Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
2018

Mathematics

Unit T3 **(With calculator)**
Higher Tier

MV18

[GMT31]
THURSDAY 24 MAY, 9.15am–11.15am

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.
Do not write on blank pages.
Complete in black ink only.
Answer **all thirty** questions.
All working should be clearly shown in the spaces provided.
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 **12** and **28**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on pages 4 and 5.

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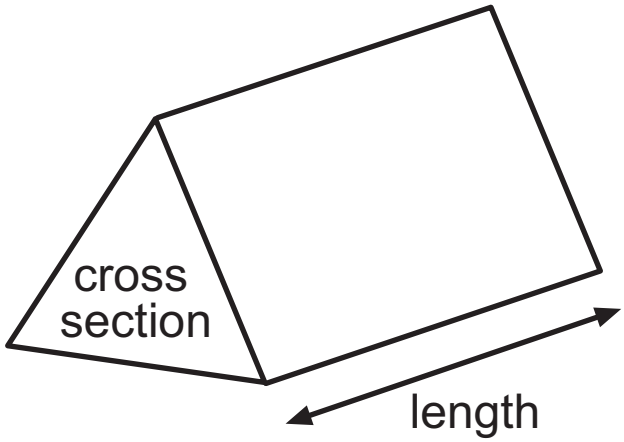
(Questions start on page 6)

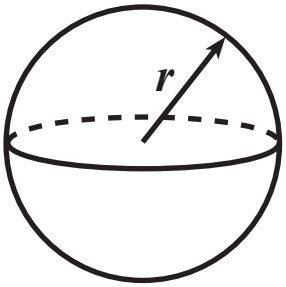
Formula Sheet

Volume of prism = area of cross section × length



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

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



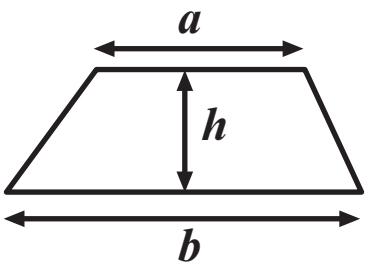
Quadratic Equation

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

where $a \neq 0$, are given by

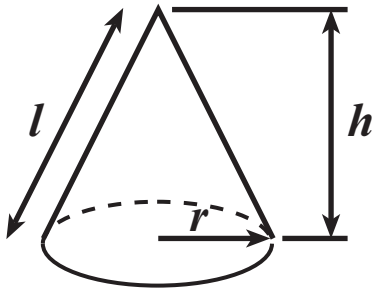
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

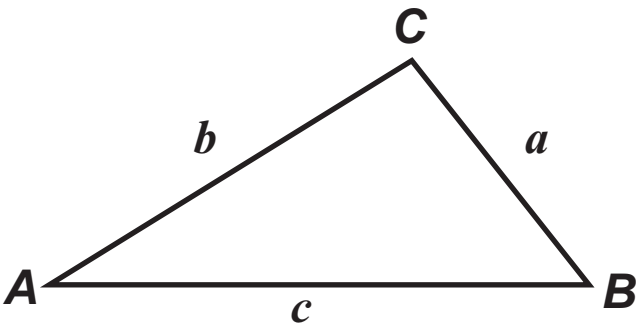


Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle *ABC*



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

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

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

1 There are 1200 pupils in a school.

228 of these pupils are in Year 12

What percentage of pupils in the school are in Year 12?
[2 marks]

Answer _____ **%**

2 Write down what $0.\dot{8}2\dot{3}$ means. [1 mark]

Answer _____

3 Emma carries out an investigation into the cost of food at her school canteen.

She asks a sample of pupils in the queue for the canteen the following question:

"Do you agree that school dinners are value for money?"

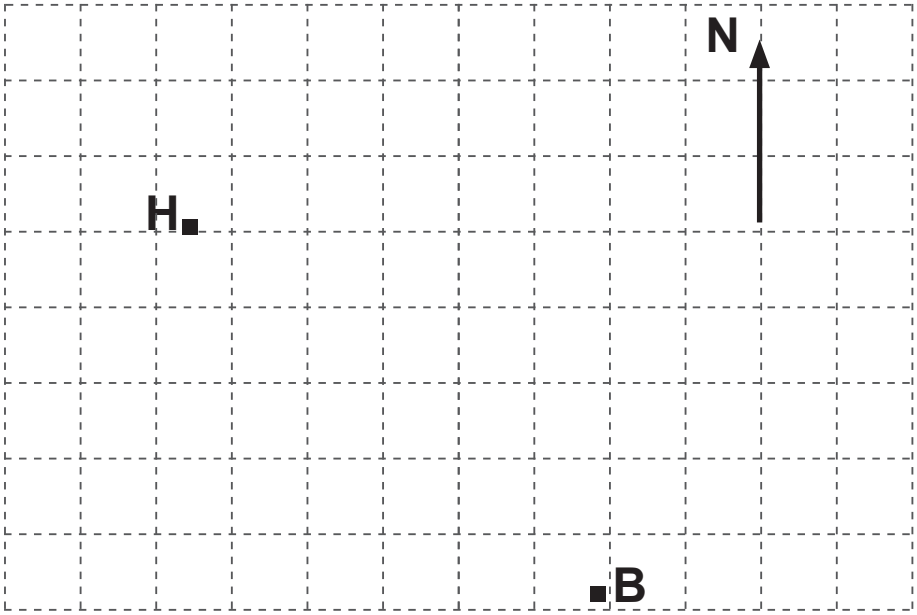
(a) Why is her sample of pupils likely to be biased? [1 mark]

Answer _____

(b) Why is her question biased? [1 mark]

Answer _____

4



The diagram shows the position of a harbour (H) and a fishing boat (B).

Find the bearing of the harbour from the fishing boat.
[1 mark]

Answer _____ °

5 John has a telephone with the following costs.

Line rental: £18.99 per month

Call charge: 5.8p per minute

Last month John made calls lasting 385 minutes.

Work out his telephone bill for last month. [3 marks]

Answer £ _____

6 **(a)** Factorise fully

(i) $12 - 8a$ [1 mark]

Answer _____

(ii) $3b^2 - b$ [1 mark]

Answer _____

(b) Solve $6x - 7 = 2x + 11$ [3 marks]

Answer $x =$ _____

7

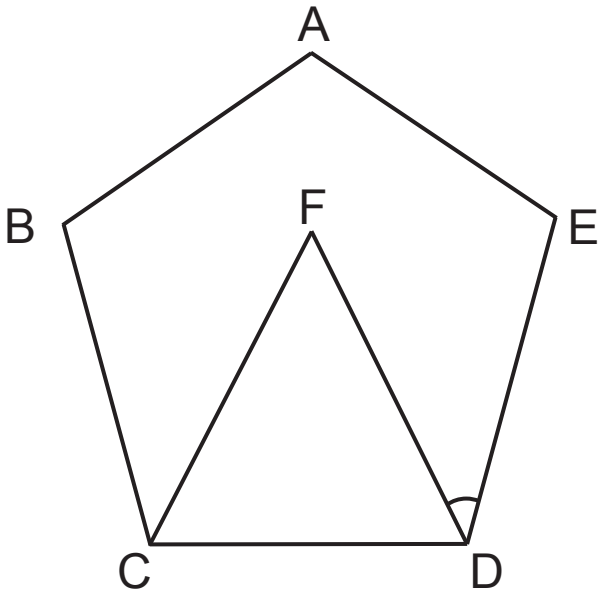


diagram not drawn accurately

ABCDE is a regular pentagon.

CDF is an equilateral triangle.

Calculate the size of angle FDE. [4 marks]

Answer _____ °

8

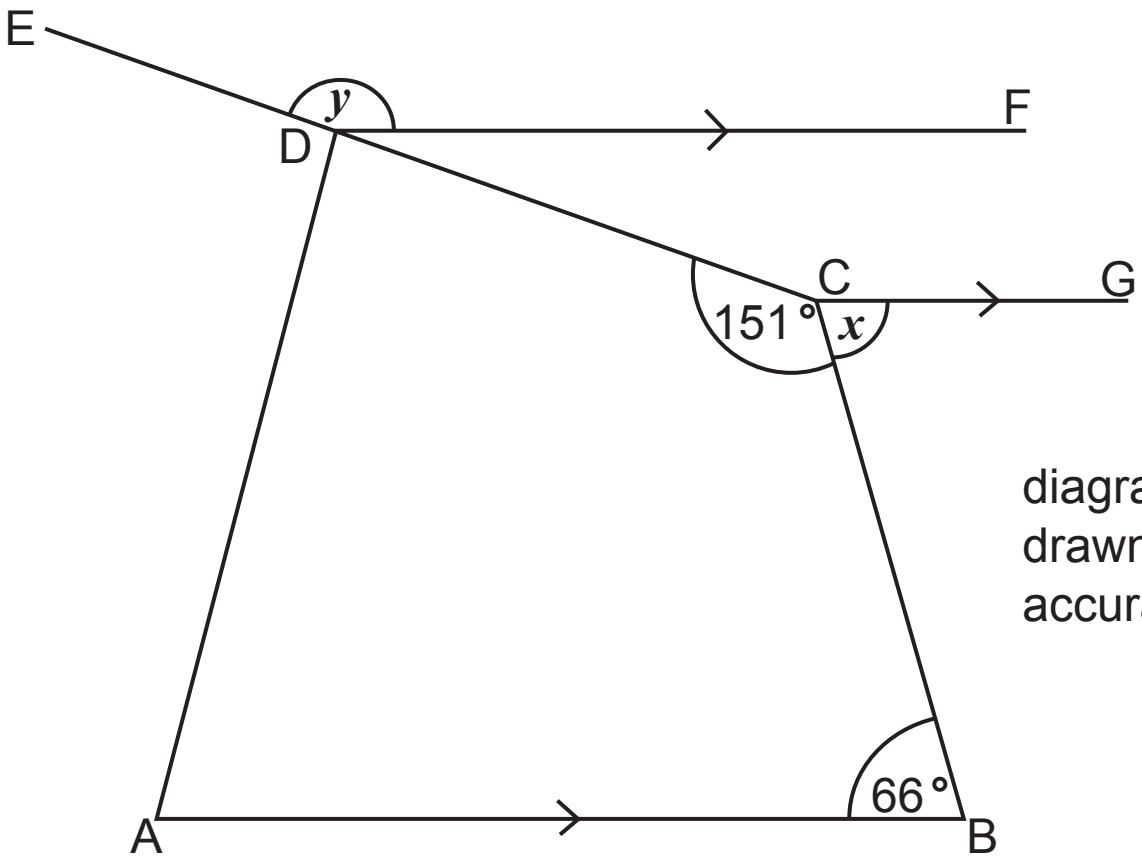


diagram not drawn accurately

EDC is a straight line.

DF, CG and AB are all parallel.

(a) (i) Write down the size of the angle marked x [1 mark]

Answer $x =$ _____ °

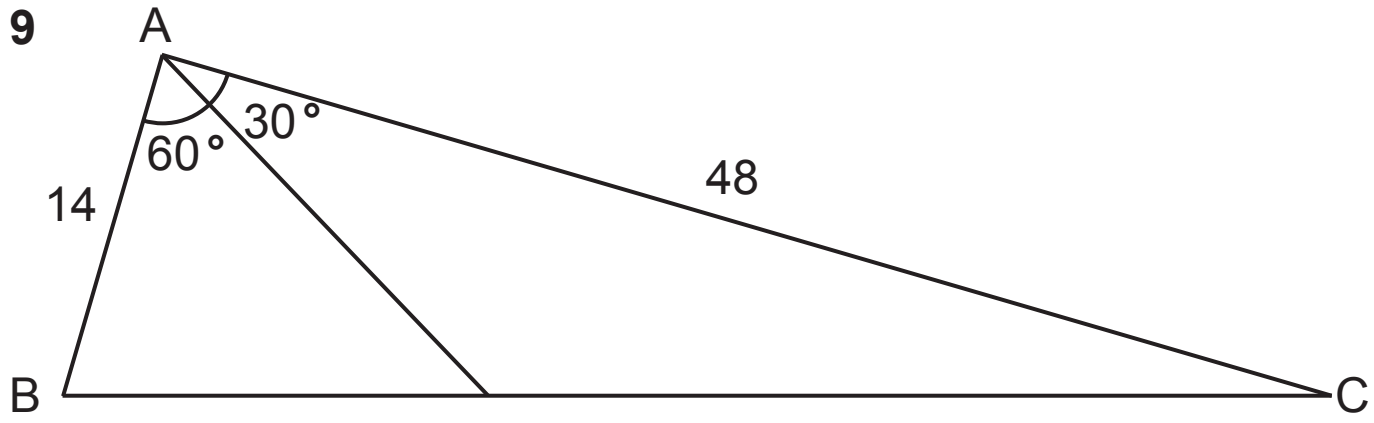
(ii) Give a reason for your answer. [1 mark]

_____

(b) Work out the size of the angle marked y [2 marks]

Answer $y =$ _____ °

9



Calculate the length of the straight line BC. [3 marks]

Answer _____

10

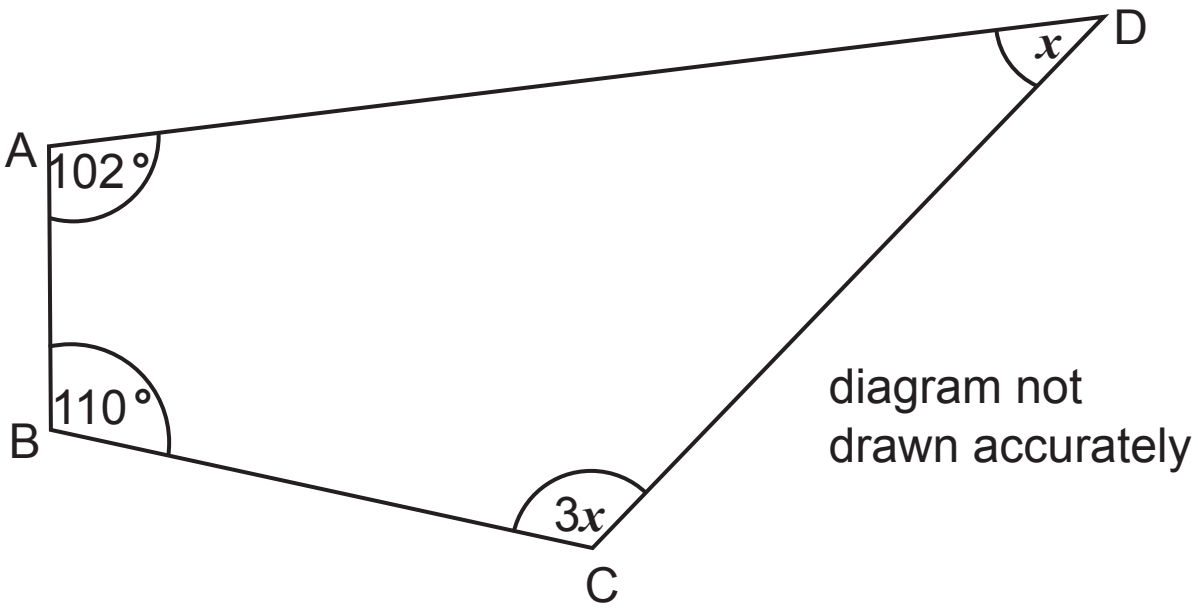


diagram not drawn accurately

ABCD is a quadrilateral.

Work out the size of the **largest** angle in the quadrilateral.
[4 marks]

Answer _____ °

11

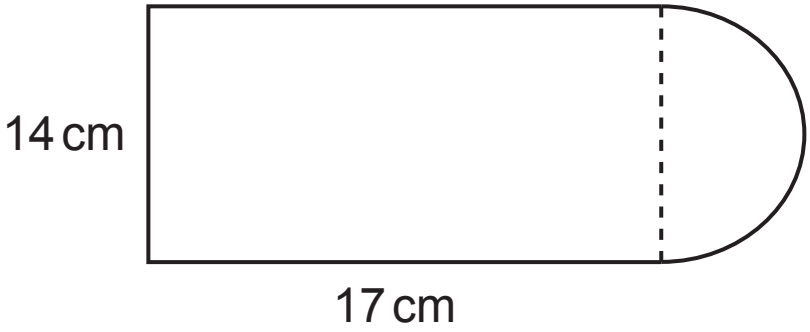


diagram not drawn accurately

This shape is made up of a rectangle and a semicircle.

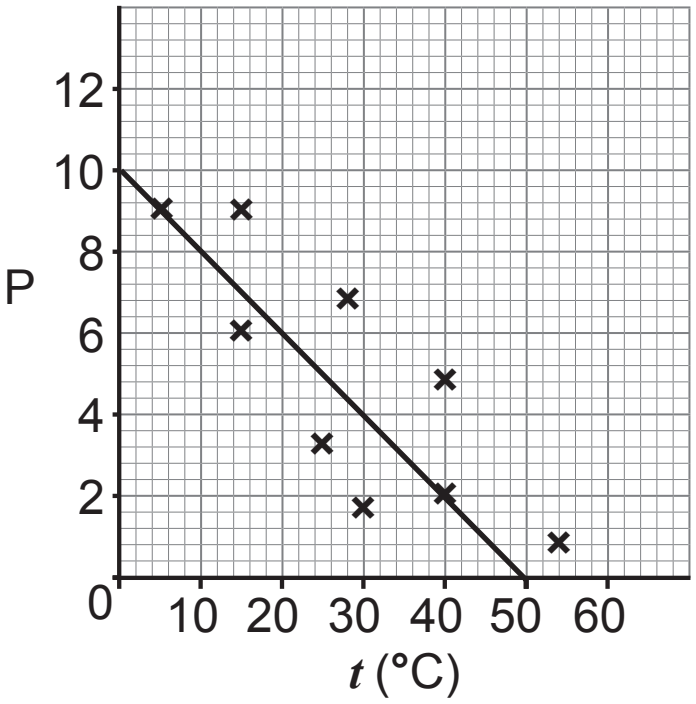
The length of the rectangle is 17 cm and its breadth is 14 cm.

Calculate the perimeter of the shape. [3 marks]

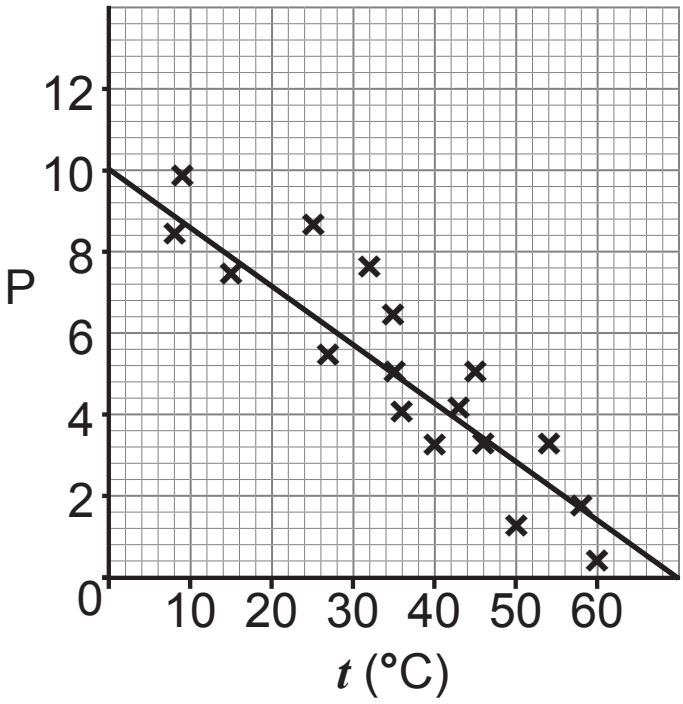
Answer _____ cm

Quality of written communication will be assessed in this question.

12 Kate and Molly carry out a scientific experiment. They each plot their results on a scatter graph and draw a line of best fit. The scatter graphs are shown below.



Kate



Molly

The teacher asks each pupil to use their line of best fit to estimate the value of P when $t = 28$ °C.

Whose graph is likely to give the better estimate? Give two reasons for your answer. [2 marks]

Answer _____ is likely to give the better estimate,

because _____

_____ and _____

_____

13 Janet wants to buy a new washing machine.

There are three shops she can buy the washing machine from.

Triwash	**Powertec**	**Ali's Appliances**
Washing Machine only £485	**Washing Machine £402 plus VAT at 20%**	**Washing Machine 25% off usual price of £645**

Which shop is cheapest for buying the washing machine?
[5 marks]

Show all your working clearly.

Answer _____

14 The first five terms of a sequence are

2, 6, 10, 14, 18, ...

(a) Write down an expression for the n^{th} term of this sequence. [2 marks]

Answer n^{th} term = _____

(b) Which term of this sequence will equal 130? [2 marks]

Answer _____

15 Solve the equation $p + 15 = 2(4p - 3)$ [3 marks]

Answer p = _____

16 Expand and simplify $4(x - 3)^2$ [3 marks]

Answer _____

17 A solution to the equation $4x^2 - x = 41$ lies between $x = 3$ and $x = 4$

Use trial and improvement to find a more accurate solution for this equation, correct to 1 decimal place. [3 marks]

Show all your working clearly.

x	$4x^2 - x$	

Answer x = _____

18 At a concert 40% of the audience are children.
One third of the rest of the audience are men.
There are 120 women in the audience.

Work out the total number of people in the audience.
[3 marks]

Answer _____

19 Amy recorded the times, in seconds, that customers spent in a queue at a supermarket checkout.

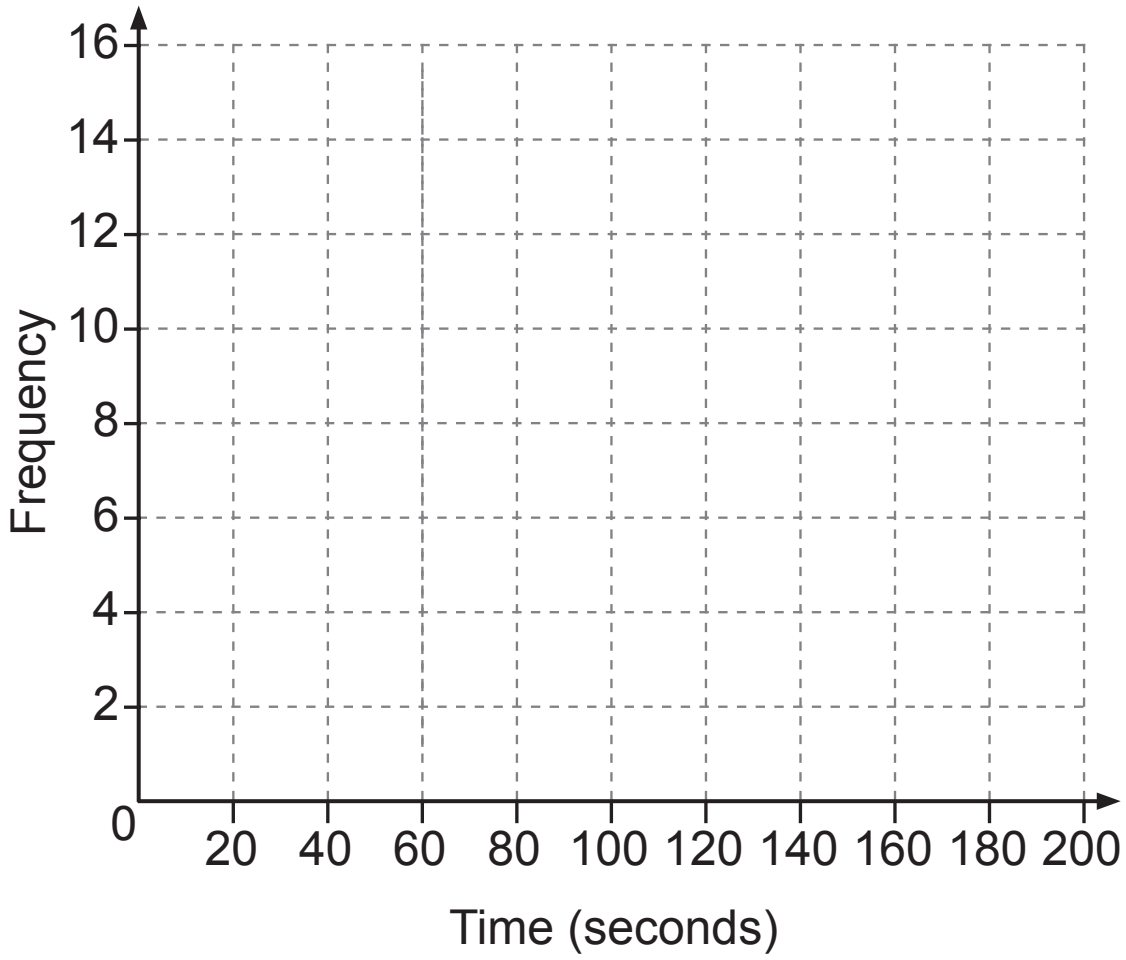
The data is shown in the table below.

Time (t seconds)	Frequency
$0 < t \leqslant 40$	4
$40 < t \leqslant 80$	14
$80 < t \leqslant 120$	10
$120 < t \leqslant 160$	16
$160 < t \leqslant 200$	6

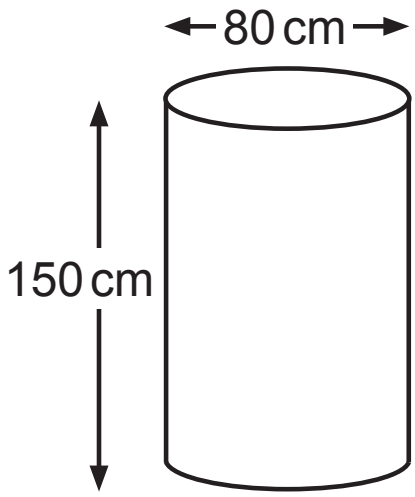
(a) What is the modal class for the data? [1 mark]

Answer _____

(b) Draw a frequency polygon for the data on the grid below. [2 marks]



20 A cylindrical tank has a diameter of 80 cm and a height of 150 cm as shown.



Calculate the volume of water the tank can hold when full.
[4 marks]

Give your answer correct to the nearest litre.

Answer _____ litres

21 Peter, John and Matthew are three brothers.

Peter is 10 years old.

John is x years old.

Matthew is a year younger than twice John's age.

The mean of their ages is 7 years.

Work out John's age. [4 marks]

Answer _____

22 Which average (mean, mode or median) would be most suitable for each set of data? [1 mark for each]

Explain your choice.

(a) The data is not numerical.

Answer _____ because _____

_____

(b) The data is fairly evenly spread but there is one extreme value at the upper end.

Answer _____ because _____

_____

(c) One value appears much more frequently than the others and it is not at the upper or lower end of the data.

Answer _____ because _____

_____

23 A school timetable is being arranged.

The day can be arranged in 30-minute classes or 50-minute classes or 60-minute classes.

No matter which of the three choices is made, the total daily teaching time will be the same.

Ignoring the time for break or lunch, what is the daily teaching time? [4 marks]

You must show all your working.

Answer _____

24 Solve the equation

$$\frac{2x-1}{3} + \frac{x+2}{2} + \frac{x}{6} = 8$$ [5 marks]

Show all your working clearly.

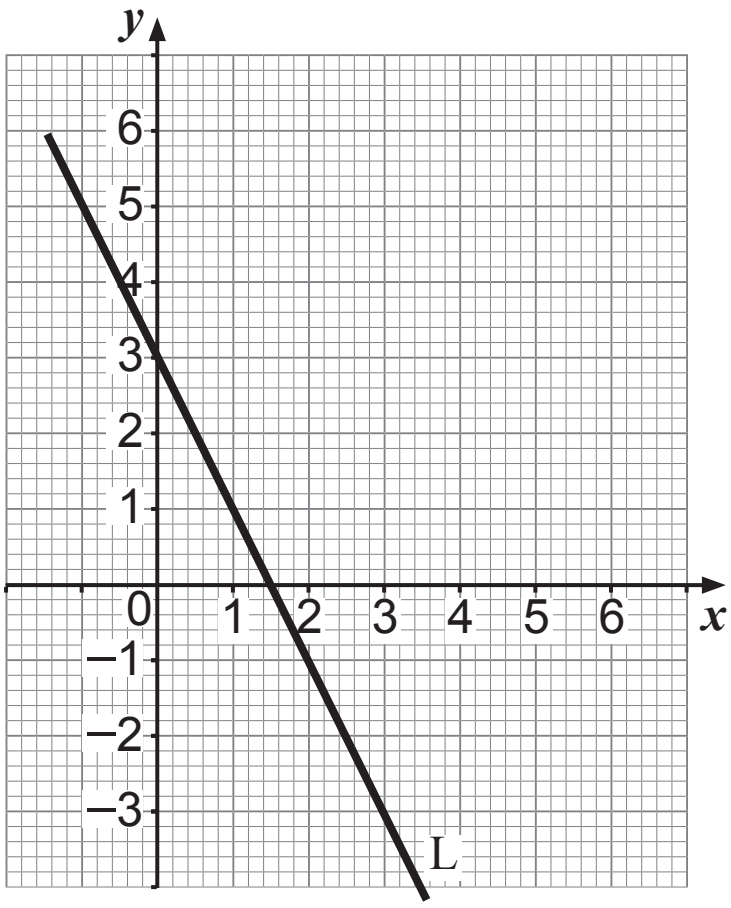
A solution by trial and improvement will not be accepted.

Answer $x =$ _____

25 Factorise $y^2 - 6y + 8$ [2 marks]

Answer _____

26 Find the equation of the straight line L. [3 marks]



Answer _____

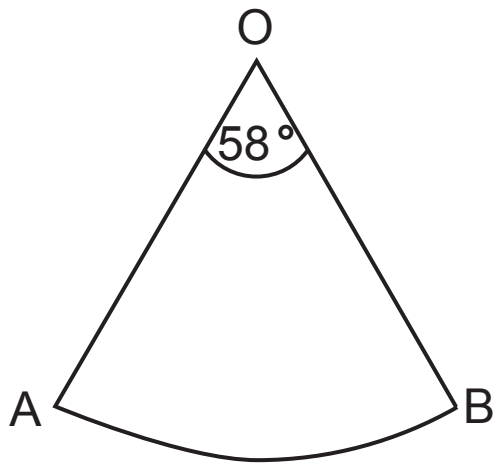
27 A man has mass 74 kg and his son has mass 42 kg, both measured to the nearest kilogram.

What is the maximum difference in mass between the man and his son? [2 marks]

Answer _____ kg

Quality of written communication will be assessed in this question.

28



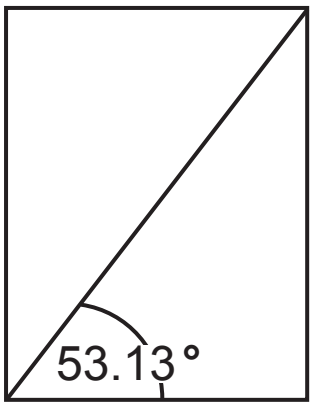
AOB is a sector of a circle with centre O and radius 4cm.

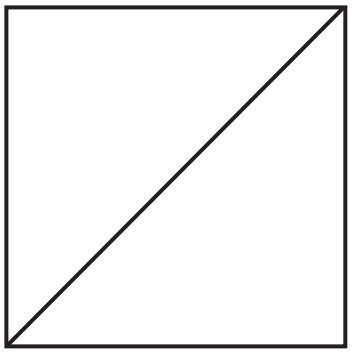
Which is longer, the radius or the arc length AB?
[3 marks]

Show working to justify your answer.

Answer _____

29 A rectangle and a square have the same length of diagonal.





diagrams not drawn accurately

Calculate the length of the side of the square. [6 marks]

Give your answer correct to 1 decimal place.

Answer _____ cm

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(Questions continue overleaf)

30 250 phone calls were made by a company one day.

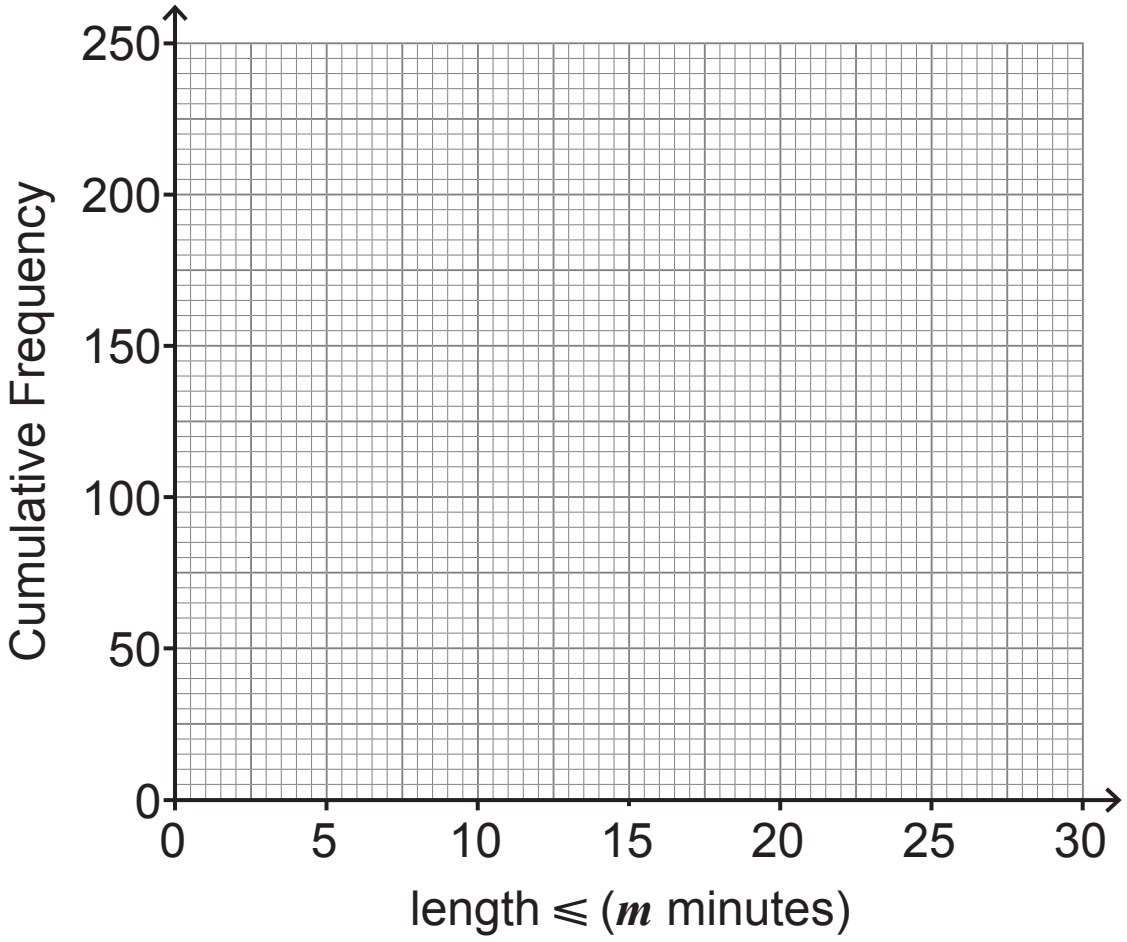
The length of each call was recorded and the results are shown in the table.

Length m in minutes	Number of phone calls
$0 < m \leqslant 5$	38
$5 < m \leqslant 10$	68
$10 < m \leqslant 15$	66
$15 < m \leqslant 20$	43
$20 < m \leqslant 25$	21
$25 < m \leqslant 30$	14

(a) Complete the cumulative frequency table. [1 mark]

Length $\leqslant m$ minutes	Number of phone calls
5	38
10	
15	
20	
25	
30	

(b) Draw the cumulative frequency graph on the grid.
[2 marks]



(c) From your graph estimate

(i) the median length of time, [1 mark]

Answer _____ minutes

(ii) the range of the hundred longest calls. [2 marks]

Answer _____ minutes

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	**Marks**
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