Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
January 2018

Mathematics

Unit T4
(With calculator)
Higher Tier

MV18

[GMT41]

MONDAY 8 JANUARY, 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 twenty** 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 **5**, **6** and **17**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on pages 4 and 5.

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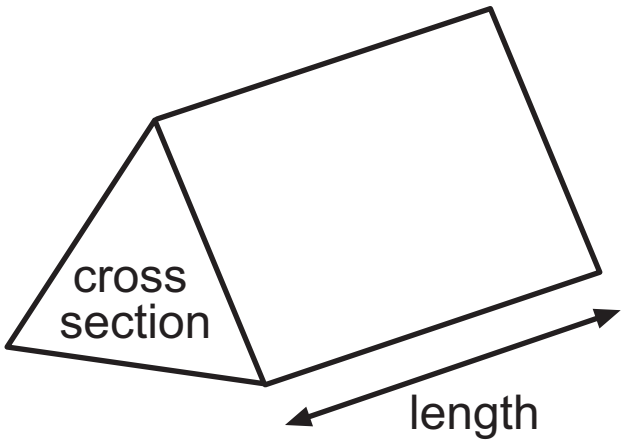
(Questions start on page 6)

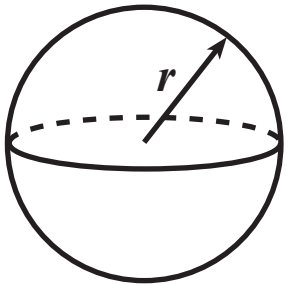
Formula Sheet

Volume of prism = area of cross section × length



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

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



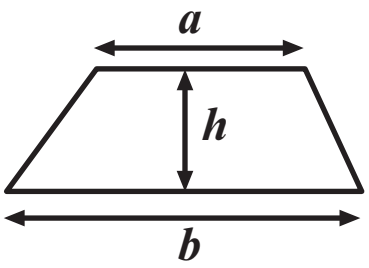
Quadratic Equation

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

where $a \neq 0$, are given by

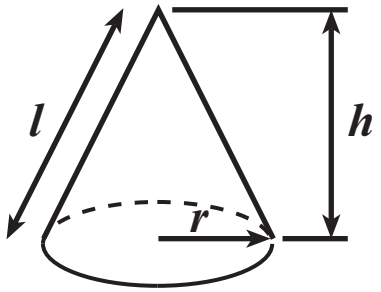
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

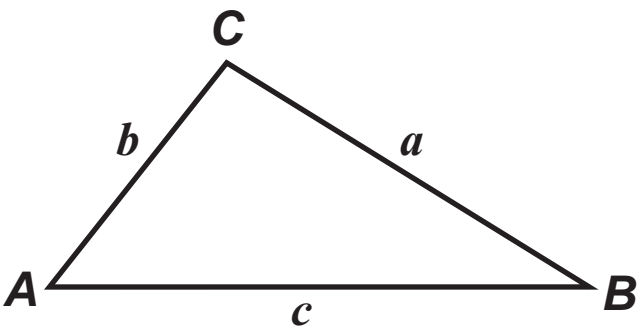


Volume of cone $= \frac{1}{3}\pi r^2 h$

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



In any triangle *ABC*



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

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

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

1 **(a)** Factorise

(i) $8rt + 12t^2$ [2 marks]

Answer _____

(ii) $k^2 - 16$ [1 mark]

Answer _____

(b) Solve the simultaneous equations $4x - y = 3$
$6x + 2y = 1$
[3 marks]

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

Answer $x =$ _____

$y =$ _____

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2 Bob was given a 3.5**%** pay rise.
His salary is now **£**25 378.20
What was his salary before the rise? [3 marks]

Answer **£** _____

3 A square of side x cm is lengthened by 2 cm on one side and 4 cm on the other side to create a rectangle.

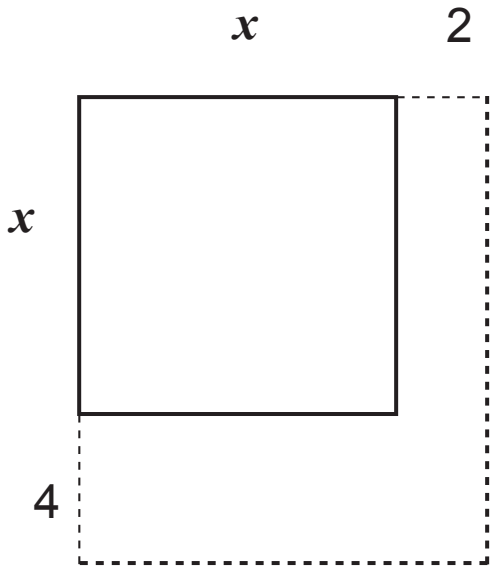


diagram not drawn accurately

(a) Write an expression for the area of the rectangle.
[2 marks]

Answer _____

(b) The area of the rectangle is 48 cm^2

Show that $x^2 + 6x - 40 = 0$ [2 marks]

(c) Hence solve the equation to find the value of x.
[3 marks]

Answer $x =$ _____

4 Calculate the size of angle x below. [4 marks]

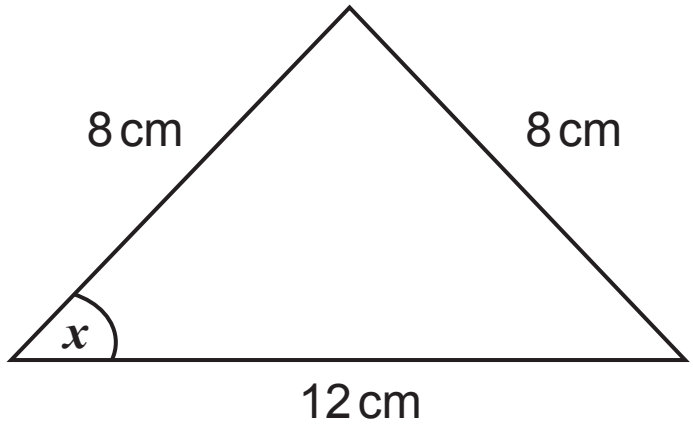
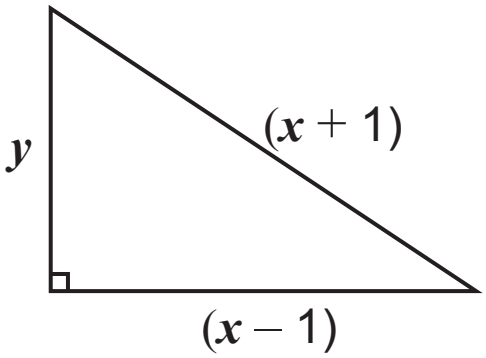


diagram not drawn accurately

Answer _____ °

Quality of written communication will be assessed in this question.

5

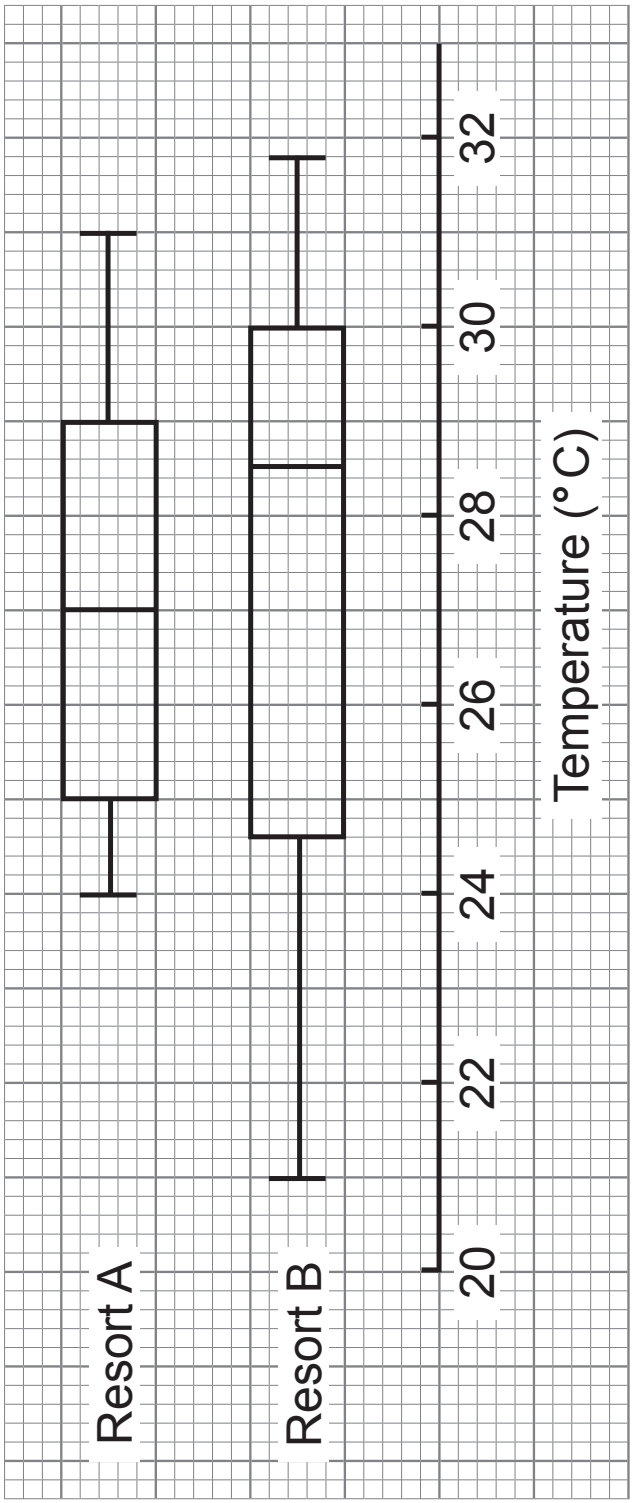


x is a square number.

Prove that y is an even number. [5 marks]

Quality of written communication will be assessed in this question.

6 The average daily temperature during the month of July was recorded each day in two holiday resorts. The data is represented in the box plots below.



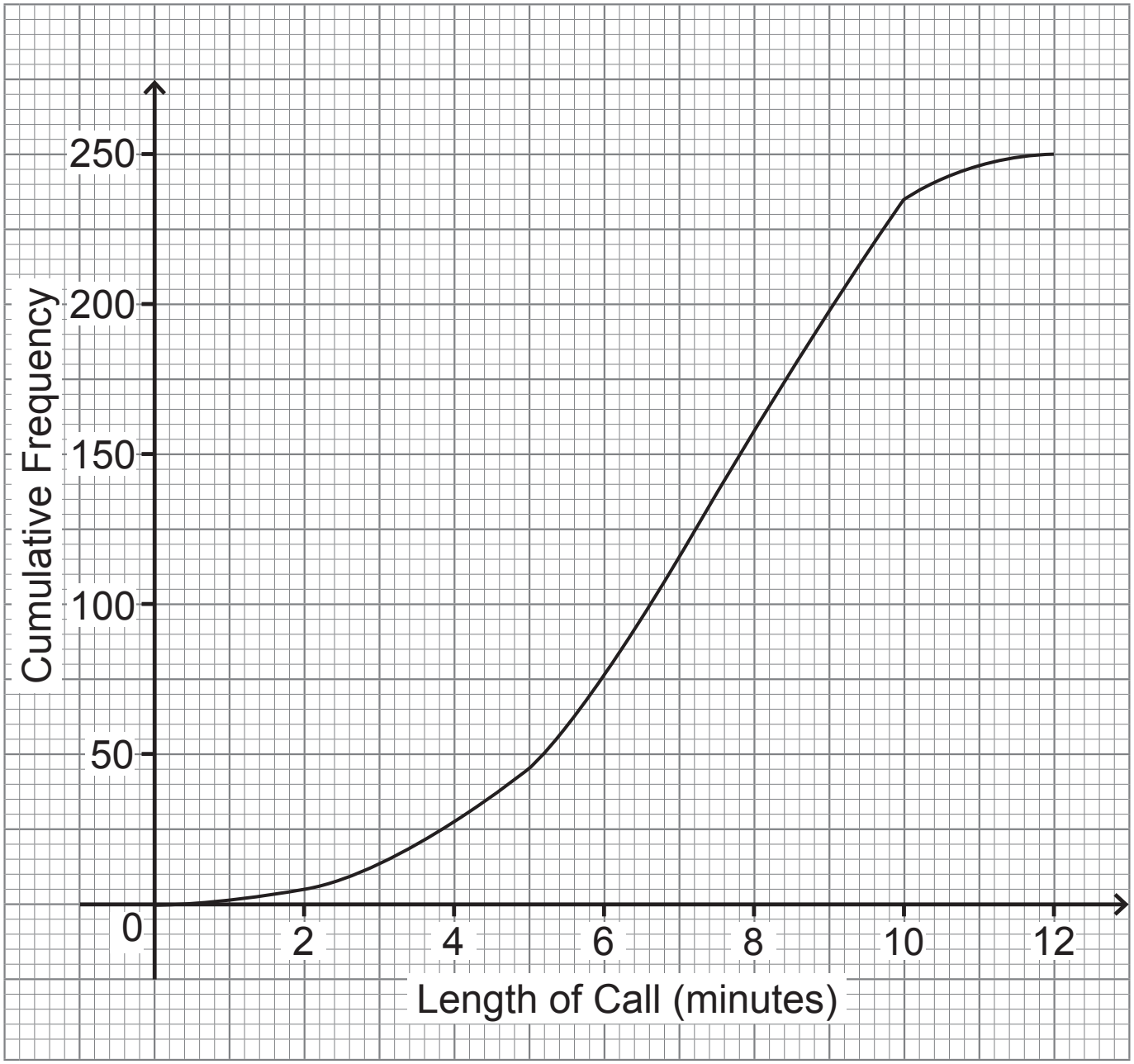
Jill likes to holiday where it is warm.

Using appropriate statistical vocabulary, explain why Jill may choose to go to

(a) Resort A, [1 mark]

(b) Resort B. [1 mark]

7 The lengths of calls received by a call centre one day are recorded and shown on the cumulative frequency graph.



Use the graph to estimate

(a) the median, [1 mark]

Answer _____ minutes

(b) the interquartile range, [2 marks]

Answer _____ minutes

(c) the percentage of calls which lasted between 5 and 10 minutes. [3 marks]

Answer _____ **%**

8 **(a)** Expand and simplify [2 marks]

$(7x - 3)(8x - 9)$

Answer _____

(b) Simplify [2 marks]

$$\frac{8a^2b^3}{6a^3b}$$

Answer _____

(c) Simplify [1 mark]

$$\frac{3(x-2)^2}{(x-2)}$$

Answer _____

9 **(a)** Find the equation of the line **L**, which passes through the points A(4, 0) and B(−2, 3). [3 marks]

Answer _____

(b) Find the equation of the line which is perpendicular to **L** and passes through the origin. [1 mark]

Answer _____

10 A and T are variables.

The variable (48 – A) is directly proportional to the square of the variable T.

A is 28 when T = 2

(a) Find the formula for (48 – A) in terms of T. [2 marks]

Answer (48 – A) = _____

(b) Set up an equation and solve it to find the values of T for which A has the same value as T. [4 marks]

A method using trial and improvement will not be accepted.

Answer _____

11 A zoologist is trying to count the number of geese at a local nature reserve. She catches 64 geese and attaches tags to their legs. The next week she catches 80 geese and finds that 7 of them are tagged.

(a) Calculate her estimate of the number of geese on the reserve. [2 marks]

Answer _____

(b) Give two improvements to her method which would make her estimate more accurate. [1 mark for each]

1. _____

2. _____

(c) Name one factor which would affect her estimate and which she cannot control. [1 mark]

_____

12 Solve the equation [6 marks]

$$\frac{2}{x-3} - \frac{7}{x} = 2$$

A method using trial and improvement will not be accepted.

Answer _____

13

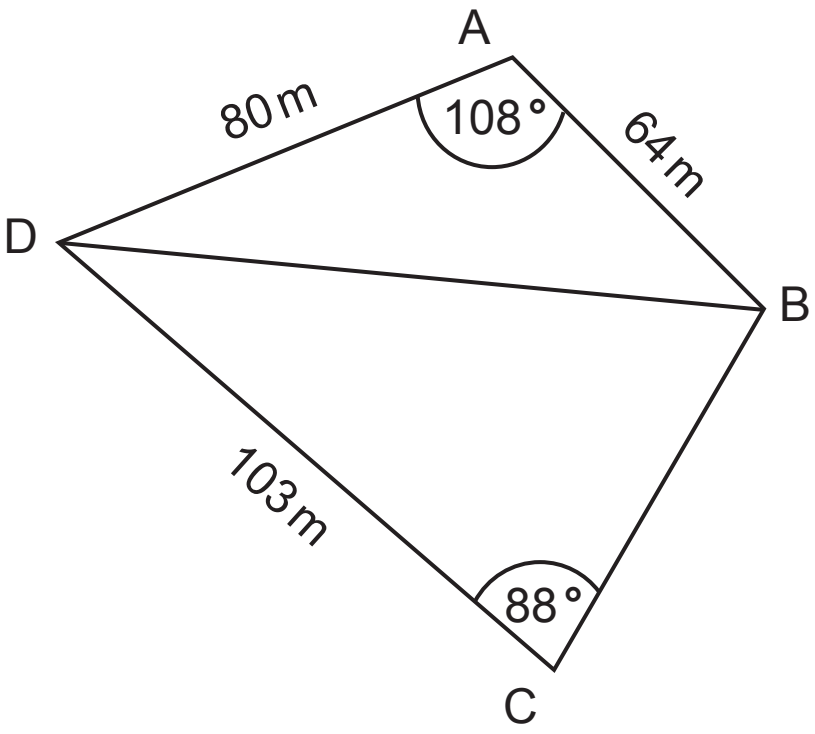


diagram not drawn accurately

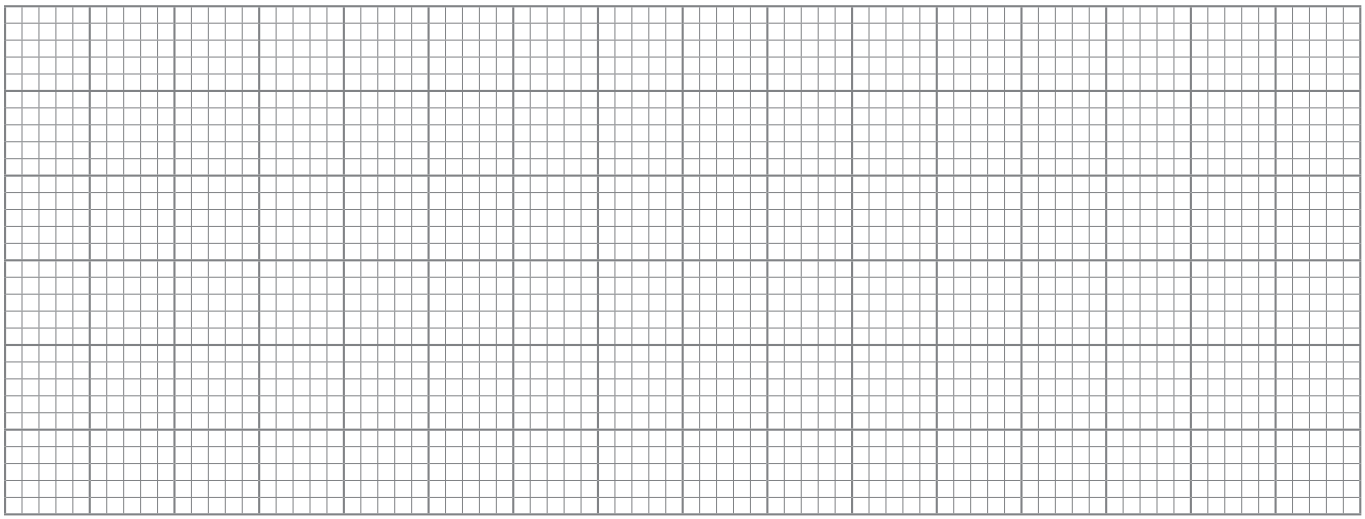
Calculate the area of ABCD. [7 marks]

Answer _____ m^2

14 A group of children recorded the time they spent doing homework on a particular night. The results are shown below.

Time (T minutes)	Number of children
$0 < T \leqslant 20$	12
$20 < T \leqslant 30$	18
$30 < T \leqslant 45$	33
$45 < T \leqslant 50$	14
$50 < T \leqslant 65$	36
$65 < T \leqslant 80$	15

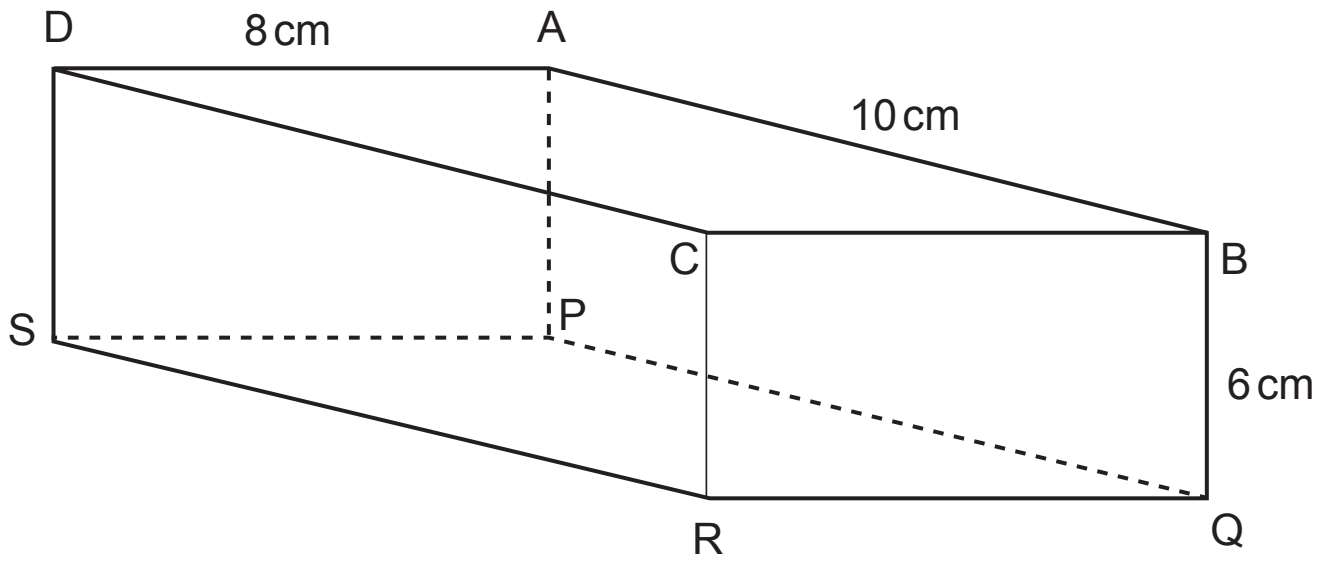
(a) Illustrate this data by drawing a histogram on the axes below. [3 marks]



(b) A sample of 40 is to be taken from the children who spent between 32 and 65 minutes. Estimate how many of the sample spent between 40 and 50 minutes.
[3 marks]

Answer _____

15 A cuboid is shown.



Calculate the angle between AR and the face ABQP.
[4 marks]

Answer _____ °

16 Solve the simultaneous equations [8 marks]

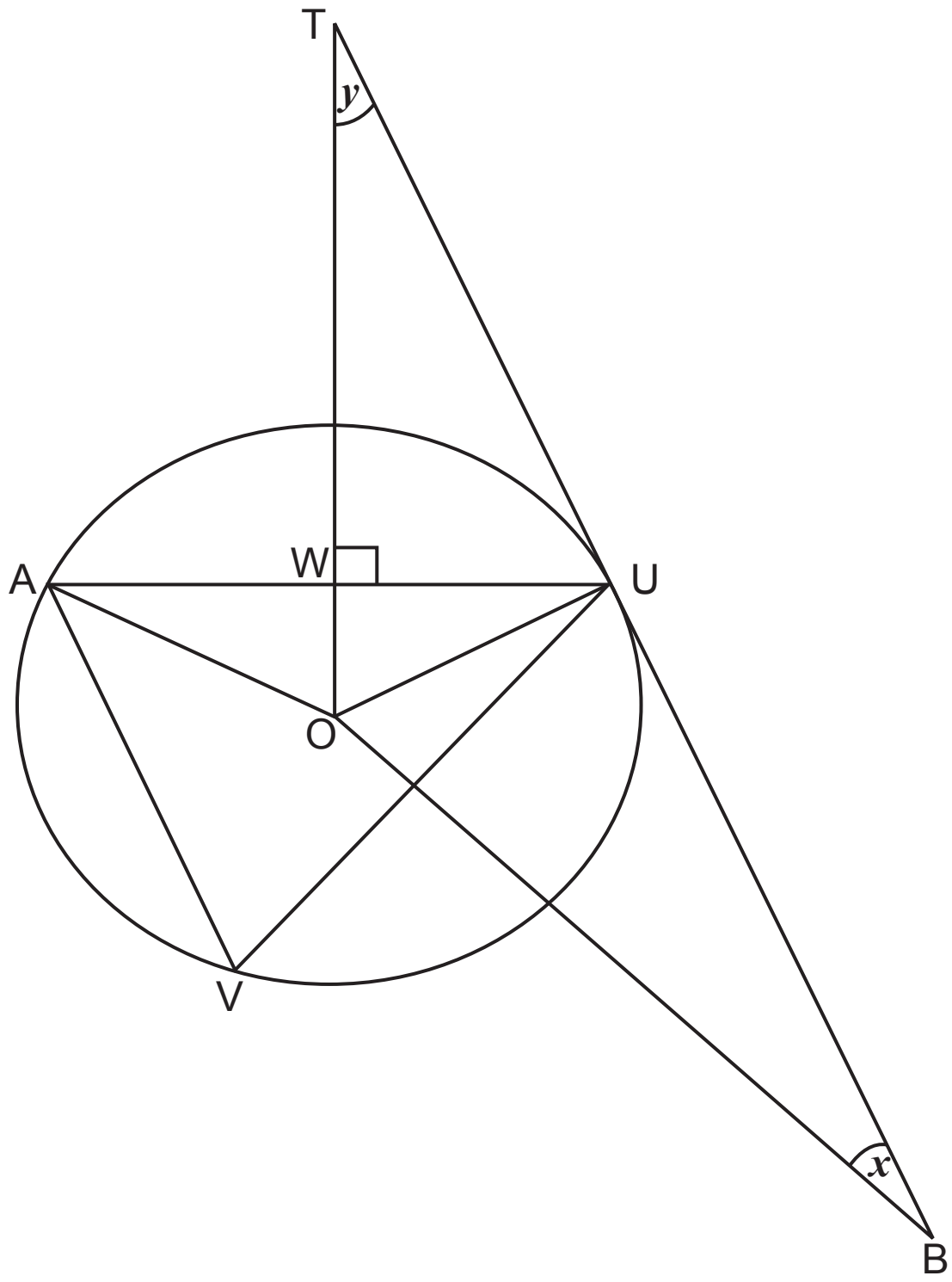
$5x - 3y = 1$ and $x^2 - y^2 = -5$

A method using trial and improvement will not be accepted.

Answer _____

Quality of written communication will be assessed in this question.

17



TUB is a tangent to the circle centre O.

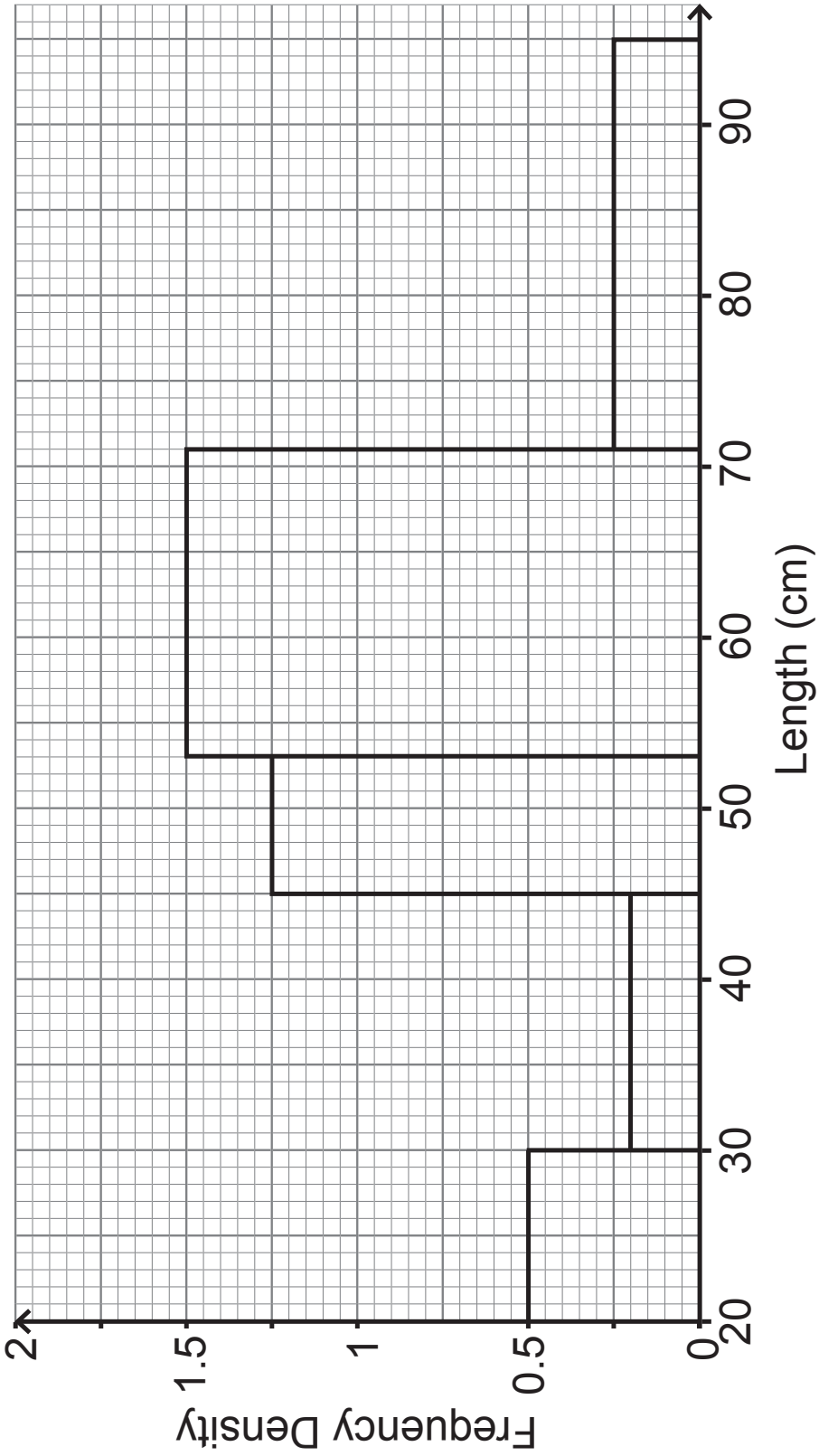
Angle TWU = 90°

Find the size of the obtuse angle AOB in terms of x and y.
[4 marks]

You must give a reason for each line of your working.

Answer _____ °

18 The histogram illustrates the lengths of a collection of twigs.



Calculate an estimate for the mean length of the twigs.
[4 marks]

Answer _____ cm

19 Factorise fully [4 marks]

$21x^4y - 3x^3y^2 - 18x^2y^3$

Answer _____

20 $(24)^{2p} \times (36)^{3q} = 48$

Using prime factors, or otherwise, find the values of p and q. [4 marks]

A method involving trial and improvement will not be accepted.

Answer $p =$ _____ , $q =$ _____

THIS IS THE END OF THE QUESTION PAPER

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