



Rewarding Learning

General Certificate of Secondary Education  
January 2013

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Candidate Number

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## Mathematics

Unit T3

(With calculator)



Higher Tier



[GMT31]

\*GMT31\*

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-five** 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 1 and 25**.

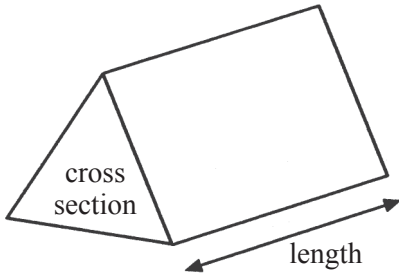
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is overleaf.

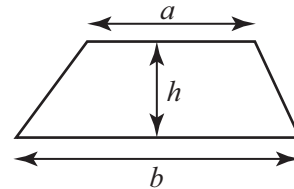


# Formula Sheet

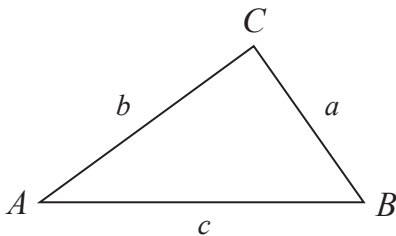
**Volume of prism** = area of cross section  $\times$  length



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



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

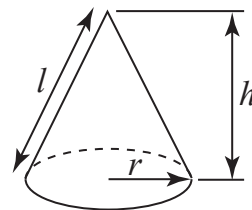
**Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$   
where  $a \neq 0$ , are given by

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

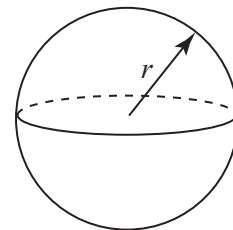
**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

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



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

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

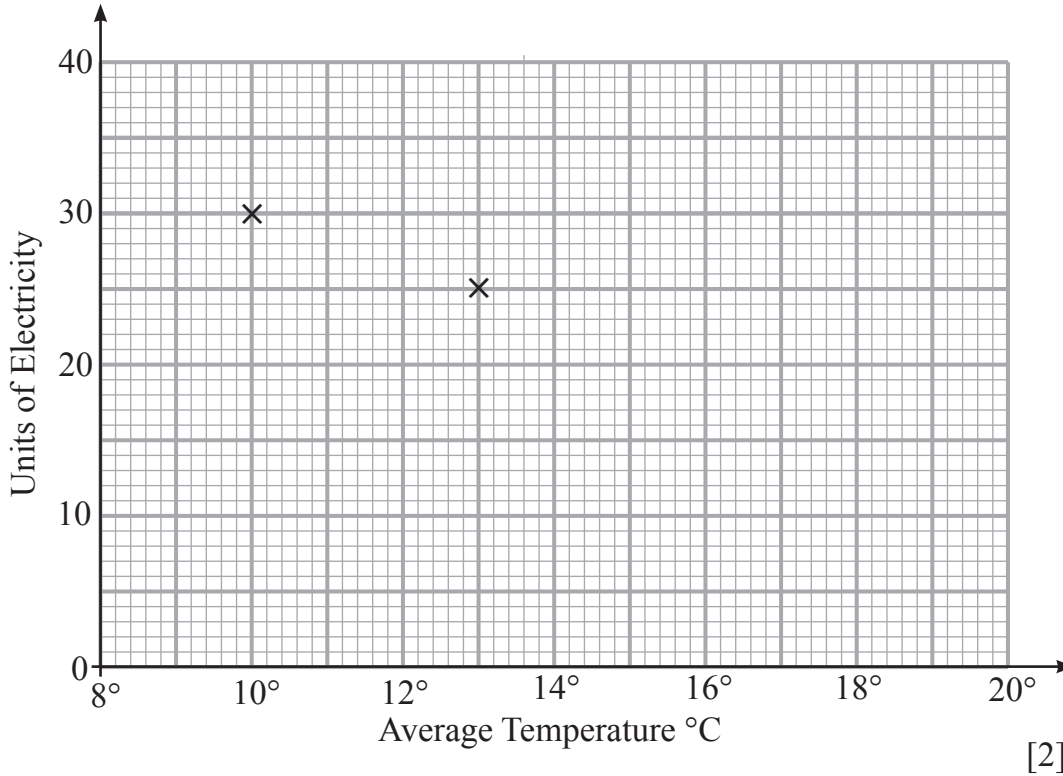




- 2 The table shows the number of units of electricity used in heating a greenhouse on eight different days and the average temperature for each day.

|  |    |    |    |    |    |    |    |    |
|--|----|----|----|----|----|----|----|----|
| Average Temperature ( $^{\circ}\text{C}$ ) | 10 | 13 | 15 | 12 | 14 | 20 | 17 | 19 |
| Units of Electricity                       | 30 | 25 | 22 | 26 | 20 | 14 | 17 | 15 |

- (a) Complete the scatter diagram shown (the first two points have been plotted for you).



- (b) Describe the correlation between Average Temperature and Units of Electricity.

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

- (c) Draw a line of best fit on the diagram.

[1]

- (d) Use your line of best fit to estimate how many of units of electricity were used when the temperature was  $16^{\circ}\text{C}$ .

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

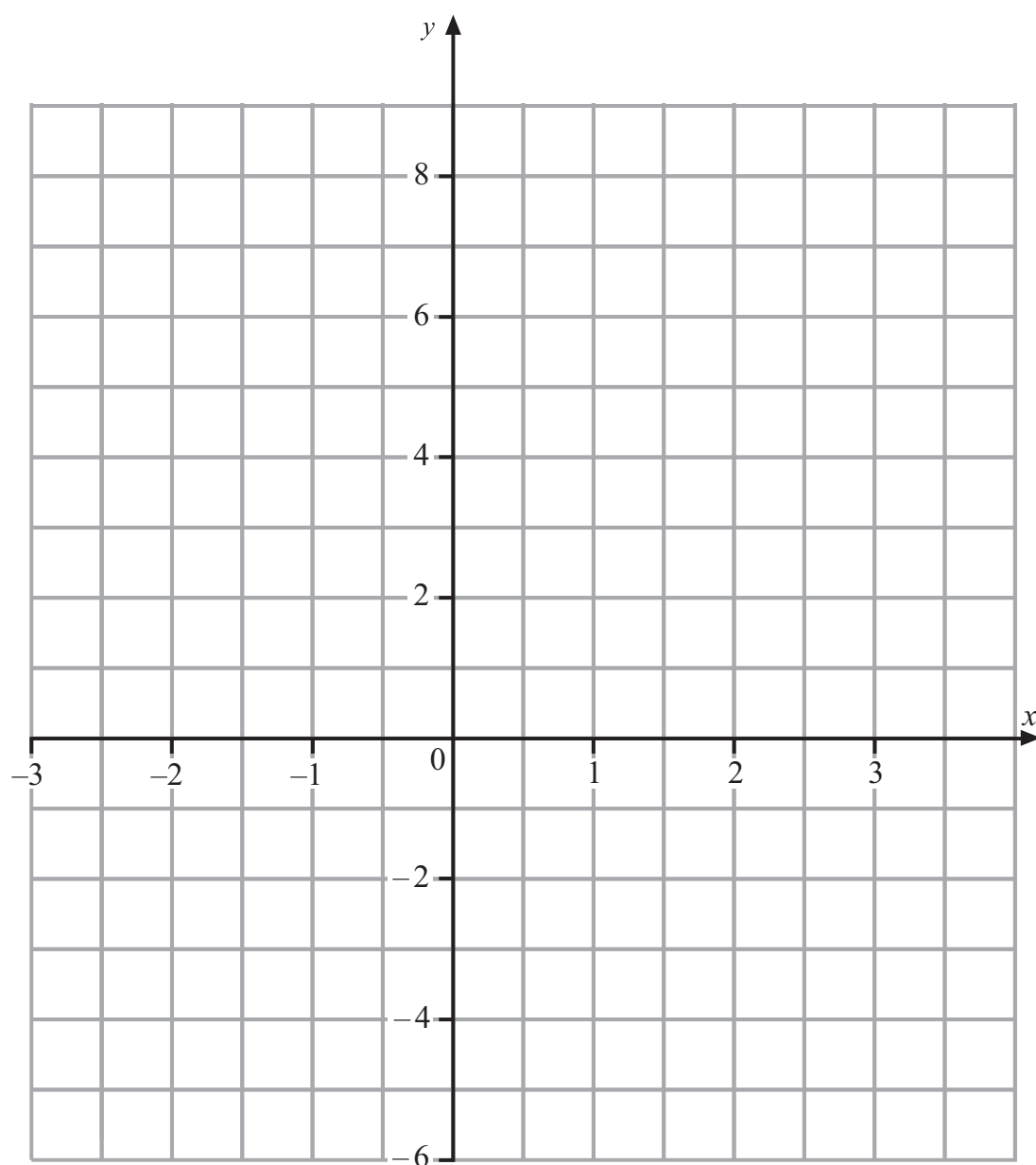
Examiner Only

Marks Remark

Total Question 2



3 Draw the graph of  $y = 3 - 2x$  on the grid below.



[3]

Examiner Only

Marks Remark

Total Question 3

[Turn over



4 A circle has a radius of 11.7 cm.

Work out the circumference of the circle.

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

Examiner Only

Marks Remark

Total Question 4

5 (a) Which of the following fractions is nearest in value to  $\frac{1}{4}$ ?

$$\frac{3}{10} \quad \frac{7}{20} \quad \frac{4}{15} \quad \frac{17}{60}$$

Show your working.

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

(b) Write down the meaning of  $0.\dot{5}\dot{7}$

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

Total Question 5



6 AB is a straight line. Three angles are shown.

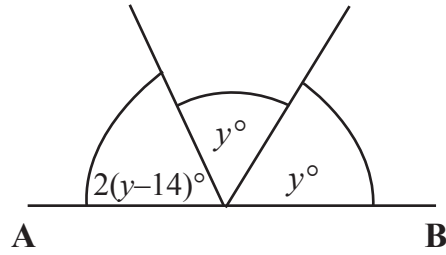


diagram  
not drawn  
accurately

(a) Write an **equation** in terms of  $y$ .

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

(b) Solve your equation to find  $y$ .

Answer  $y =$  \_\_\_\_\_ [3]

Examiner Only

Marks Remark

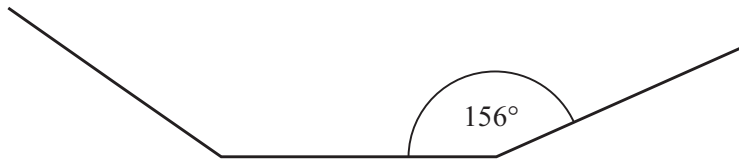
Total Question 6

[Turn over



7 The diagram below shows part of a regular polygon.

Each interior angle is  $156^\circ$ .



(a) Calculate the size of the exterior angle of the polygon.

Answer \_\_\_\_\_  $^\circ$  [2]

(b) Calculate the number of sides of the polygon.

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

Examiner Only

Marks Remark

Total Question 7











10



The diagram above represents the location of two boats, A and B, at sea.

A lighthouse, H, can be seen from both boats.

The bearing of the lighthouse from A is  $216^\circ$ .

The bearing of the lighthouse from B is  $278^\circ$ .

On the diagram above, locate and mark the position of the lighthouse, H.

[2]

Examiner Only

| Marks | Remark |
|-------|--------|
|-------|--------|

|                   |  |
|-------------------|--|
| Total Question 10 |  |
|                   |  |



11

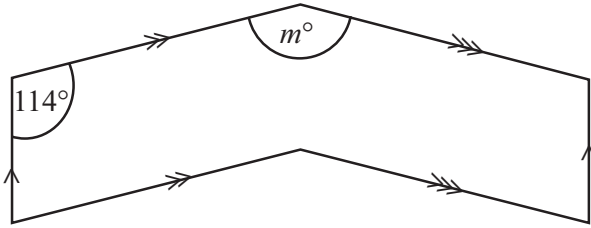


diagram  
not drawn  
accurately

The shape above has three pairs of parallel lines and one line of symmetry.

An angle of  $114^\circ$  is as shown on the diagram.

Find the size of the angle marked  $m$ .

Answer  $m =$  \_\_\_\_\_ [2]

| Examiner Only     |        |
|-------------------|--------|
| Marks             | Remark |
|                   |        |
| Total Question 11 |        |
|                   |        |

[Turn over



12 Simplify  $\frac{x}{4} - \frac{x}{6}$

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

Examiner Only

Marks Remark

Total Question 12

13 The volume of water in a tank increases by 5% every hour.  
At 2pm there are 6000 litres of water in the tank.  
What will the volume of water be at 5pm?

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

Total Question 13





15 (a) The two points A (6, 6) and B (-4, 6) are joined by a straight line.

Work out the  $x$  co-ordinate of the midpoint of the line AB.

Answer midpoint ( \_\_\_\_\_, 6 ) [1]

(b) C has coordinates (6, -1). B has coordinates (-4, 6).  
Calculate the length of the line CB.

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

Examiner Only

Marks Remark

Total Question 15







16 In a class there are 16 girls and 14 boys.  
Thirteen of the girls are right-handed and eleven of the boys are right-handed.  
What percentage of the class are right-handed?

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

| Examiner Only     |        |
|-------------------|--------|
| Marks             | Remark |
|                   |        |
| Total Question 16 |        |
|                   |        |

17 A student is designing a questionnaire for her friends to complete. She wants to find the different activities that her friends attend after school.  
  
Design a suitable question with appropriate response boxes which would allow **every** student to make a response.

[2]

|                   |  |
|-------------------|--|
|                   |  |
| Total Question 17 |  |
|                   |  |



18 Write 90 as a product of prime factors.

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

Examiner Only

Marks Remark

Total Question 18

19 One solution of  $x^3 - 2x = 30$  lies between 3 and 4

Use the method of **trial and improvement** to find this solution correct to one decimal place.

**Show all your working.**

Answer  $x =$  \_\_\_\_\_ [3]

Total Question 19



20 (a) Expand and simplify

(i)  $6(y + 3) - 2(2y + 3)$

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

(ii)  $(x - 3)^2$

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

(b) Write down the  $n$ th term for the sequence

2, 8, 14, 20, .....

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

Examiner Only

Marks Remark

Total Question 20

[Turn over





22 (a) Evaluate  $\frac{3}{4} + 2\frac{1}{2} \times 1\frac{1}{3}$  giving your answer as a mixed number.

Show all your working.

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

(b) Find the lowest common multiple (LCM) of 48 and 80

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

Examiner Only

Marks Remark

Total Question 22

[Turn over

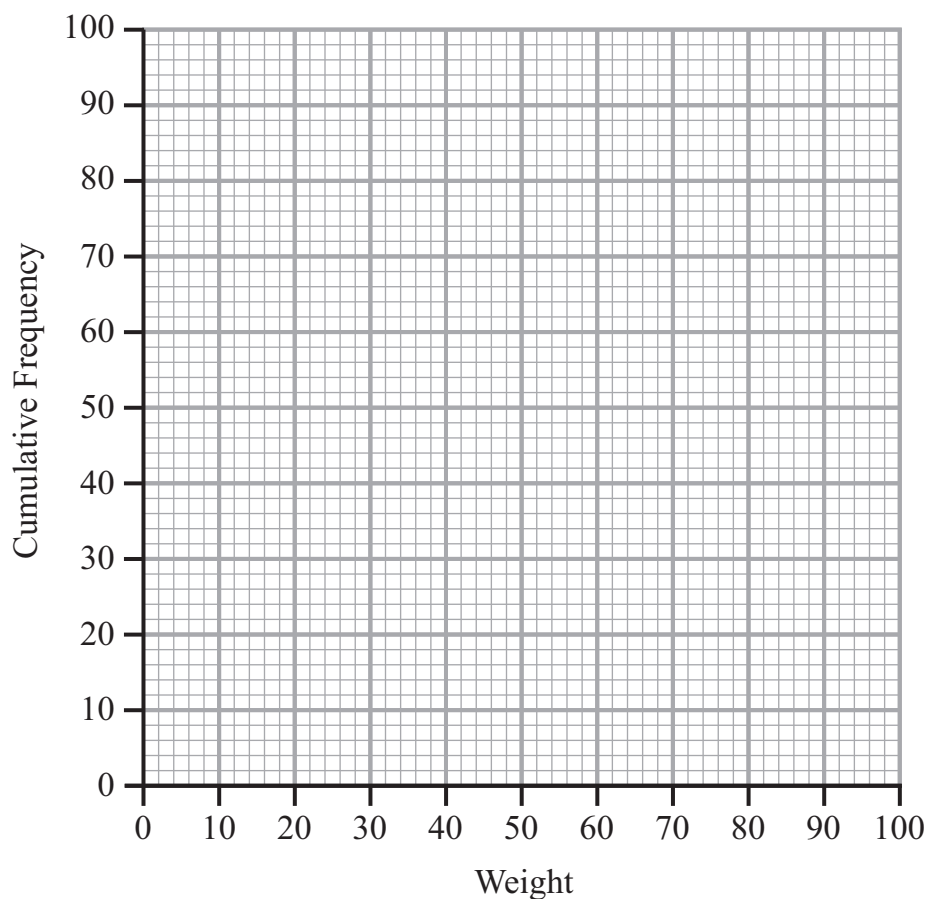


23 The weights of potatoes collected from 100 garden plots are shown in the table.

| 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 |
|               |        |





24 (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  $x =$  \_\_\_\_\_,  $y =$  \_\_\_\_\_ [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  $x =$  \_\_\_\_\_ [4]

Examiner Only

Marks Remark

Total Question 24

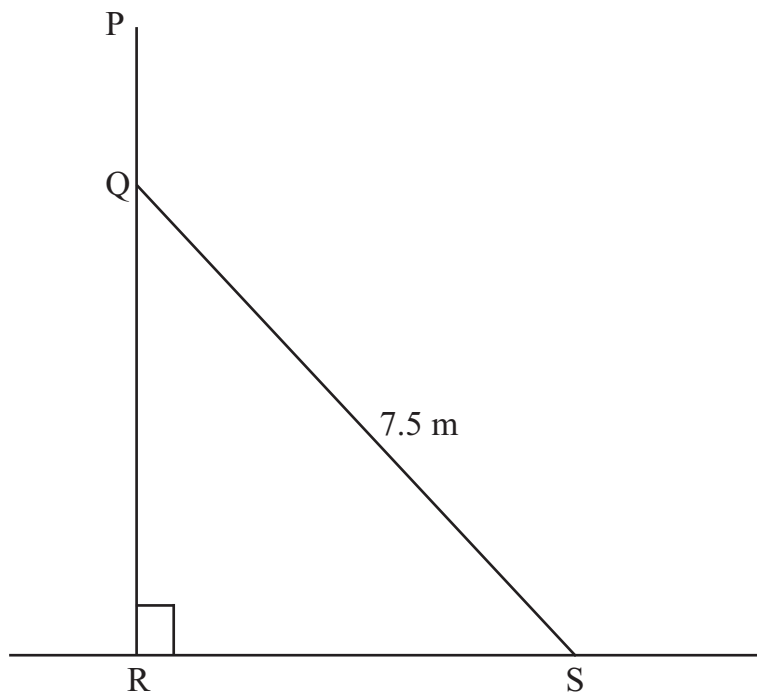




Quality of written communication will be assessed in this question.

Show your working.

25



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.

[4]

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Marks Remark

Total Question 25



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| For Examiner's use only |       |
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| Question Number         | Marks |
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| 2                       |       |
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| <b>Total Marks</b> |  |
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Examiner Number

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