



General Certificate of Secondary Education  
2015

Centre Number

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Candidate Number

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# Mathematics

Unit T4 (With calculator)

Higher Tier



[GMT41]

\*GMT41\*

THURSDAY 21 MAY, 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, on blank pages or tracing paper.**

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

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.

## 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.

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 page 2.

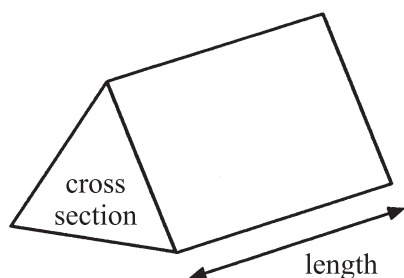
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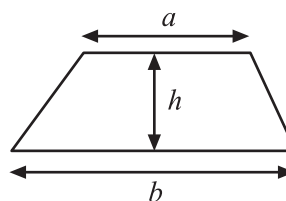
\*24GMT4101\*

# Formula Sheet

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

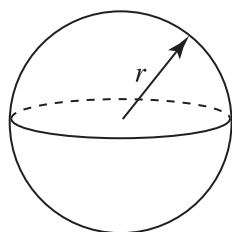


**Area of trapezium** =  $\frac{1}{2}(a + b)h$



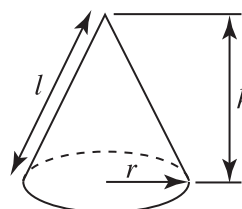
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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

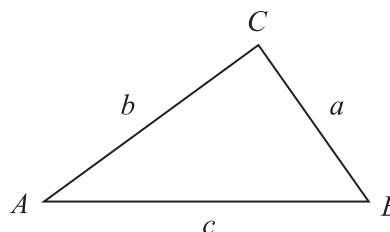


**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

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





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**(Questions start overleaf)**

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\*24GMT4103\*

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

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

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

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

(b) Use the graph to estimate

(i) the median,

Answer \_\_\_\_\_ [1]

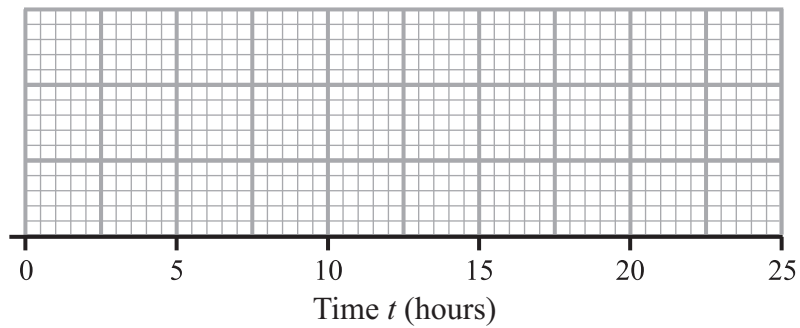
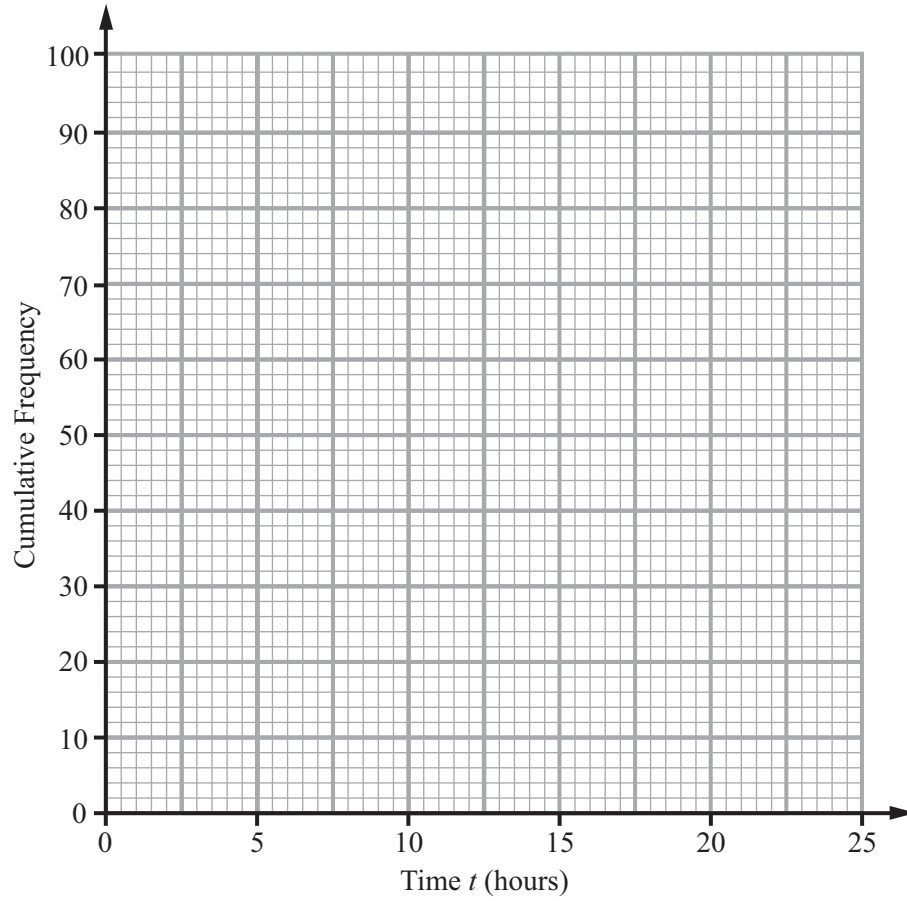
(ii) the inter-quartile range.

Answer \_\_\_\_\_ [2]

(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]





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

Answer \_\_\_\_\_ [2]

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

Write down the  $n^{\text{th}}$  term

Answer \_\_\_\_\_ [1]

**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.

Answer £ \_\_\_\_\_ [3]

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\*24GMT4106\*

5 Solve the simultaneous equations

$$5x + 2y = 19$$

$$4x - 3y = 29$$

A solution by trial and improvement will not be accepted.

Answer  $x =$  \_\_\_\_\_ ,  $y =$  \_\_\_\_\_ [4]



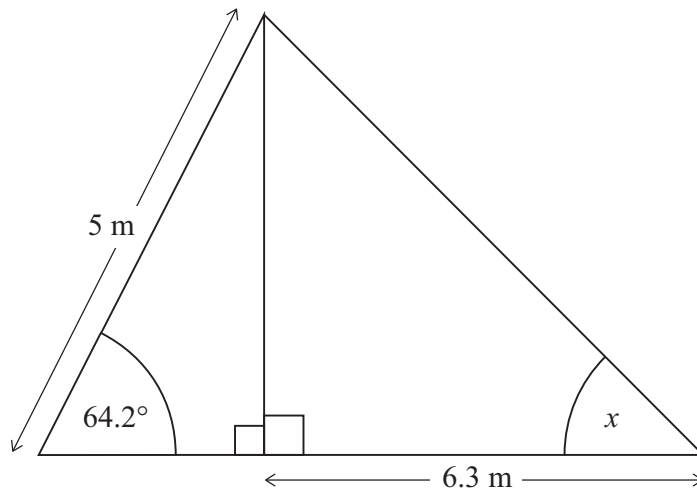
6 Factorise fully  $14x^2y - 35x$

Answer \_\_\_\_\_ [2]





7 Find the value of the angle marked  $x$  in the triangle shown.



Answer  $x =$  \_\_\_\_\_  $^\circ$  [6]

[Turn over



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

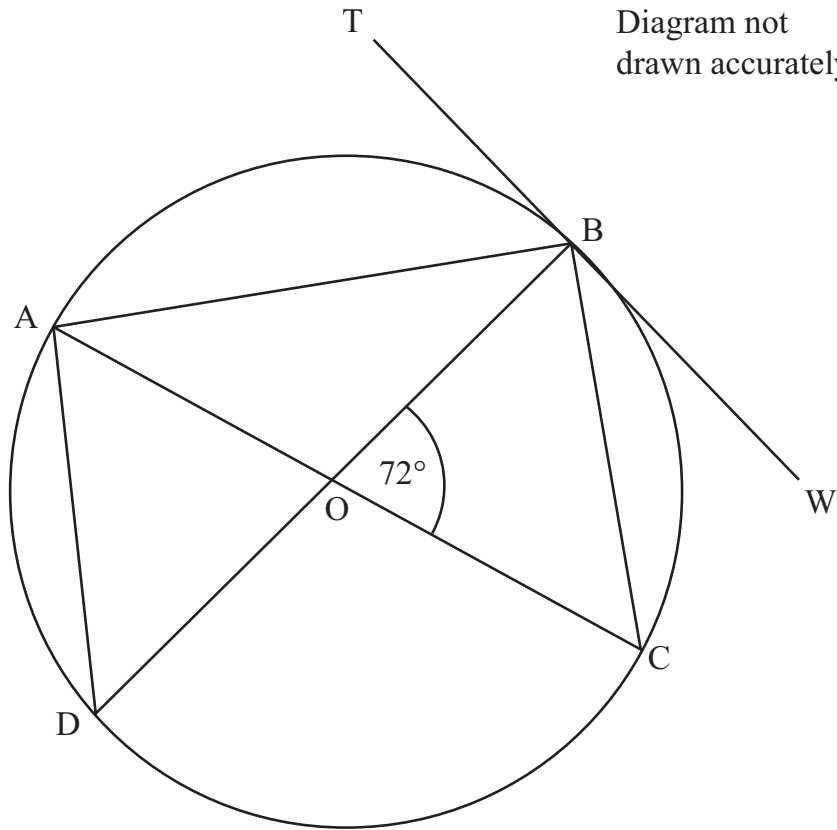
Show all your work.

Answer  $x =$  \_\_\_\_\_ [4]



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

Answer \_\_\_\_\_° [1]

(b) CAB

Answer \_\_\_\_\_° [1]

(c) CBW

Answer \_\_\_\_\_° [1]

(d) DBC

Answer \_\_\_\_\_° [1]

[Turn over



- 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.

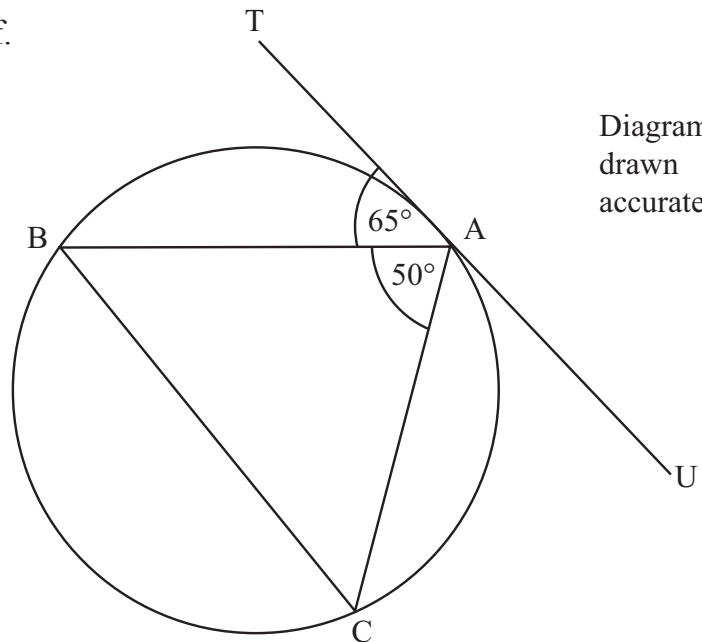
Shortest length \_\_\_\_\_ cm [1]

Longest length \_\_\_\_\_ cm [1]

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

- 11 Prove that BC is parallel to the tangent TU in the diagram shown.

Justify each step of your proof.



[3]



12 Simplify fully  $\frac{x^2 + x - 6}{2x^2 - 9x + 10}$

Answer \_\_\_\_\_ [3]

13 Solve  $x^2 = \frac{2x + 7}{3}$ , giving your answers correct to two decimal places.

Answer  $x =$  \_\_\_\_\_ [4]

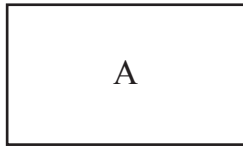
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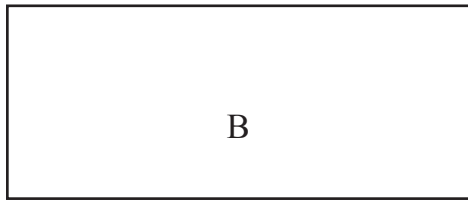


\*24GMT4113\*

14



$x$



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  $450\text{ cm}^2$  greater than the area of A.  
Find an equation for  $x$  and solve it to find the width of A.

Answer \_\_\_\_\_ cm [6]



- 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?

Answer \_\_\_\_\_ mm [5]

[Turn over



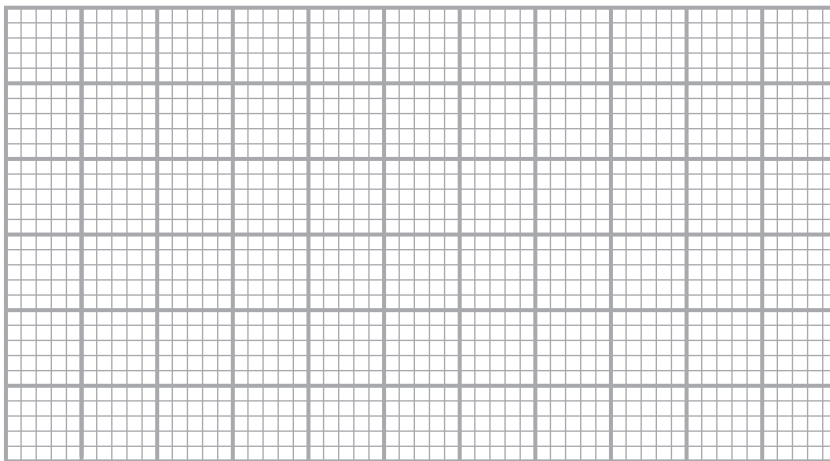
Quality of written communication will be assessed in part (d) of this question.

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

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

(a) Draw a histogram on the axes provided to illustrate this data.

[3]



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

Answer \_\_\_\_\_ [3]



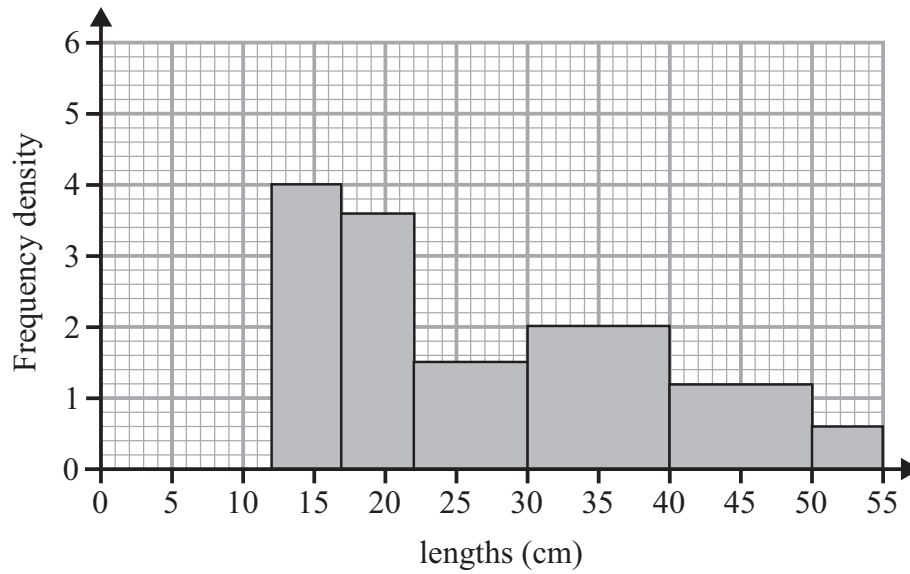


A stratified sample of 10 leaves is to be selected from those with lengths longer than 21 cm.

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

Answer \_\_\_\_\_ [3]

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



(d) State two comparisons between these two histograms.

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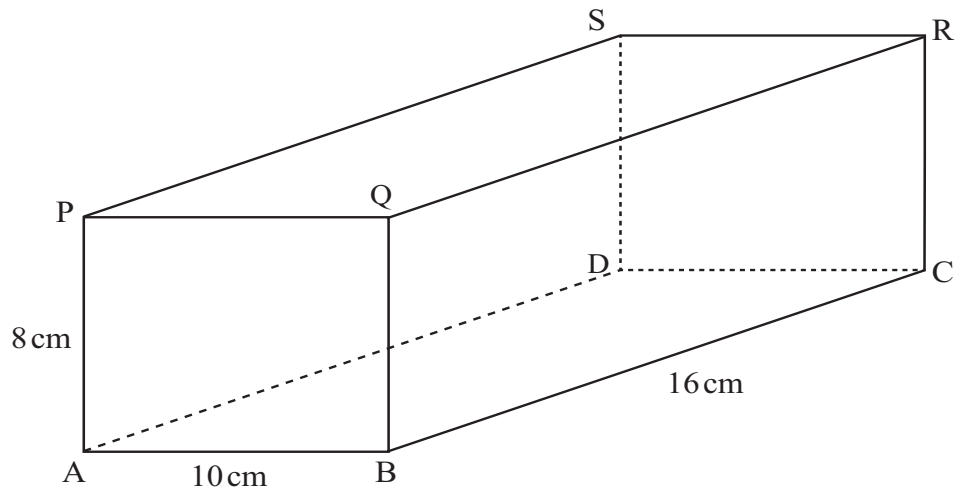
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[2]

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17



(a) Calculate the length of the space diagonal PC of the cuboid.

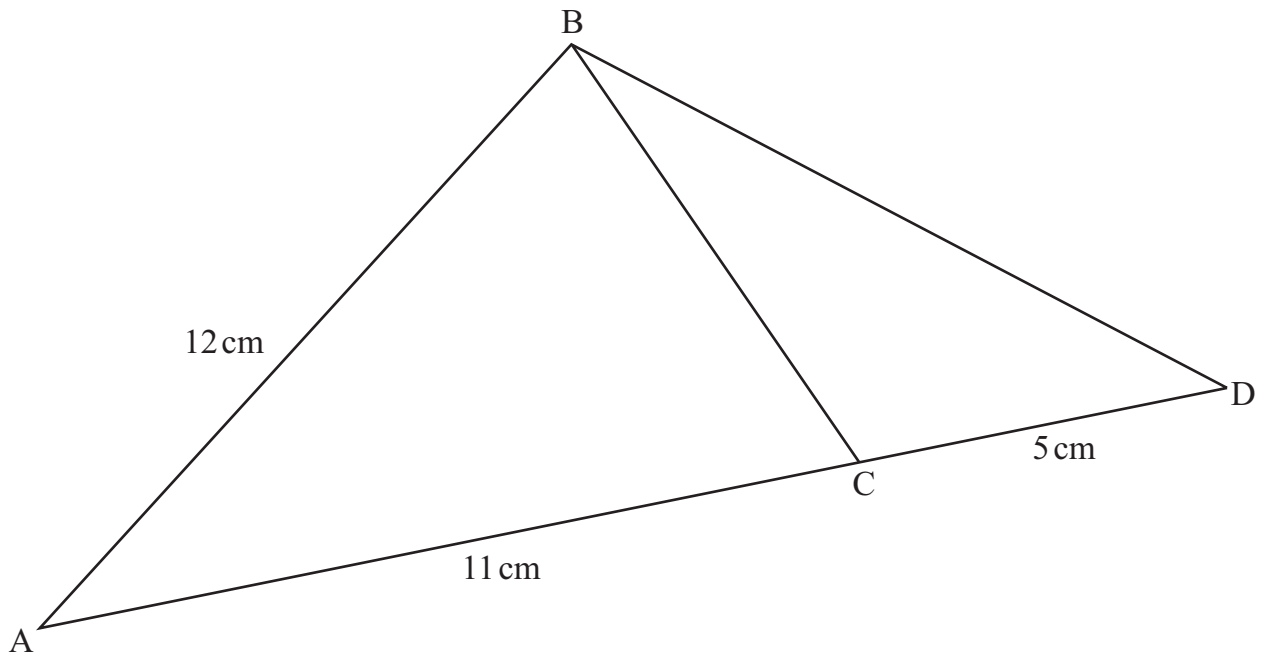
Answer \_\_\_\_\_ cm [2]

(b) Find the angle between PC and the face PSDA.

Answer \_\_\_\_\_ ° [3]



- 18 The area of the triangle ABC in the diagram below is  $49 \text{ cm}^2$   
The angle A is acute.  
ACD is a straight line.



Find the area of the triangle BCD.

Answer \_\_\_\_\_  $\text{cm}^2$  [4]

[Turn over



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

Answer  $a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_ [3]

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

Answer \_\_\_\_\_ [1]

20 Solve the simultaneous equations

$$\begin{aligned}y^2 &= 6x - 23 \\ y &= x - 3\end{aligned}$$

**Show all your work.**

**A solution by trial and improvement will not be accepted.**

Answer \_\_\_\_\_ [5]

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\*24GMT4120\*

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

**Show all your work.**

**A solution by trial and improvement will not be accepted.**

Answer  $x =$  \_\_\_\_\_ [6]

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

Answer \_\_\_\_\_ [2]

**[Turn over**

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\*24GMT4121\*

- 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.

Answer \_\_\_\_\_ [4]





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