



Rewarding Learning

General Certificate of Secondary Education
January 2013

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Candidate Number

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StudentBounty.com

Mathematics

Unit T4

(With calculator)



Higher Tier



[GMT41]

GMT41

FRIDAY 11 JANUARY 9.15 am–11.15 am

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 box, around each page, on blank pages or tracing paper.

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

Answer **all twenty-one** 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 6 and 18**.

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

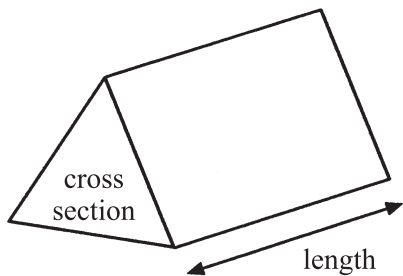
Your Formula Sheet is on page 2.

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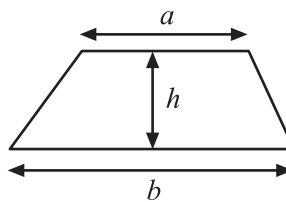


Formula Sheet

Volume of prism = area of cross section \times length

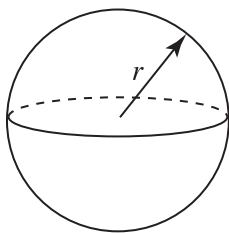


Area of trapezium = $\frac{1}{2}(a+b)h$



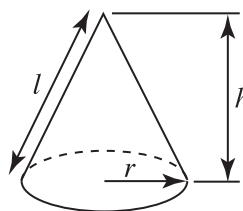
Volume of sphere = $\frac{4}{3}\pi r^3$

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

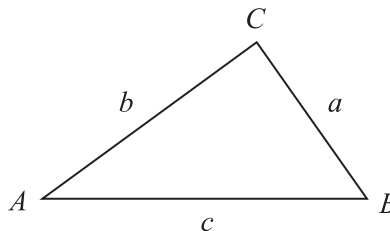


Volume of cone = $\frac{1}{3}\pi r^2 h$

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



- 1 A chair has a sale price of £52.48 which is a saving of 18% on the original price.
What was the original price of the chair?



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Answer £ _____ [3]

Examiner Only

Marks	Remark
Total Question 1	

- 2 A has coordinates (6, -1), B has coordinates (-4, 6).
Calculate the length of the line AB.

Answer _____ [3]

Total Question 2

- 3 Factorise fully

(a) $8p^2 + 10pq$

Answer _____ [2]

(b) $25 - a^2$

Answer _____ [1]

(c) $x^2 - x - 20$

Answer _____ [2]

Total Question 3

[Turn over

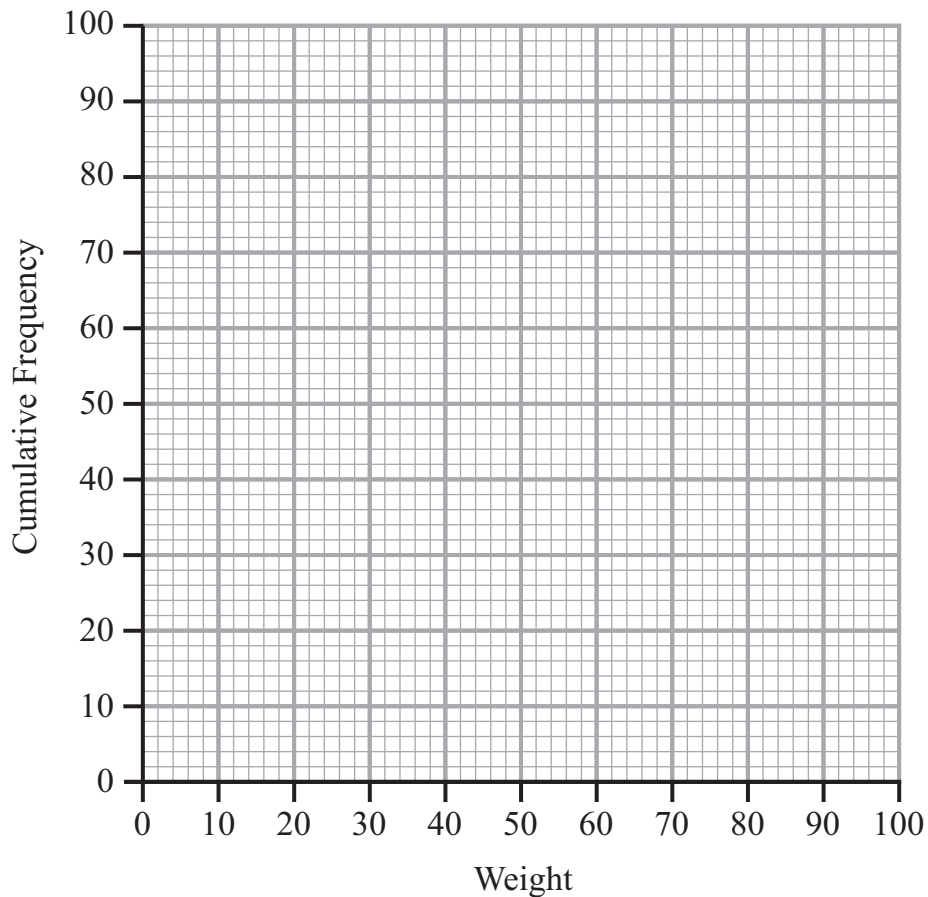
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- 4 The weights of potatoes collected from 100 garden plots are shown in the table.

Weights (w kg)	Frequency	Cumulative Frequency
$0 < w \leq 10$	4	4
$10 < w \leq 20$	8	
$20 < w \leq 30$	11	
$30 < w \leq 40$	13	
$40 < w \leq 50$	10	
$50 < w \leq 60$	32	
$60 < w \leq 70$	10	
$70 < w \leq 80$	8	
$80 < w \leq 90$	4	

- (a) Complete the Cumulative Frequency column in the table. [1]
- (b) Hence draw the Cumulative Frequency graph on the axes provided.



[3]



Examiner Only	
Marks	Remark



(c) From your completed graph,

(i) find the median weight,

Answer _____ kg [1]

(ii) find the inter-quartile range,

Answer _____ kg [2]

(iii) estimate the number of garden plots which produced weights of at least 45 kg.

Answer _____ [2]

Examiner Only

Marks Remark

Total Question 4

[Turn over



5 (a) Solve the simultaneous equations

$$2x - 4y = 10$$
$$3x + 2y = 7$$

Show your working.

A solution by trial and improvement will not be accepted.

Answer $x = \underline{\hspace{2cm}}$, $y = \underline{\hspace{2cm}}$ [3]

(b) Solve the equation $\frac{x-1}{3} + \frac{3x-2}{4} = \frac{4}{3}$

Show your working.

A solution by trial and improvement will not be accepted.

Answer $x = \underline{\hspace{2cm}}$ [4]

Examiner Only

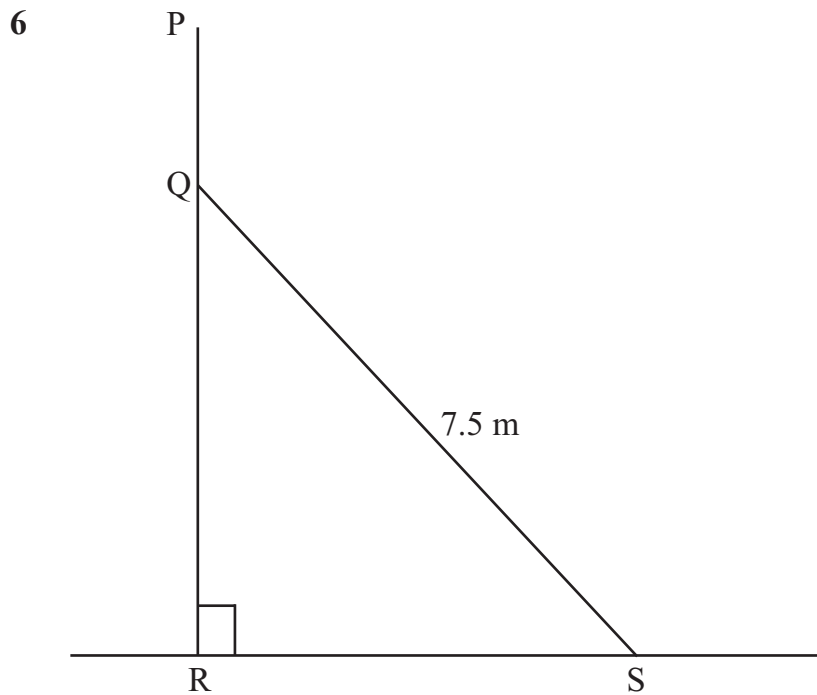
Marks Remark

Total Question 5



Quality of written communication will be assessed in this question.

Show your working.



The diagram represents a vertical wall PQR .

RS is horizontal ground.

SQ is a metal support of length 7.5 metres.

The height of the wall is 10 metres.

For the support to be effective, the length PQ must be at least 3 metres.

Show that when the angle $RSQ = 67^\circ$ the support will be effective.

Examiner Only

Marks

Remark

Total Question 6

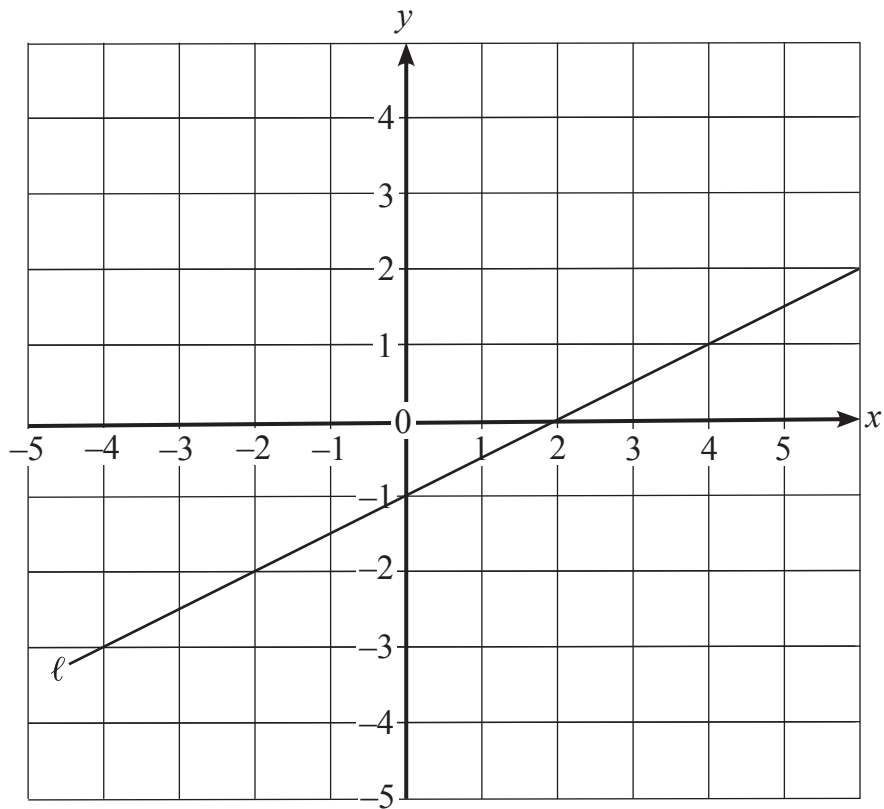
[4]

[Turn over

8124.04 R



8 (a) Write down the equation of line l .



Answer _____ [3]

(b) Write down the equation of the line which passes through $(0, 2)$ and is perpendicular to the line $y = 1 - 4x$.

Answer _____ [2]

Examiner Only
Marks Remark

Total Question 8

[Turn over



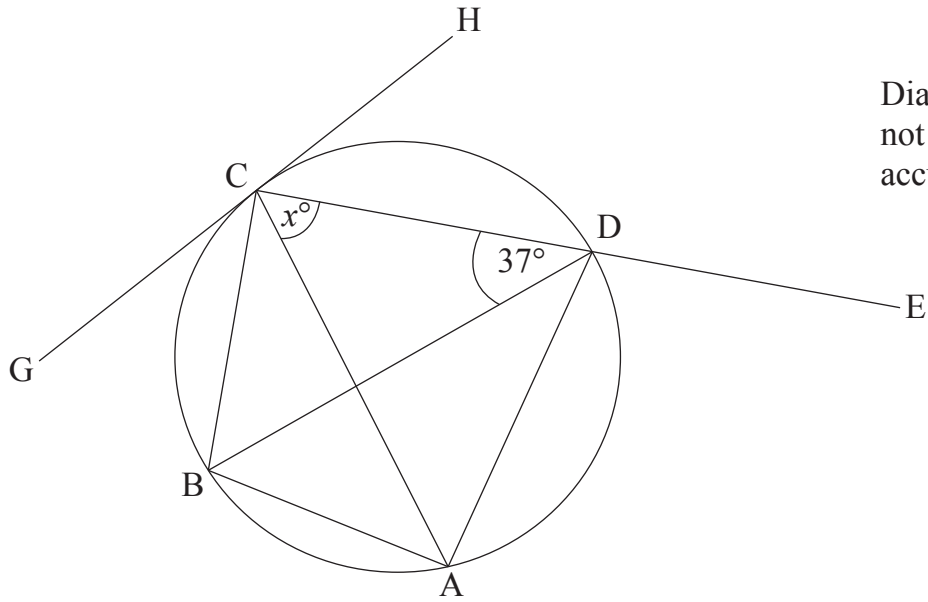


Diagram not drawn accurately

A, B, C and D are points on the circumference of a circle.
 BD is a diameter of the circle.
 CDE is a straight line.
 GCH is a tangent to the circle.
 Angle BDC = 37°.

(a) (i) Explain why the angle BAC is equal to 37°.

_____ [1]

(ii) Calculate the size of angle CBD.

Answer _____ ° [1]

(iii) Angle ACD = x°. Work out the size of angle ADE in terms of x.

Answer _____ [1]

Examiner Only	
Marks	Remark



(b) Find the size of angle DCH.

Give a reason for your answer.

Answer _____ °

Reason _____

_____ [2]

Examiner Only

Marks Remark

Total Question 9

10 A teacher has recorded the marks of all the papers of the 40 students who sat a test for her. Before handing back the papers to the students she realises that she has incorrectly marked the student who scored the highest mark and she has to increase his mark by three. Which statistical average would have been altered by this change and by how much?

_____ [2]

Total Question 10

11 (a) Solve

(i) $3^x = 1$

Answer $x =$ _____ [1]

(ii) $3^y = \frac{1}{81}$

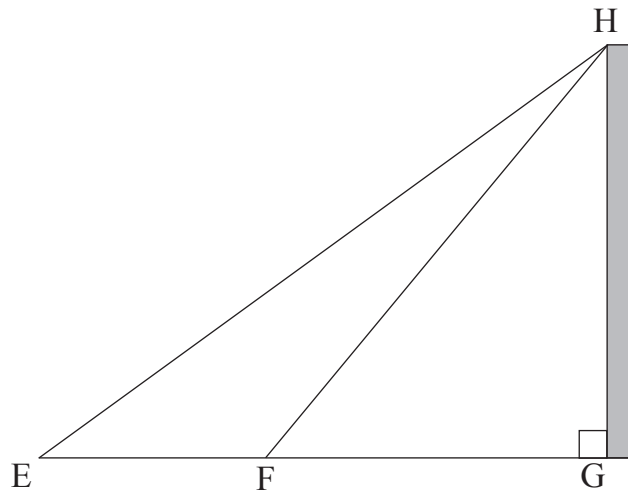
Answer $y =$ _____ [1]

(b) Evaluate $625^{-\frac{3}{4}}$

Answer _____ [1]

Total Question 11





Not drawn
to scale

Arthur wants to work out the height of a tall chimney GH which is standing on horizontal ground.

To do this, Arthur measures the angle of elevation of the top of the chimney from two different points E and F on the ground.

The angle of elevation from E is 56° .

The angle of elevation from F is 71° .

$EF = 28$ metres.

Calculate the height of the chimney.

Answer _____ metres [5]

Examiner Only	
Marks	Remark
Total Question 12	



13 Simplify $\frac{4x^2 + 6xy}{2x^2 + 3xy - 8x - 12y}$

Answer _____ [4]

Examiner Only

Marks Remark

Total Question 13

[Turn over

8124.04 R



14 The pressure P , in a weather balloon is **inversely** proportional to the square root of the height h , at which it is flying.
At a height of 25 m, the pressure is 1.44 atmospheres.

(a) Find a formula connecting P and \sqrt{h} .

Answer _____ [3]

(b) What will the pressure be at a height of 36 m?

Answer _____ atmospheres [1]

(c) At what height will the balloon be flying when the pressure is 1.6 atmospheres?

Answer _____ m [2]

(d) If the height quadruples (becomes four times greater), what effect will this have on the pressure?

Answer _____ [1]

Examiner Only

Marks Remark

Total Question 14

8124.04 R





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(Questions continue overleaf)

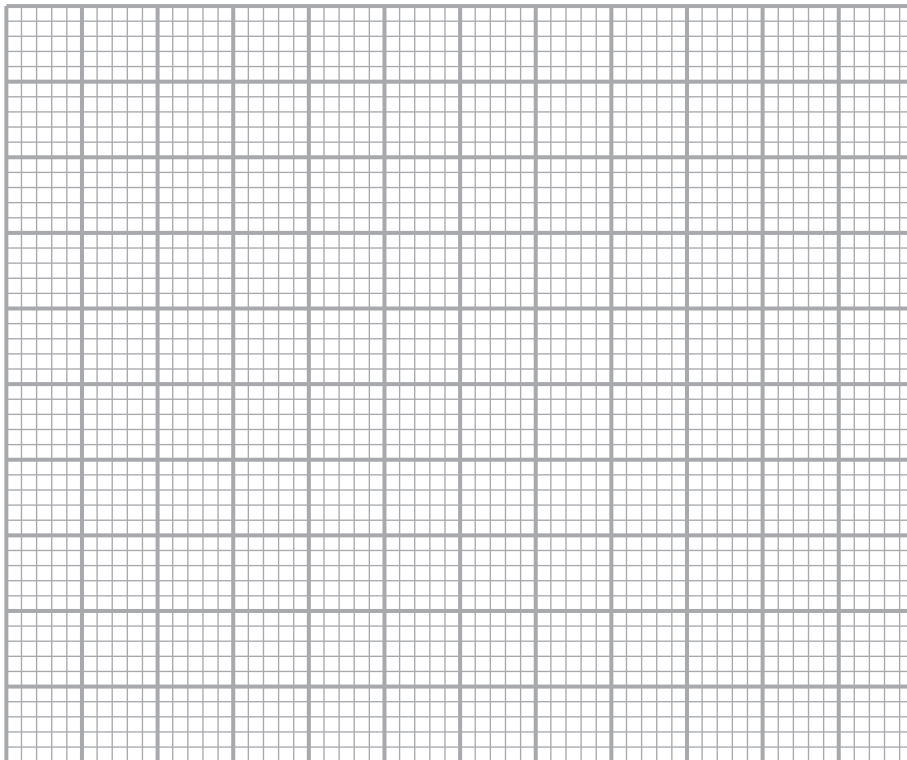
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15 The lengths of pieces of wood cut by a machine are shown in the table.

Lengths (cm)	Frequency
$10 < l \leq 20$	12
$20 < l \leq 40$	36
$40 < l \leq 55$	48
$55 < l \leq 65$	25
$65 < l \leq 95$	24
$95 < l \leq 120$	15

(a) Draw a clearly labelled histogram for this information on the grid provided.



[3]

Examiner Only	
Marks	Remark



(b) Estimate the number of pieces that have a length longer than the middle length in the modal class.

Answer _____ [2]

(c) A sample of size 50 is to be taken from the lengths which are shorter than 75 cm. Estimate how many of this sample will have a length shorter than 45 cm.

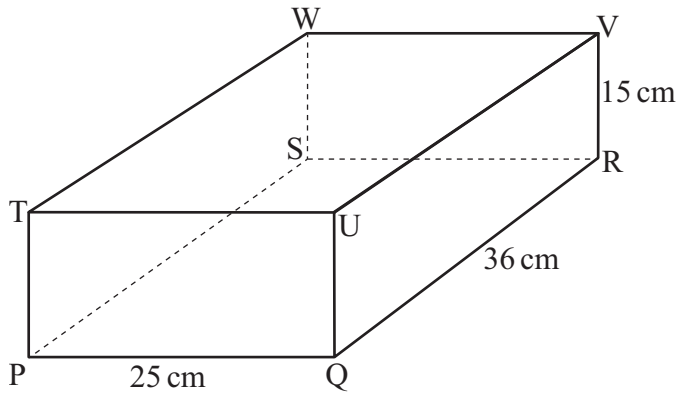
Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 15	

[Turn over



16



The cuboid above has dimensions $36 \text{ cm} \times 25 \text{ cm} \times 15 \text{ cm}$.

(a) Find the length of the space diagonal TR.

Answer _____ cm [2]

(b) Find the angle which TR makes with the face PQUT of the cuboid.

Answer _____ ° [3]

17 Given that $x^2 - 6x + 15 = (x - a)^2 + b$, find a and b .

Answer $a =$ _____ $b =$ _____ [3]

Examiner Only	
Marks	Remark
Total Question 16	
Total Question 17	

8124.04 R



Quality of written communication will be assessed in this question.

Show your working.

18 To estimate the number of ants in an anthill a sample of 200 was collected and marked with a blue dye. The next day a sample of 400 was taken and it was found to contain 64 ants with the blue dye.

(a) Estimate the number of ants in the anthill.

Answer _____ [2]

(b) Suggest an improvement to this sampling process which would give a more accurate estimate of the population of ants in the anthill.

_____ [2]

Examiner Only

Marks Remark

Total Question 18

[Turn over



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

Show all your working.

A solution by trial and improvement will not be accepted.

Answer _____ [7]

Examiner Only

Marks Remark

Total Question 20

[Turn over





In an election 45% of the votes went to Candidate A, $\frac{2}{3}$ of the remaining votes went to Candidate B and the rest of the votes were split evenly between Candidates C, D and E. Candidate D received 957 votes. If no votes were spoiled, how many people voted altogether?

Answer _____ [4]

Examiner Only	
Marks	Remark
Total Question 21	





THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	Marks
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Total Marks	

Examiner Number

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