Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

Mathematics

MV18

Unit T4 **(With calculator)**

Higher Tier

[GMT41]

THURSDAY 21 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.
Complete in blue or black ink only.
Answer **all twenty-three** 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.

INSTRUCTIONS 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 **4, 11** and **16(d)**
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on pages 4 and 5.

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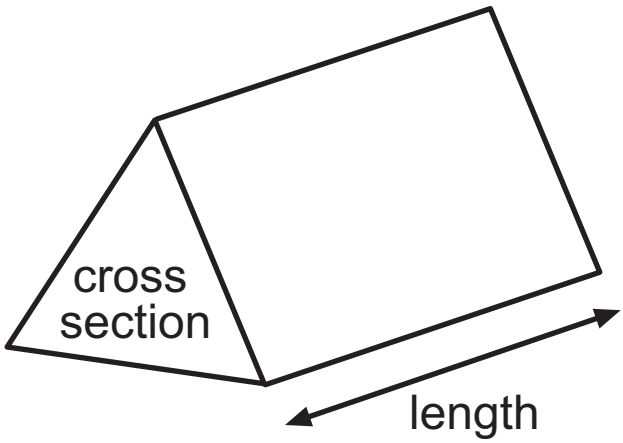
(Questions start overleaf)

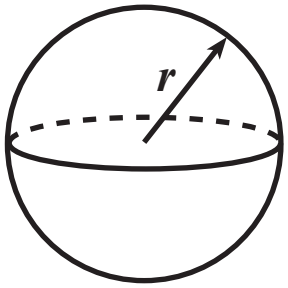
Formula Sheet

Volume of prism = area of cross section × length



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

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



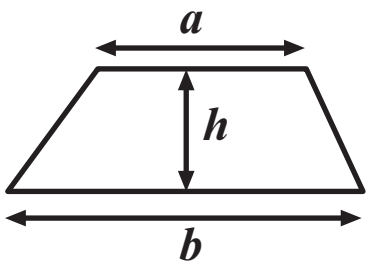
Quadratic Equation

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

where $a \neq 0$, are given by

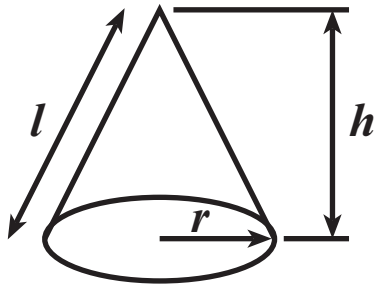
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

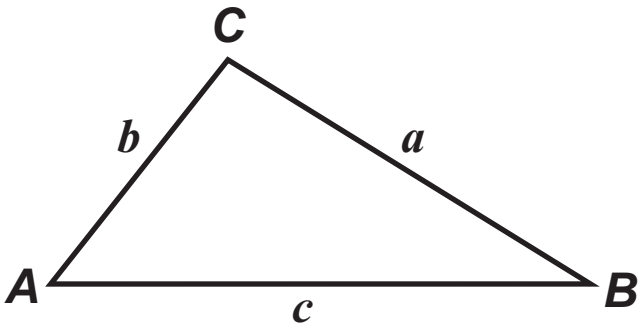


Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$



In any triangle *ABC*



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 The times that students spent doing homework during one week were recorded as shown in the table.

Time t (hours)	Frequency	Cumulative Frequency
$0 < t \leqslant 5$	18	
$5 < t \leqslant 10$	30	
$10 < t \leqslant 15$	32	
$15 < t \leqslant 20$	15	
$20 < t \leqslant 25$	5	

(a) (i) Complete the table. [1 mark]

(ii) Hence draw the cumulative frequency graph on the opposite page. [3 marks]

(b) Use the graph to estimate

(i) the median, [1 mark]

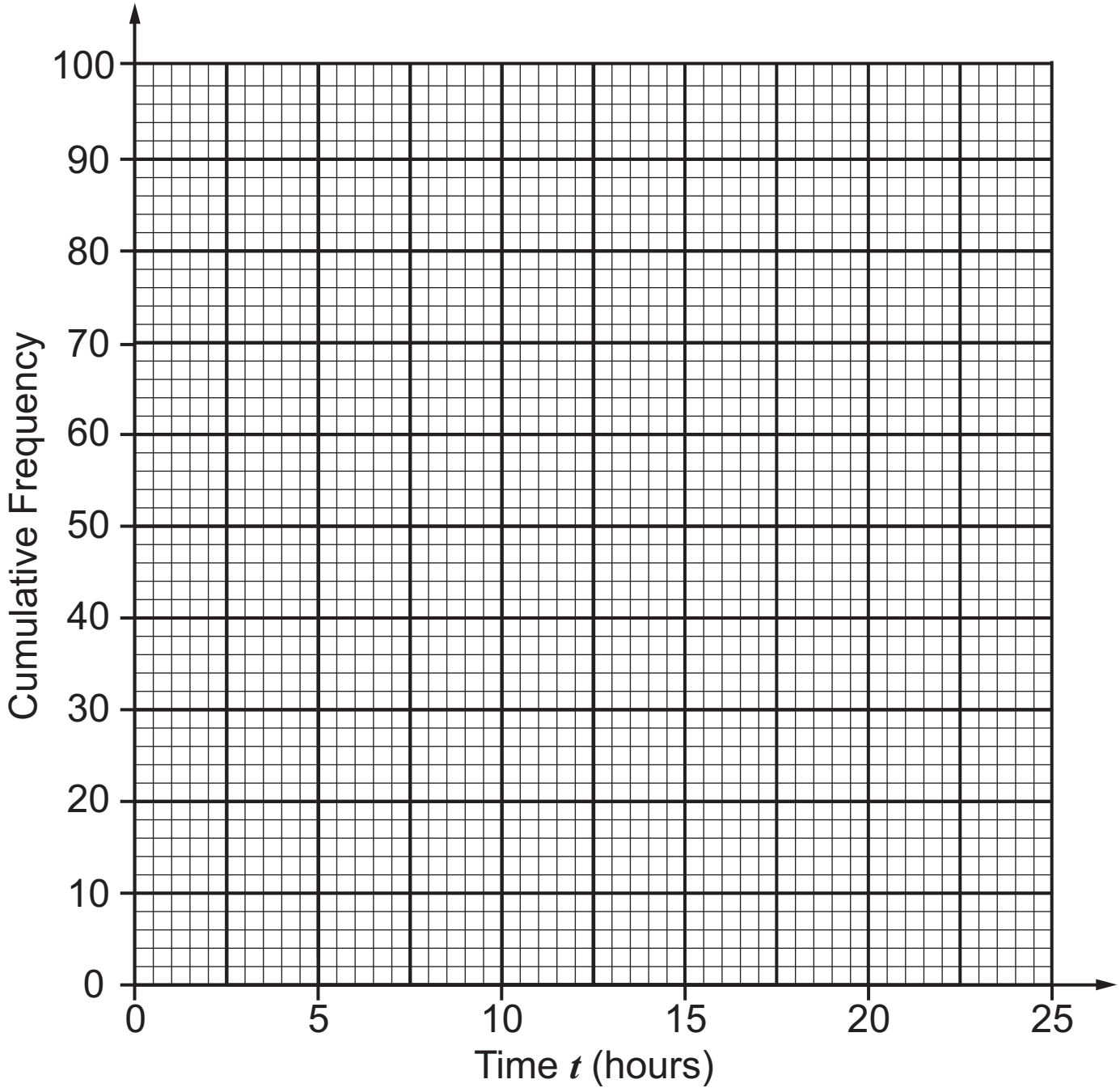
Answer _____

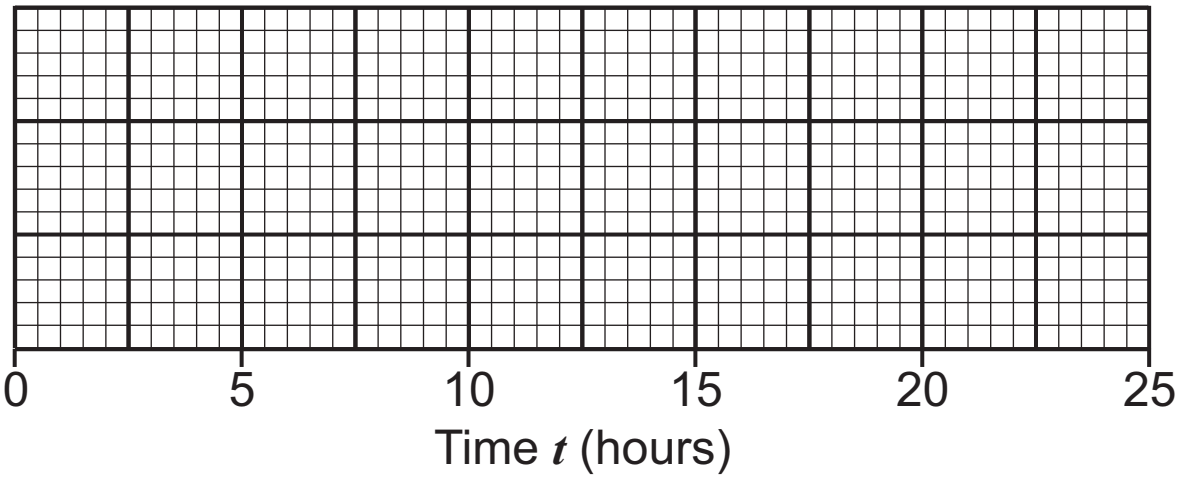
(ii) the inter-quartile range. [2 marks]

Answer _____

(c) The least time was 2 hours and the greatest time was 24 hours.

Draw a box plot on the grid opposite to illustrate this information. [3 marks]





2 Expand and simplify $(3w - 7)(5w - 8)$ [2 marks]

Answer _____

3 The first three terms of a sequence are $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$ . . . . .

Write down the n^{th} term [1 mark]

Answer _____

Quality of written communication will be assessed in this question.

4 Marie gets a basic monthly salary of **£**560 plus a commission of 22**%** of her sales that month.

In April her total salary was **£**3299

Work out her sales in April. [3 marks]

Answer **£** _____

5 Solve the simultaneous equations

$5x + 2y = 19$
$4x - 3y = 29$

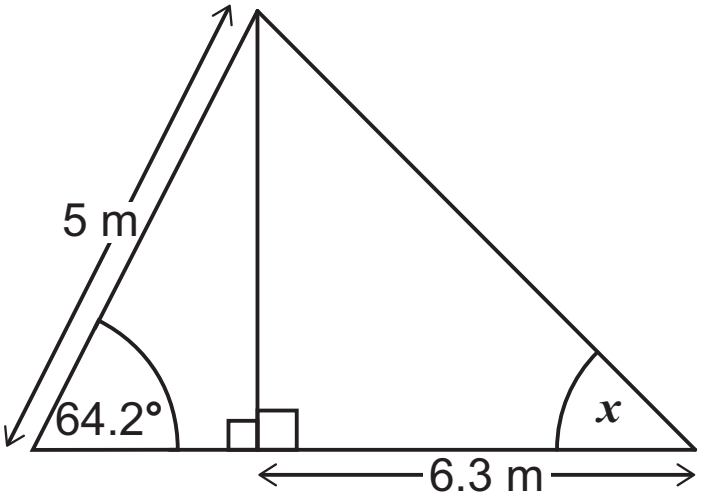
A solution by trial and improvement will not be accepted.
[4 marks]

Answer $x =$ _____ , $y =$ _____

6 Factorise fully $14x^2y - 35x$ [2 marks]

Answer _____

7 Find the value of the angle marked x in the triangle shown.
[6 marks]



Answer x = _____°

8 Solve the equation $\frac{2x+3}{4} + \frac{x-1}{3} = 5$ [4 marks]

Show all your work.

Answer $x =$ _____

9

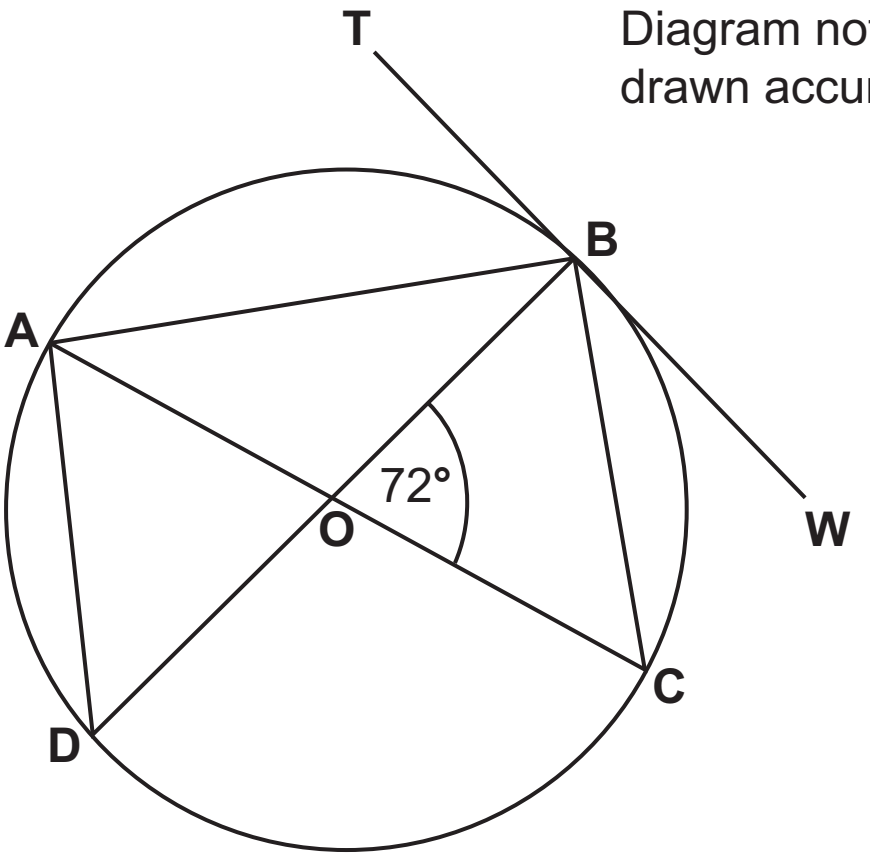


Diagram not drawn accurately

O is the centre of the circle and the tangent **TW** touches the circle at B.

Find the size of the angles

(a) TBO [1 mark]

Answer _____ °

(b) CAB [1 mark]

Answer _____ °

(c) CBW [1 mark]

Answer _____ °

(d) DBC [1 mark]

Answer _____ °

10 Eleven pencils each measuring 13 cm, to the nearest cm, in length are placed end to end.

Find the shortest possible total length and longest possible total length of the pencils.

Shortest length _____ cm [1 mark]

Longest length _____ cm [1 mark]

Quality of written communication will be assessed in this question.

11 Prove that **BC** is parallel to the tangent **TU** in the diagram shown. [3 marks]

Justify each step of your proof.

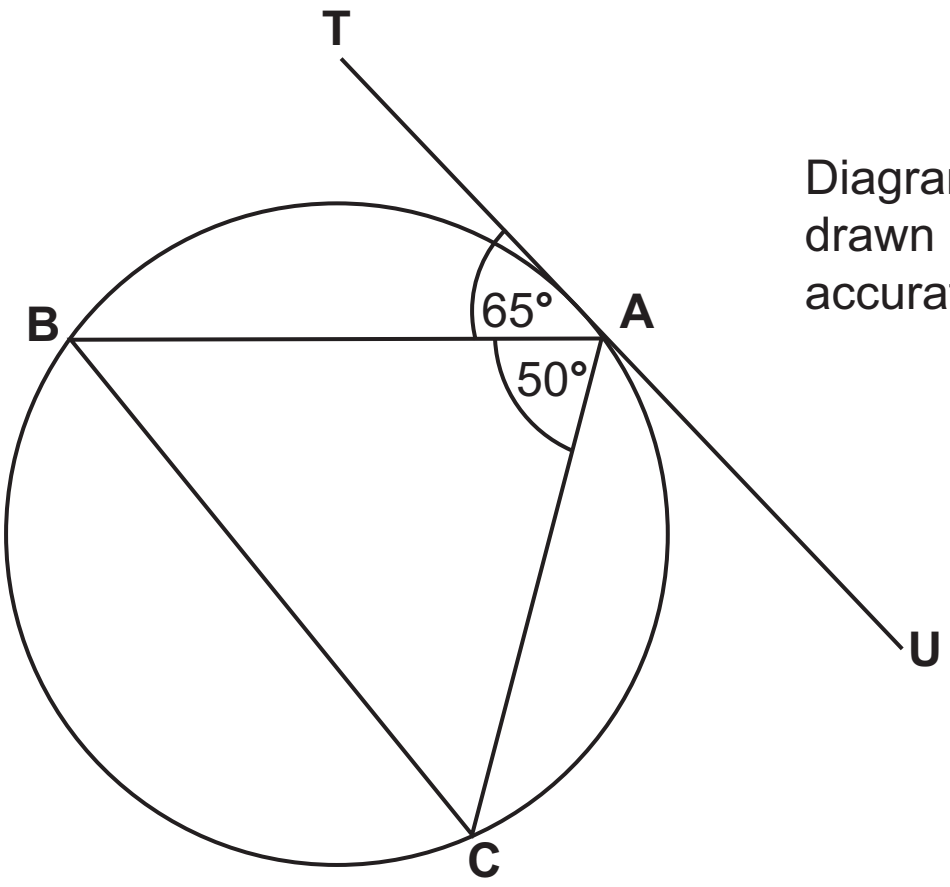


Diagram not drawn accurately

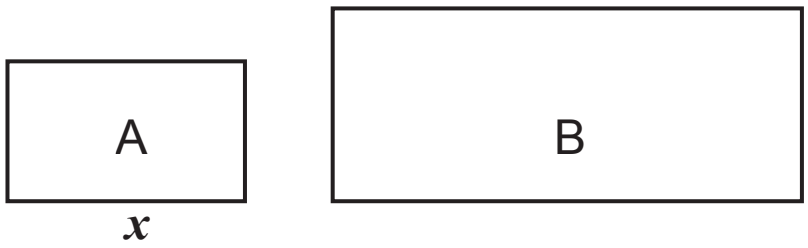
12 Simplify fully $\dfrac{x^2 + x - 6}{2x^2 - 9x + 10}$ [3 marks]

Answer _____

13 Solve $x^2 = \dfrac{2x + 7}{3}$, giving your answers correct to two decimal places. [4 marks]

Answer x = _____

14



The diagram shows two rectangles, A and B.
The width of A is x cm.
The height of A is 20 cm less than the width.

The width of B is three times the width of A.
The height of B is 5 cm more than the height of A.
The area of B is 450 cm^2 greater than the area of A.
Find an equation for x and solve it to find the width of A.
[6 marks]

Answer _____ cm

15 The force, F newtons, between two particles is inversely proportional to the square of the distance, d mm, between them.

When the particles are 4 mm apart the force between them is 12.5 newtons.

How far apart are the particles when the force between them is 3.125 newtons? [5 marks]

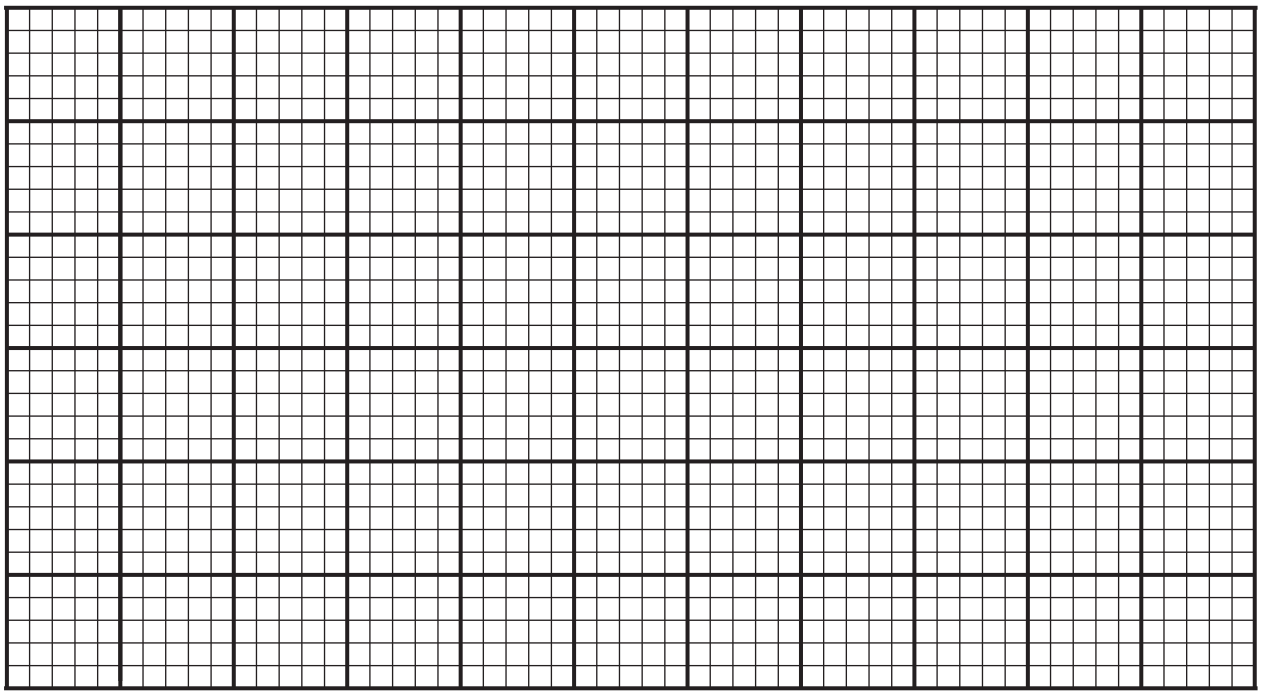
Answer _____ mm

Quality of written communication will be assessed in part (d) of this question.

16 The table shows the lengths of a collection of leaves.

Lengths (cm)	Frequency		
$0 < x \leqslant 8$	12		
$8 < x \leqslant 12$	18		
$12 < x \leqslant 15$	15		
$15 < x \leqslant 20$	14		
$20 < x \leqslant 27$	14		
$27 < x \leqslant 35$	6		

(a) Draw a histogram on the axes provided to illustrate this data. [3 marks]



(b) Estimate the number of leaves with lengths longer than the middle of the modal class. [3 marks]

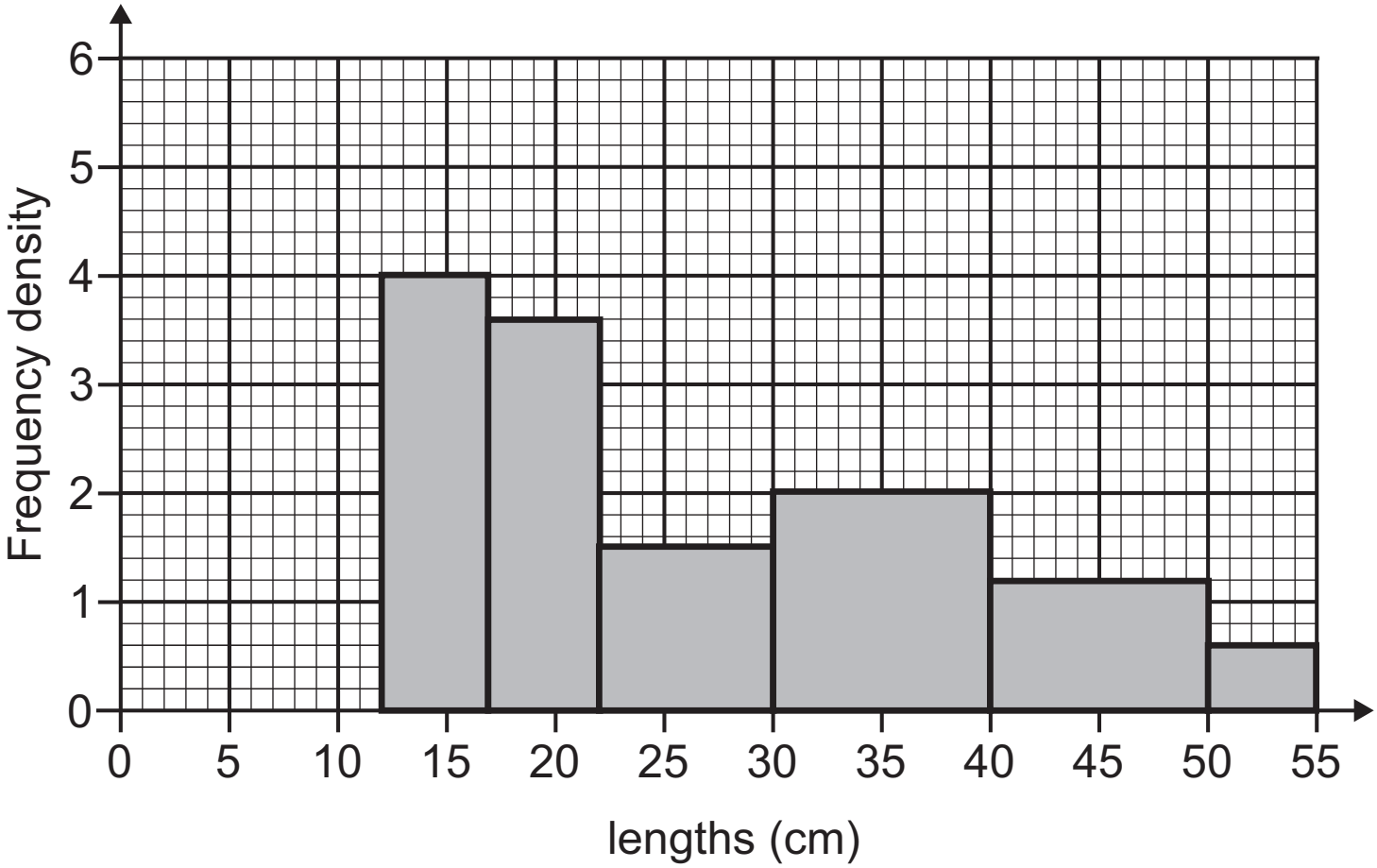
Answer _____

A stratified sample of 10 leaves is to be selected from those with lengths longer than 21 cm.

(c) Estimate how many of this sample would have lengths between 26 and 33 cm. [3 marks]

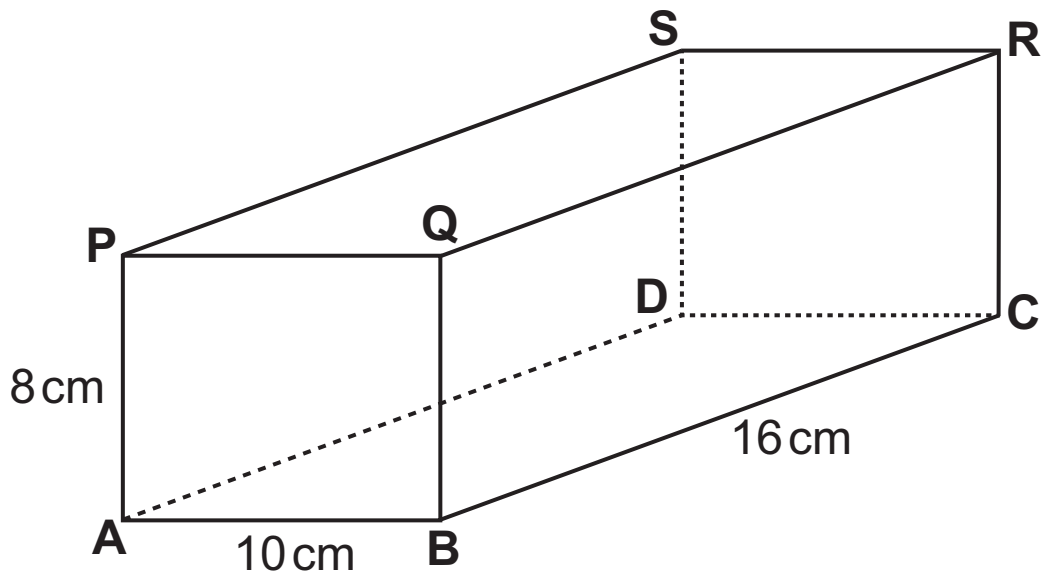
Answer _____

The lengths for a second collection of leaves are shown in the histogram below.



(d) State two comparisons between these two histograms. [2 marks]

17



(a) Calculate the length of the space diagonal **PC** of the cuboid. [2 marks]

Answer _____ cm

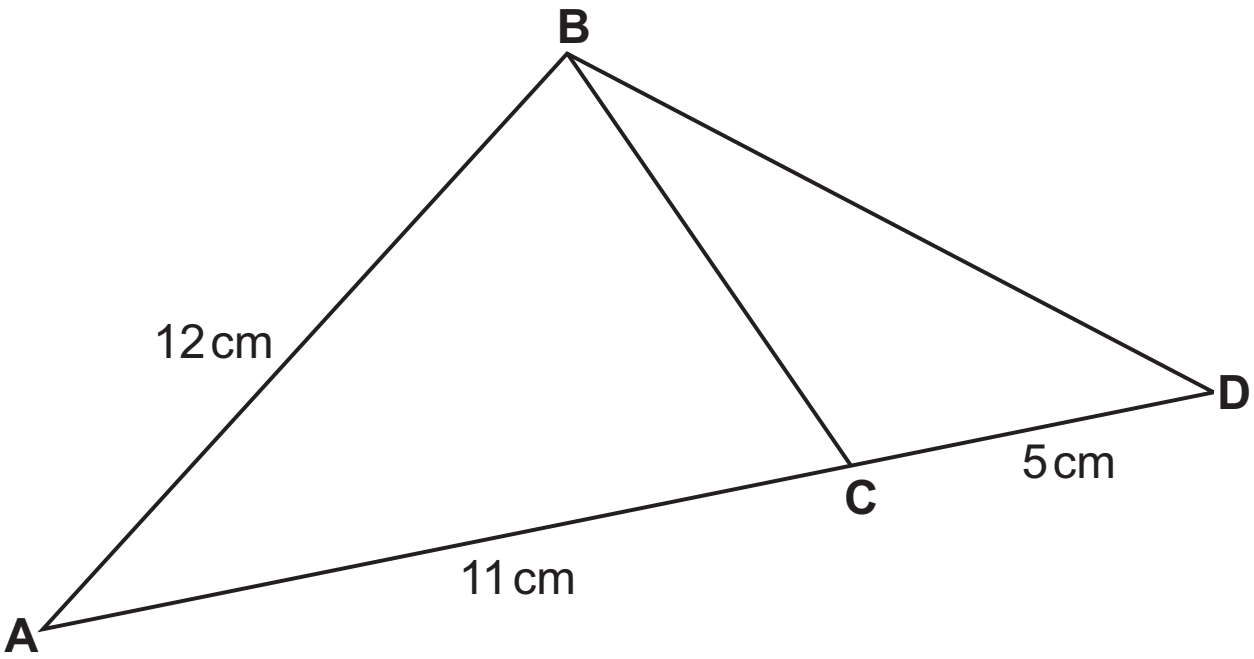
(b) Find the angle between **PC** and the face **PSDA**. [3 marks]

Answer _____ °

18 The area of the triangle **ABC** in the diagram below is $49\,cm^2$

The angle **A** is acute.

ACD is a straight line.



Find the area of the triangle **BCD**. [4 marks]

Answer _____ cm^2

19 (a) Given that $x^2 + ax + b$ can be written as $(x - 5)^2 + a$ work out the values of a and b. [3 marks]

Answer $a =$ _____ $b =$ _____

(b) Hence, write down the smallest possible value of $y = x^2 + ax + b$, using the values of a, b from above. [1 mark]

Answer _____

20 Solve the simultaneous equations [5 marks]

$y^2 = 6x - 23$
$y = x - 3$

Show all your work.
A solution by trial and improvement will not be accepted.

Answer _____

21 Solve $\frac{x}{2x-3} + \frac{4}{x+1} = 1$ [6 marks]

Show all your work.
A solution by trial and improvement will not be accepted.

Answer $x =$ _____

22 Factorise $6x^2 - 17xy + 12y^2$ [2 marks]

Answer _____

23 A group of men and women were asked to give their ages in complete years.
The total of the men's ages was 1000
The total of the women's ages was 900
There were 5 more women than men and the mean of the women's ages was 10 smaller than the mean of the men's ages.
Find the number of men. [4 marks]

Answer _____

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	**Marks**
1	
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