



Centre Number

71	
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Candidate Number

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General Certificate of Secondary Education  
2013

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## Mathematics

Unit T3  
(With calculator)  
Higher Tier



[GMT31]

MV18

TUESDAY 11 JUNE 9.15 am–11.15 am

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### TIME

2 hours, plus your additional time allowance.

### 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.**

Complete in blue or black ink only.

Answer **all twenty-six** questions.

Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.

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

## INFORMATION FOR CANDIDATES

The total mark for this paper is 100.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Functional Elements will be assessed in this paper.

Quality of written communication will be assessed in

**questions 17 and 26.**

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

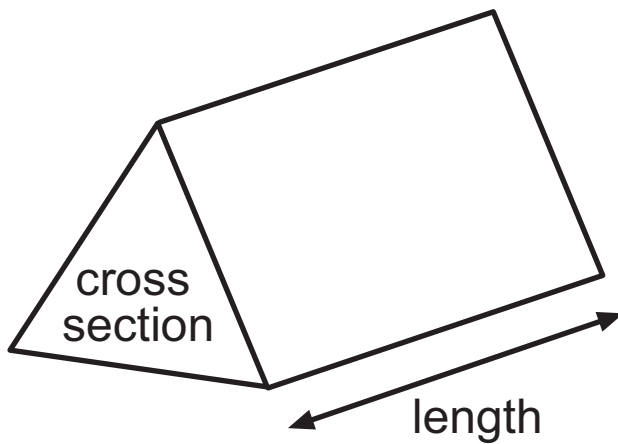
The Formula Sheet is on pages 4 and 5.

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**(Questions start on page 6)**

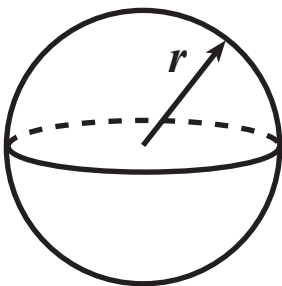
# Formula Sheet

**Volume of prism = area of cross section  $\times$  length**



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

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



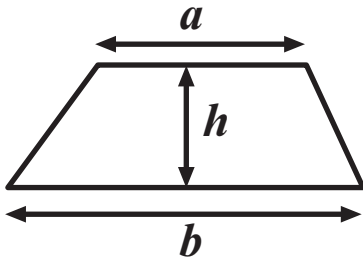
## Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

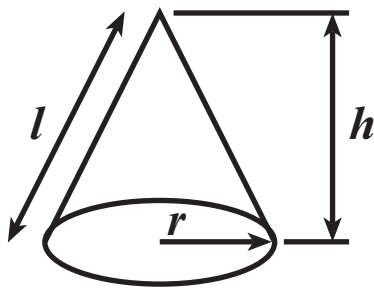
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

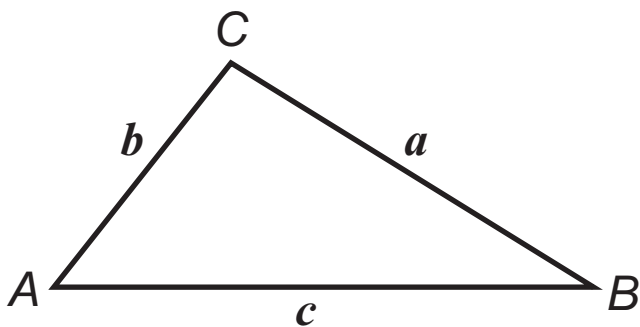


**Volume of cone**  $= \frac{1}{3} \pi r^2 h$

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



**In any triangle  $ABC$**

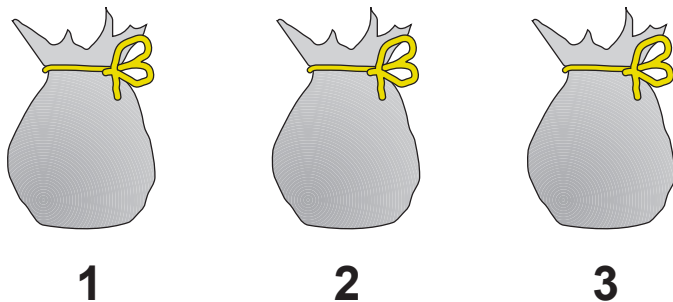


**Area of triangle**  $= \frac{1}{2} ab \sin C$

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

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

1



Bag 1 contains  $m$  marbles.

Bag 2 contains 5 less marbles than Bag 1

(a) Write down an expression in terms of  $m$  for the number of marbles in Bag 2 [1 mark]

Answer \_\_\_\_\_

Bag 3 contains twice as many as in Bag 1 **plus** the number of marbles that are in Bag 2

(b) Write down an expression in terms of  $m$  for the number of marbles in Bag 3  
Give your answer in its simplest form. [2 marks]

Answer \_\_\_\_\_

The total number of marbles in Bag 3 is 22

- (c) Set up and solve an equation to help find how many marbles are in **Bag 2** [3 marks]

Answer In Bag 2 there are \_\_\_\_\_ marbles

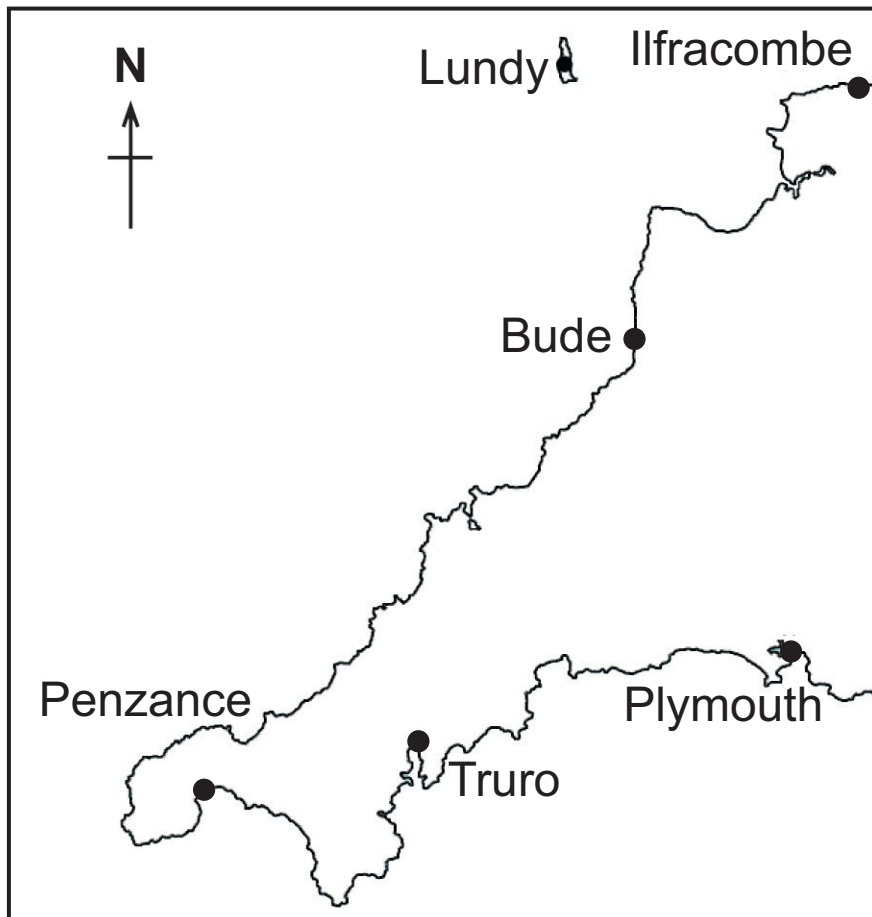
- 2 (a) Solve  $6x + 9 = 11 - 2x$  [3 marks]

Answer \_\_\_\_\_

- (b) Simplify  $\frac{x}{3} - \frac{x}{5}$  [2 marks]

Answer \_\_\_\_\_

3



Boscastle is on a bearing of  $218^\circ$  from Bude.

Boscastle is on a bearing of  $310^\circ$  from Plymouth.

Locate the position of Boscastle on the map above. Indicate Boscastle with a point marked B. [3 marks]



- 4 (a) Show how to work out the answer to the following without using a calculator. [2 marks]

$$\frac{3}{8} \div \frac{3}{4}$$

- (b) What percentage is £24 of £320? [2 marks]

Answer \_\_\_\_\_ %

- 5** The correlation in a scatter graph may be described as one of the following:

no correlation      positive correlation      negative correlation

Write down the type of correlation you would expect to find in scatter graphs which show the following information:

- (a)** average daily temperature and cold drinks sales, [1 mark]

Answer \_\_\_\_\_

- (b)** marks in a test and distance travelled to school, [1 mark]

Answer \_\_\_\_\_

- (c)** number in family and average weekly amount spent on food, [1 mark]

Answer \_\_\_\_\_

- (d)** average speed for journey to school and average time for journey to school. [1 mark]

Answer \_\_\_\_\_

- 6** The heights (in centimetres) of fifteen girls in a Dance Class are:

151   173   157   165   166   168   170   169  
169   169   168   171   154   176   177

Construct a stem and leaf diagram to illustrate these heights. [3 marks]

7

**Primus Energy Gas Tariff**

Standing charge is 7.93p per day

Gas used is 4.433p per unit

Marie's gas meter was read on 1<sup>st</sup> March.

The reading was

0	1	9	5	7
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The meter was read again on 1<sup>st</sup> June.

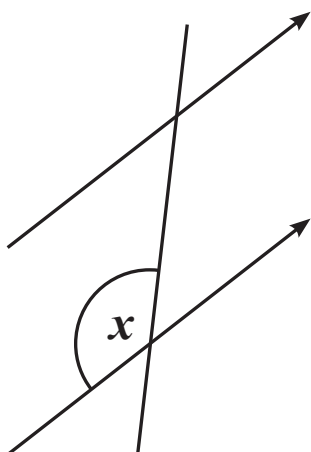
The reading was

0	4	1	0	8
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Calculate the total gas bill that Marie will have to pay for the 92 days from 1<sup>st</sup> March, if VAT is charged at 5% on the total. [5 marks]

Answer £ \_\_\_\_\_

- 8 (a) Mark the angle corresponding to angle  $x$  on the diagram. [1 mark]



- (b) Write down the size of angle  $y$ . [1 mark]

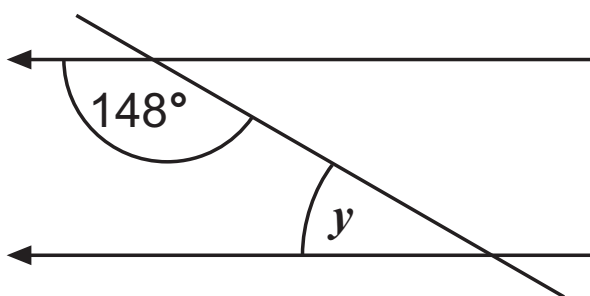


diagram not  
drawn  
accurately

Answer \_\_\_\_\_°

- (c) Calculate the sum of the interior angles of a regular octagon. [2 marks]

Answer \_\_\_\_\_°

(d) Is it possible to have a regular polygon with an interior angle of  $130^\circ$ ? [2 marks]

**Explain your answer.**

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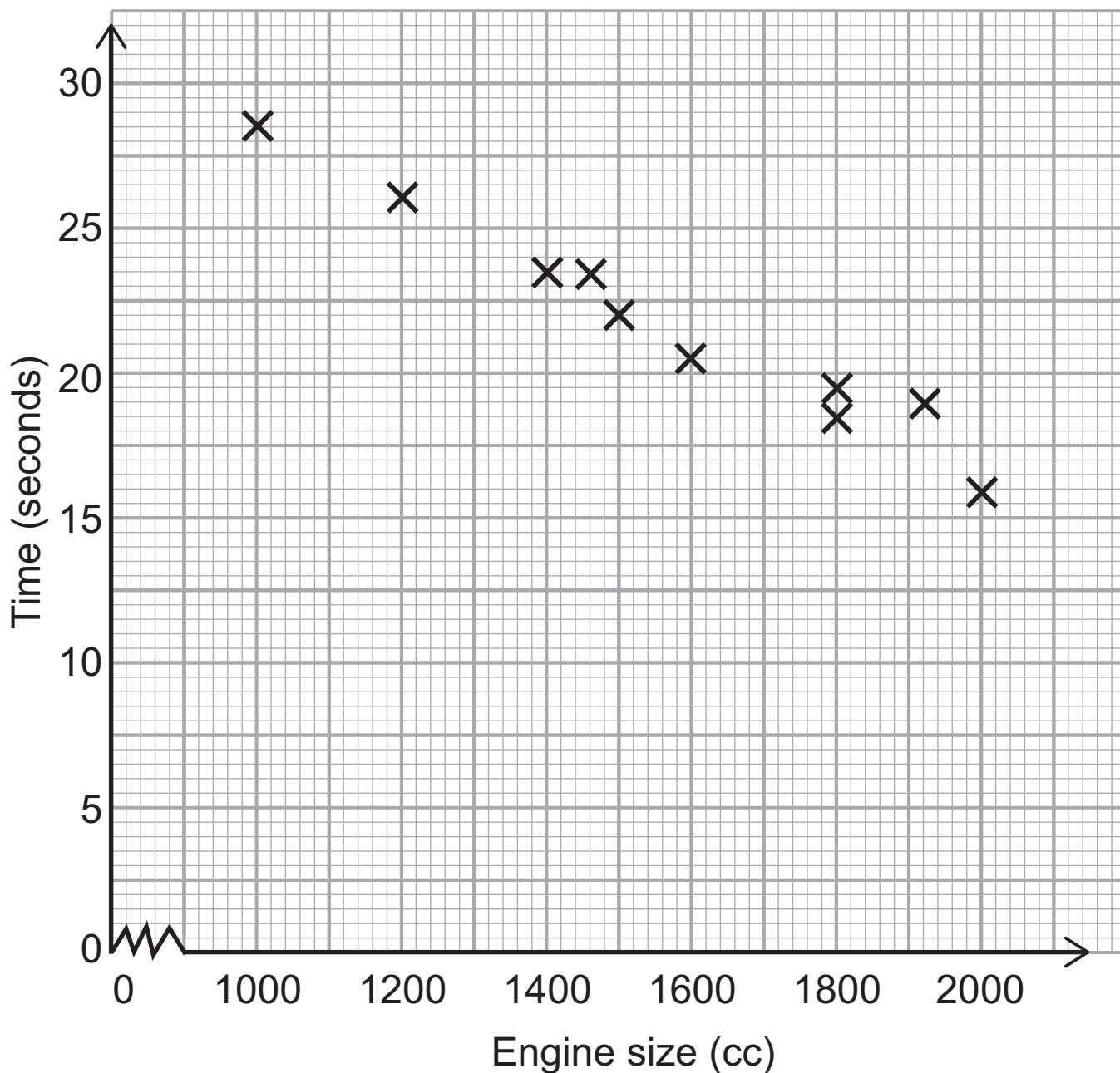
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**9** Convert  $62\,000\text{ cm}^2$  into  $\text{m}^2$ . [2 marks]

Answer \_\_\_\_\_  $\text{m}^2$

- 10** Ten models of car were tested to find how long it took each car to travel 500 metres. The times and engine sizes are plotted below.



**(a)** Draw a line of best fit. [1 mark]

**(b)** Use your line to predict the time for a car with engine size 1700 cc to travel 500 metres. [1 mark]

Answer: \_\_\_\_\_ seconds

11 Solve  $\frac{2x}{5} - 3 = 7$  [2 marks]

Answer  $x =$  \_\_\_\_\_

12 Derek is trying to find a number  $x$  such that  $x^2 + \sqrt{x} = 90$

He knows the answer is between 9 and 10

Use trial and improvement to find Derek's number to

**2 decimal places.** [4 marks]

**Show your work.**

Answer    Derek's number is \_\_\_\_\_



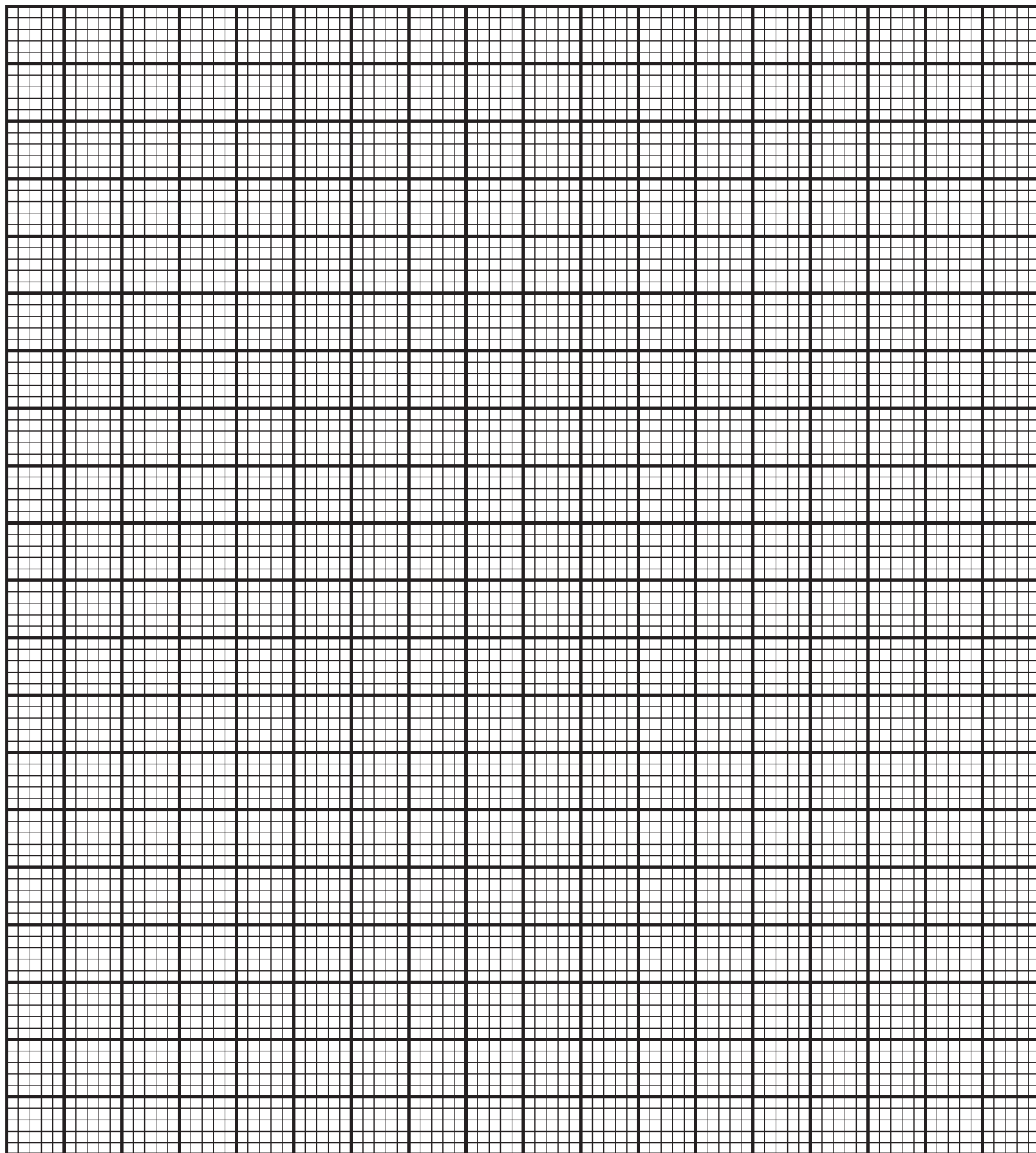
**13** Expand  $y(4 - 2y)$  [2 marks]

Answer \_\_\_\_\_

- 14** The number of items that 80 students had in their sports bags was recorded.  
The numbers were grouped as shown in the table.

Number ( $n$ )	Frequency
$2 < n \leq 4$	8
$4 < n \leq 6$	24
$6 < n \leq 8$	18
$8 < n \leq 10$	17
$10 < n \leq 12$	9
$12 < n \leq 14$	4

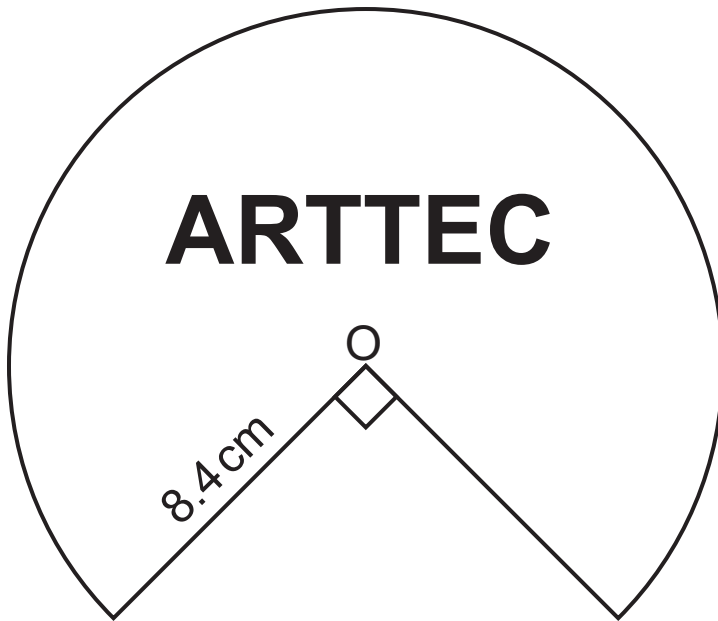
(a) Show this information on a frequency polygon. [3 marks]



(b) Which class interval contains the median number? [1 mark]

Answer \_\_\_\_\_

- 15 A company logo is shown below. It is  $\frac{3}{4}$  of a circle centre O.



Calculate the perimeter of the logo. [3 marks]

Answer \_\_\_\_\_ cm

**16** The times that 100 sportsmen spent playing golf one week were recorded.

The times were grouped as shown in the table.

Time $t$ (hours)	Frequency		
$0 < t \leq 4$	4		
$4 < t \leq 8$	19		
$8 < t \leq 12$	32		
$12 < t \leq 16$	18		
$16 < t \leq 20$	16		
$20 < t \leq 24$	11		

Calculate an estimate for the mean time. [4 marks]

Answer \_\_\_\_\_ hours

**Quality of written communication will be assessed in this question.**

**17** The dimensions of three triangles are given:

<b>Triangle A:</b>	5 cm	6 cm	8 cm
<b>Triangle B:</b>	5 cm	12 cm	13 cm
<b>Triangle C:</b>	5 cm	10 cm	12 cm

Only one of these triangles is right-angled.  
Which one? [3 marks]  
Explain your answer clearly.

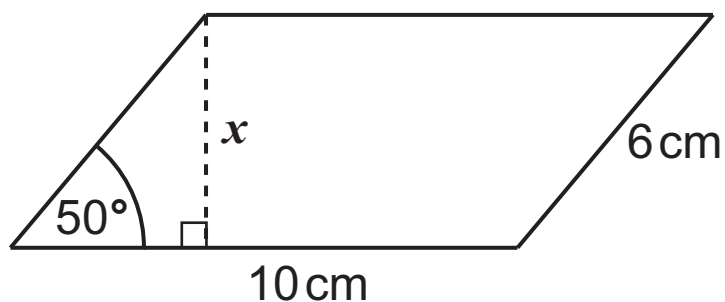
Triangle: \_\_\_\_\_ because \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 18 (a)** Calculate the exact value of  $4\frac{1}{6} - 2\frac{5}{8}$  without using a calculator. [3 marks]  
**Show your work.**

- (b)** Conor bought a new car for £23 000  
Each year the value of the car depreciated by 15%.  
Work out the value of the car at the end of 3 years,  
giving your answer to the nearest pound. [4 marks]

Answer £ \_\_\_\_\_

- 19** A parallelogram has sides of 6 cm and 10 cm, with an angle of  $50^\circ$  between the sides.  
Calculate the height  $x$  of the parallelogram. [3 marks]



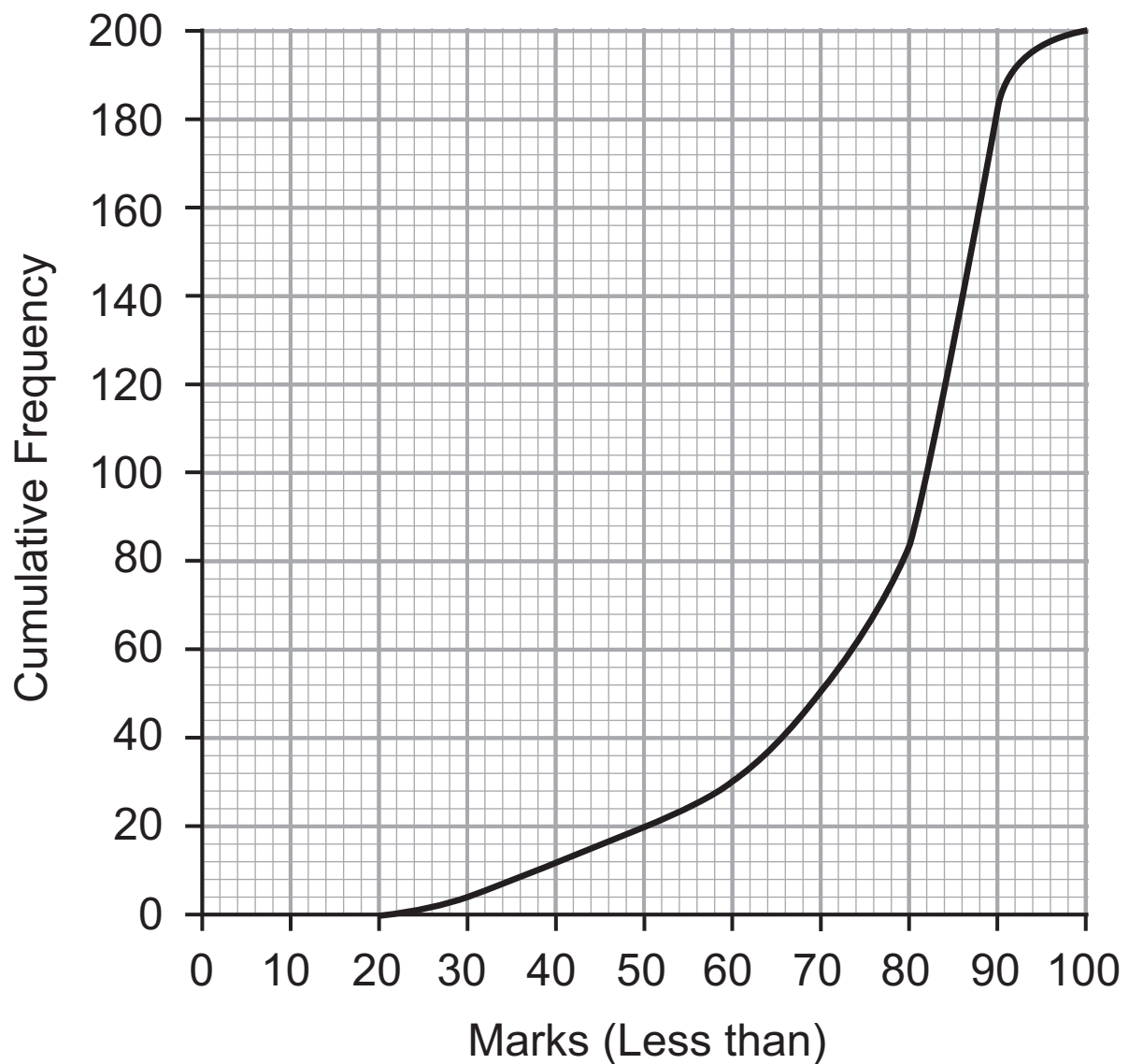
Answer  $x$  \_\_\_\_\_ cm



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**(Questions continue overleaf)**

- 20** The graph below shows the cumulative frequency of marks obtained in a spelling test.



- (a)** Use the graph to estimate the median. [1 mark]

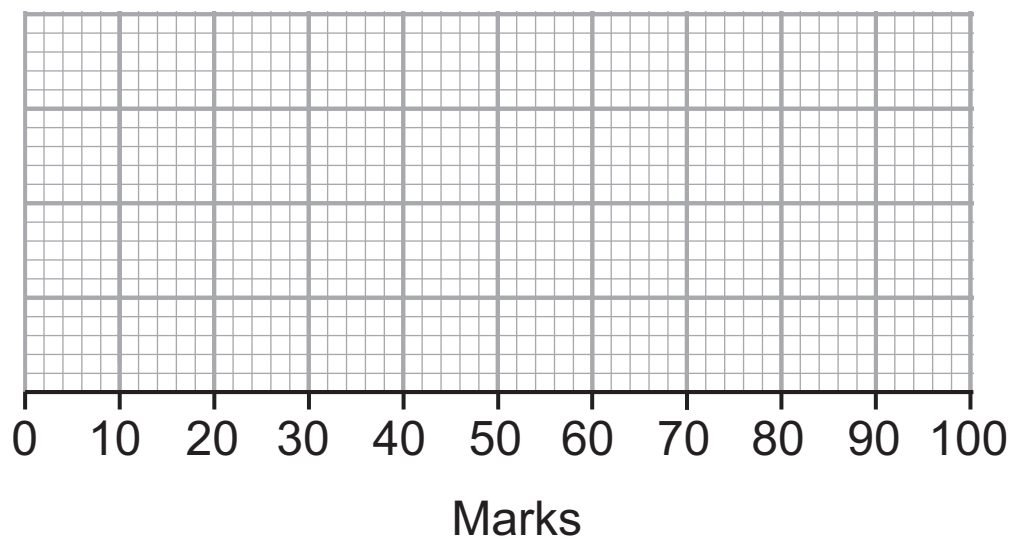
Answer \_\_\_\_\_

**(b)** The pass mark is 75

Estimate how many passed the spelling test. [2 marks]

Answer \_\_\_\_\_

**(c)** From the graph on page 26 draw a box plot. [3 marks]



**21 (a)** Solve the simultaneous equations [2 marks]

$$5x - y = 9$$

$$-2x + y = 3$$

**Show your working clearly.**

Answer  $x =$  \_\_\_\_\_  $y =$  \_\_\_\_\_

**(b)** Solve  $\frac{2}{3}(1 - x) - \frac{1}{4}(3x - 1) = 8$  [4 marks]

Answer  $x =$  \_\_\_\_\_

## 22 Factorise

(a)  $15xy - 5y^2$  [2 marks]

Answer \_\_\_\_\_

(b)  $x^2 - 9x - 36$  [2 marks]

Answer \_\_\_\_\_

23 What is the Highest Common Factor (HCF) of 210 and 252? [2 marks]

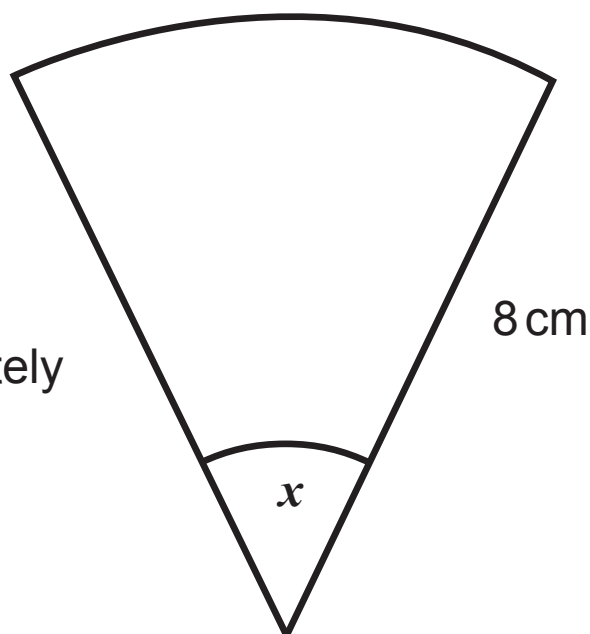
Answer \_\_\_\_\_

- 24** Tony opened a savings account with the Western Bank.  
After one year, the bank paid 6% per annum interest into his account.  
The total amount in his account was then £710.20  
Work out the amount of money with which Tony opened the account. [3 marks]

Answer £ \_\_\_\_\_

- 25** The area of the sector is  $20.11 \text{ cm}^2$   
Calculate the angle  $x$ . [4 marks]

diagram not  
drawn accurately



Answer \_\_\_\_\_ °

**Quality of written communication will be assessed in this question.**

- 26** A football pitch is 105 metres long and 68 metres wide.  
The length is measured to the nearest 5 metres.  
The width is measured to the nearest metre.  
Work out the maximum area of the pitch. [3 marks]  
**Show your working.**

Answer \_\_\_\_\_ m<sup>2</sup>

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**THIS IS THE END OF THE QUESTION PAPER**

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## Sources

Pg 8, Q3, Map of the South West tip of England: © Graded examples in Mathematics: Geometry & Trigonometry, by M R Heylings, page 24, published by Schofield & Sims, 1984. ISBN 0721722314





For Examiner's use only	
Question Number	Marks
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<b>Total Marks</b>	
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