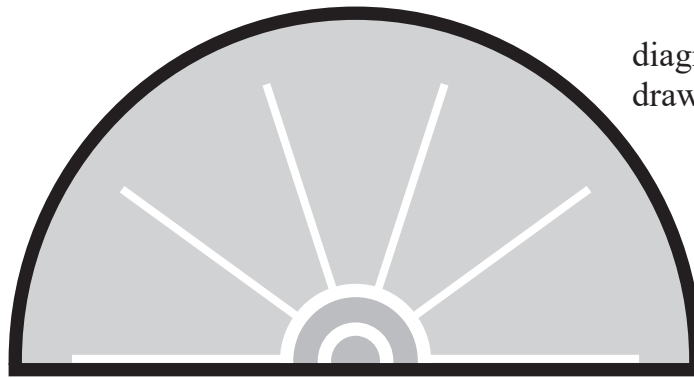


diagram not
drawn accurately

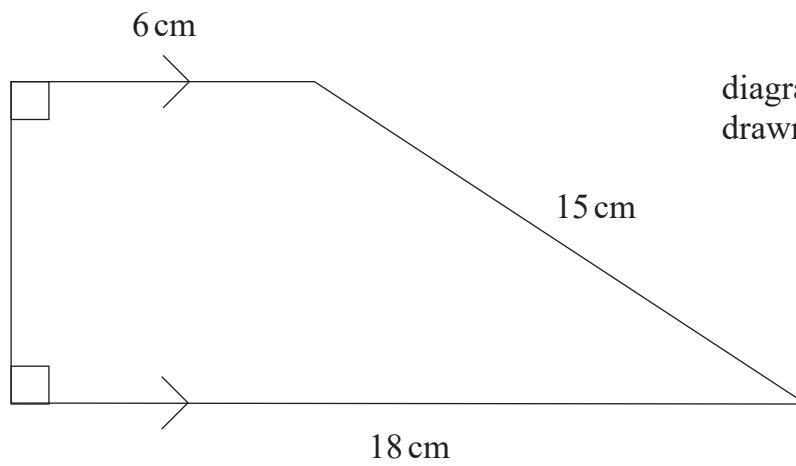
Calculate the perimeter of the doormat.

Answer _____ cm [3]

[Turn over



6



Calculate the area of the trapezium.

Answer _____ cm^2 [5]

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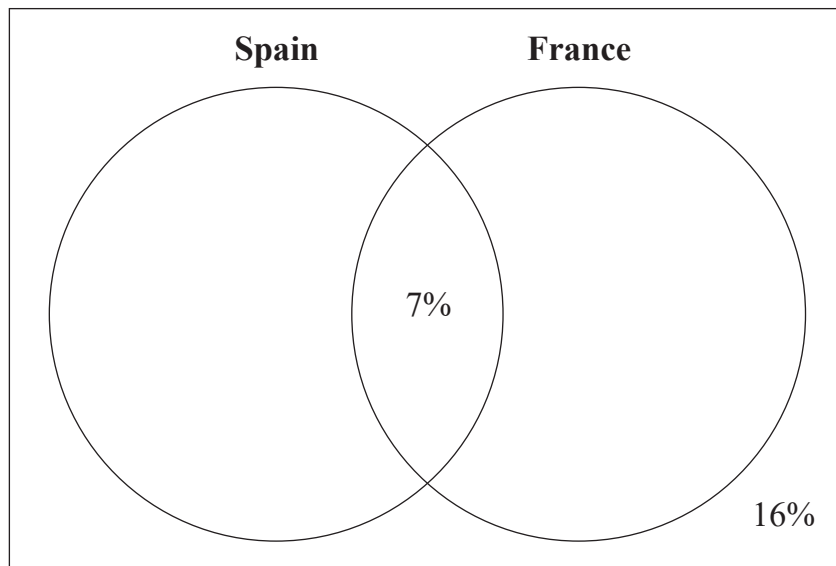
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7 Pupils in a year group were asked whether they had travelled to Spain or France.

Some information is shown in the Venn diagram.

53% had travelled to France.

Complete the Venn diagram below.



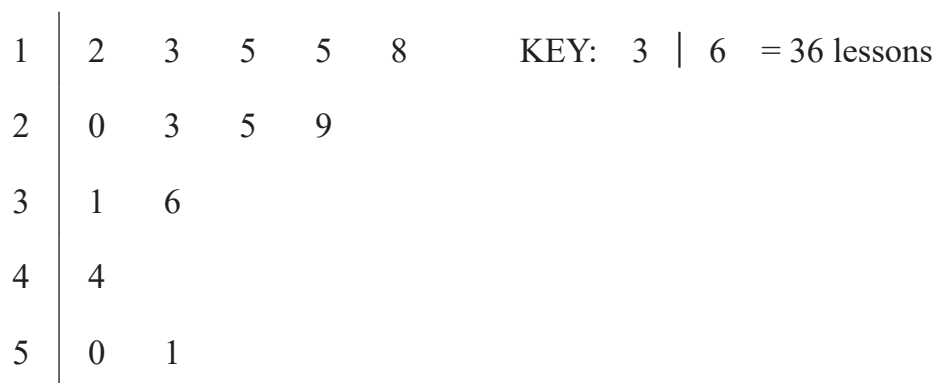
[2]

[Turn over



- 8 A group of people were surveyed about the number of driving lessons they had before passing their driving test.

The results are shown in the stem and leaf diagram.



Alice passes her test.

When her number of driving lessons is included in the stem and leaf diagram, the range increases by 2 and the median decreases by 1

Work out the number of driving lessons Alice had.

Answer _____ [2]



9 Solve the equation

$$\frac{18-x}{3} = 4 - 2x$$

Answer $x =$ _____ [3]



10 In 2022 Rob sold his house for £227 700

This was a loss of 10%

He had bought the house from Lisa in 2019

She had made a profit of 15% in selling to Rob.

Work out how much Lisa originally paid for the house.

Answer £ _____ [4]



11 A ladder is placed against a vertical wall.

To be safe, it must be inclined at an angle between 70° and 80° to the ground.

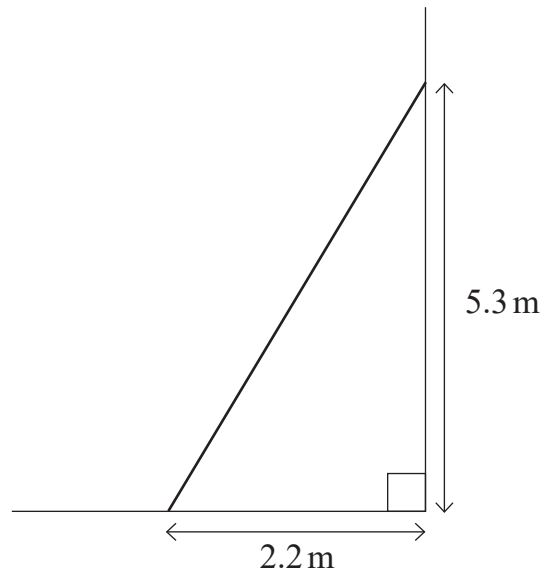


diagram not
drawn accurately

Is the ladder positioned safely?

Show your working out clearly.

Answer _____ [3]

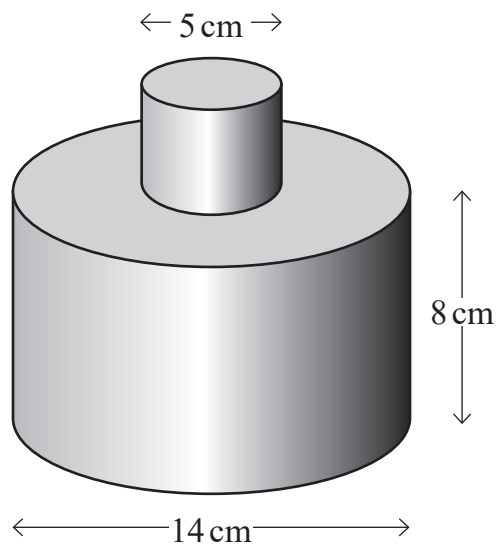
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- 12 A solid is made from a cylinder of diameter 14 cm and height 8 cm, with a smaller cylinder of diameter 5 cm on top.

The total height of the solid is 12 cm.

Calculate the total surface area of the solid.



Answer _____ cm^2 [5]





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13 The grouped frequency table shows the time taken by 50 workers to travel to work.

Journey time (t mins)	Frequency	Journey time $\leq t$ mins	Cumulative frequency
$0 < t \leq 20$	7	20	7
$20 < t \leq 25$	11	25	18
$25 < t \leq 30$	18		
$30 < t \leq 35$	9		
$35 < t \leq 45$	4		
$45 < t \leq 60$	1		

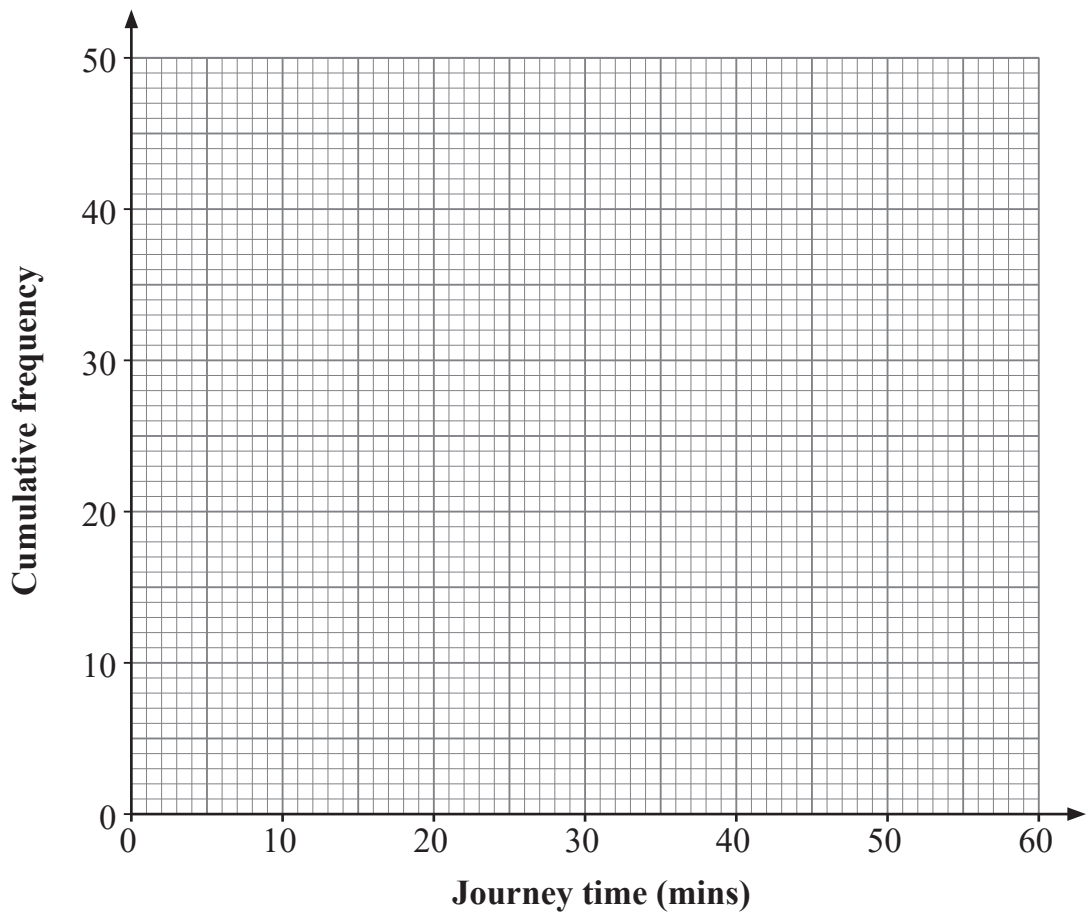
(a) Complete the table above.

[1]



(b) Draw the cumulative frequency graph on the grid below.

[2]



(c) Use your graph to estimate the number of journeys that took between 24 and 38 minutes.

Answer _____ [2]

[Turn over



14 The light on a lighthouse flashes every 50 seconds.

The light on a different lighthouse flashes every 65 seconds.

After they flash together for the first time, how long will it be until they flash together again?

Give your answer in minutes and seconds.

Answer _____ minutes _____ seconds [3]



15 The lines DBF and DAE are tangents to the circle as shown.

The lines BC and AC are equal.

Angle CAE = 61°

Use circle theorems to find the following angles, giving reasons for each answer.

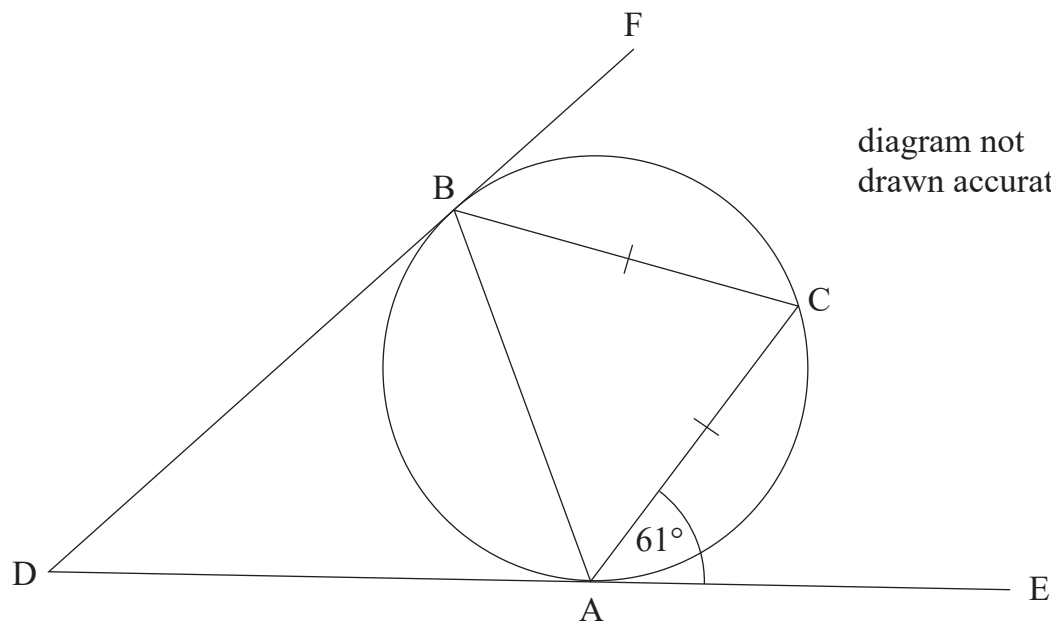


diagram not
drawn accurately

(a) Angle ABC = _____ $^\circ$ because _____
 _____ [2]

(b) Angle DAB = _____ $^\circ$ because _____
 _____ [2]

(c) Angle BDA = _____ $^\circ$ because _____
 _____ [2]

[Turn over



16 A stone is dropped from a bridge and falls at a speed of V m/s.

The distance it falls, S m, is calculated using the formula

$$S = \frac{V^2}{2g}$$

$V = 14.2$ m/s correct to 3 significant figures.

$g = 9.81$ m/s² correct to 3 significant figures.

Find the maximum possible distance the stone falls.

Answer _____ m [3]



17 Find the equation of the line perpendicular to $y = 3x + 2$ which passes through the point $(-3, 2)$.

Answer _____ [4]

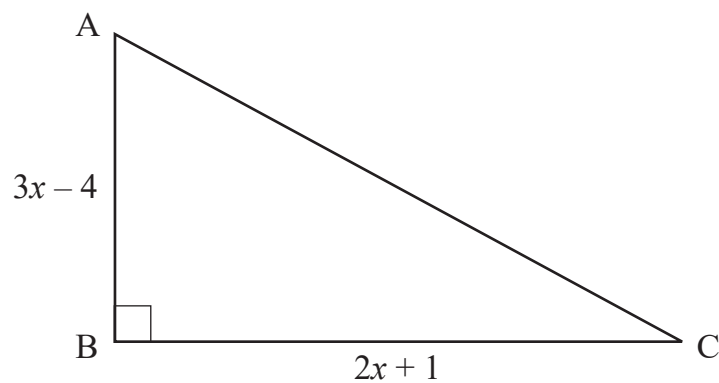


18 ABC is a right-angled triangle.

$$AB = (3x - 4) \text{ cm.}$$

$$BC = (2x + 1) \text{ cm.}$$

The area of ABC is 10.5 cm^2



(a) Show that $6x^2 - 5x - 25 = 0$

[3]



(b) Hence find the lengths of the lines AB and BC.

Answer AB = _____ cm

Answer BC = _____ cm [3]

[Turn over



19 Simplify fully

$$\frac{2x^2 - 32}{3x^2 - 11x - 4}$$

Answer _____ [5]

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20 Solve the following equation, giving your answers to two decimal places.

$$\frac{2x}{3x+1} + \frac{4}{x-1} = \frac{5}{2}$$

Answer $x =$ _____ [8]

[Turn over

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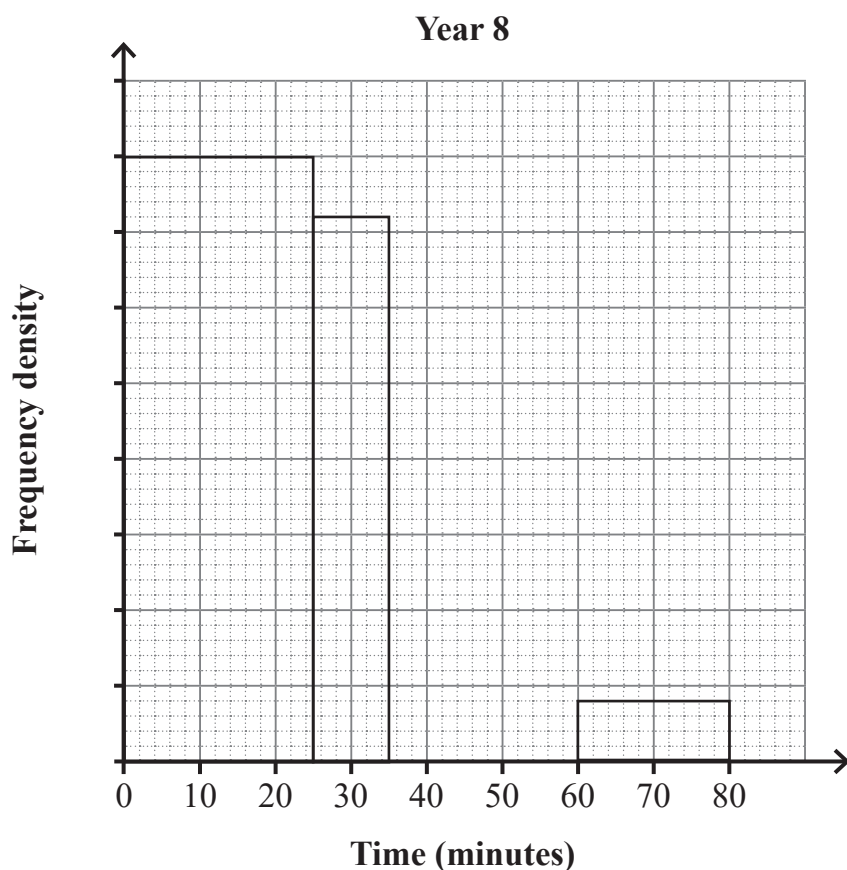
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21 Year 8 pupils were surveyed on how much time they spent doing homework on one night.

The incomplete table and histogram show some information on this.

No student spent longer than 80 minutes on their homework.

Time, t (minutes)	Frequency
$0 < t \leq 25$	100
$25 < t \leq 35$	
$35 < t \leq 50$	24
$50 < t \leq 60$	12
$60 < t \leq 80$	



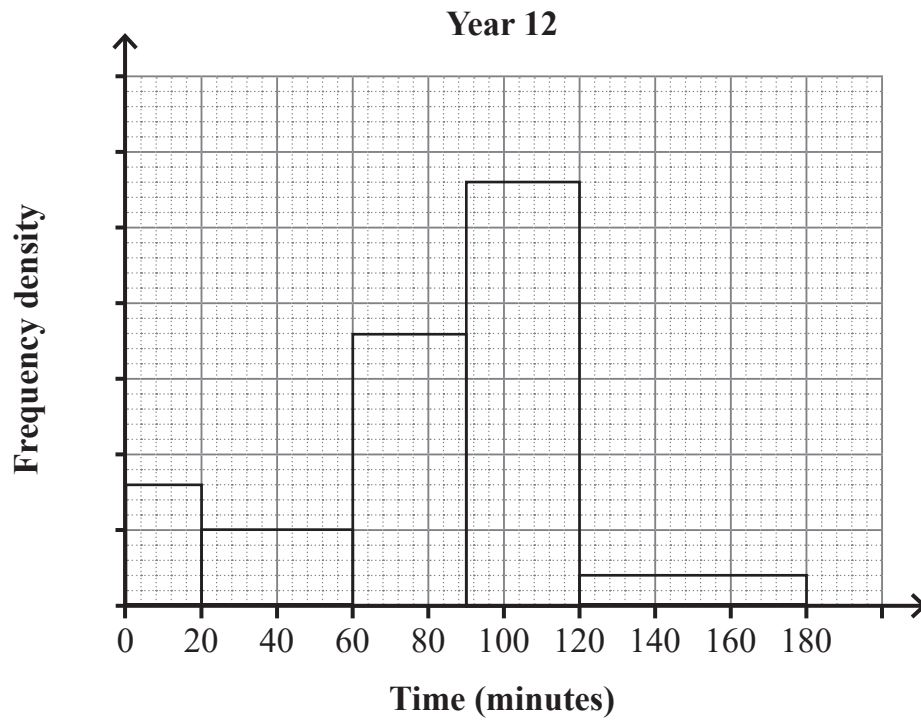
(a) Use the table to complete the histogram. [2]

(b) Use the histogram to complete the table. [2]

[Turn over



The following histogram shows the time spent on homework by Year 12 students on the same night.



36 Year 12 students spent less than 60 minutes working on their homework.

(c) Find the mean time spent on homework by Year 12 students.

Answer Mean = _____ minutes [6]



(d) A stratified sample is taken from the Year 12 students.

(i) Given that 14 students are sampled from the $90 < t \leq 120$ group, calculate the number of students in the sample.

Answer _____ [2]

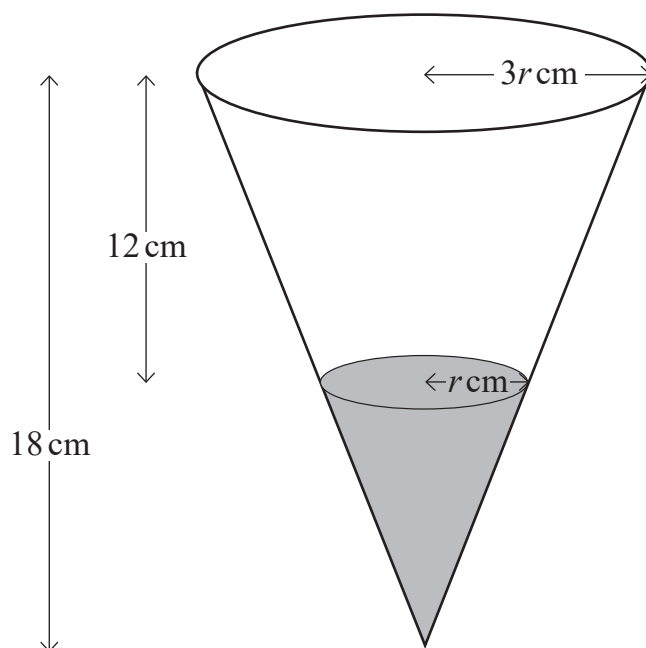
(ii) Estimate the number of students **in the sample** who spent more than 150 minutes on homework.

Answer _____ [2]

[Turn over



22 An ice-cream cone is filled with chocolate at the bottom, as shown in the diagram.



The radius of the circle at the top of the chocolate is r cm and the radius of the circle at the top of the cone is $3r$ cm.

The height of the ice-cream cone is 18 cm and the distance between the top of the cone and the chocolate is 12 cm.

The volume of space left in the cone is 196 cm^3



Calculate the diameter of the cone.

Answer $d =$ _____ cm [7]

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Question Number	Marks
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