Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
January 2013

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**.
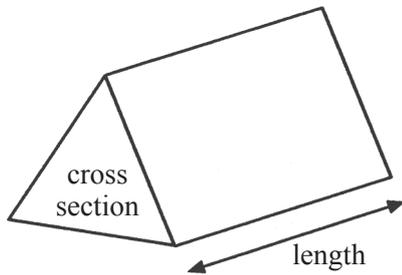You should have a calculator, ruler, compasses and a protractor.
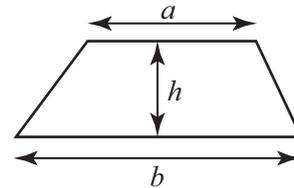The Formula Sheet is overleaf.

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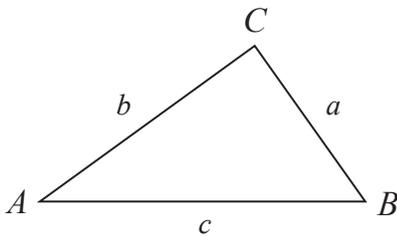
Formula Sheet

Volume of prism = area of cross section × length

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

In any triangle *ABC*

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

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

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

Cosine Rule: $a^2 = b^2 + c^2 - 2bc\cos A$
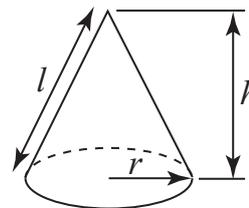
Area of triangle = $\frac{1}{2}ab\sin C$

Quadratic Equation
The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by
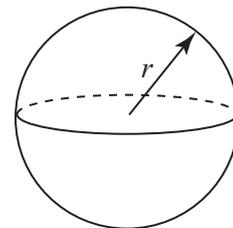
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

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

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1 **Quality of written communication will be assessed in this question.**
   Show your working.

The signs below showed the price of the same table in two different stores.

Super Price
£640
15% off
marked price

Right Price
£460
plus
20% VAT

Which store had the cheaper price for the table?

Explain your answer.
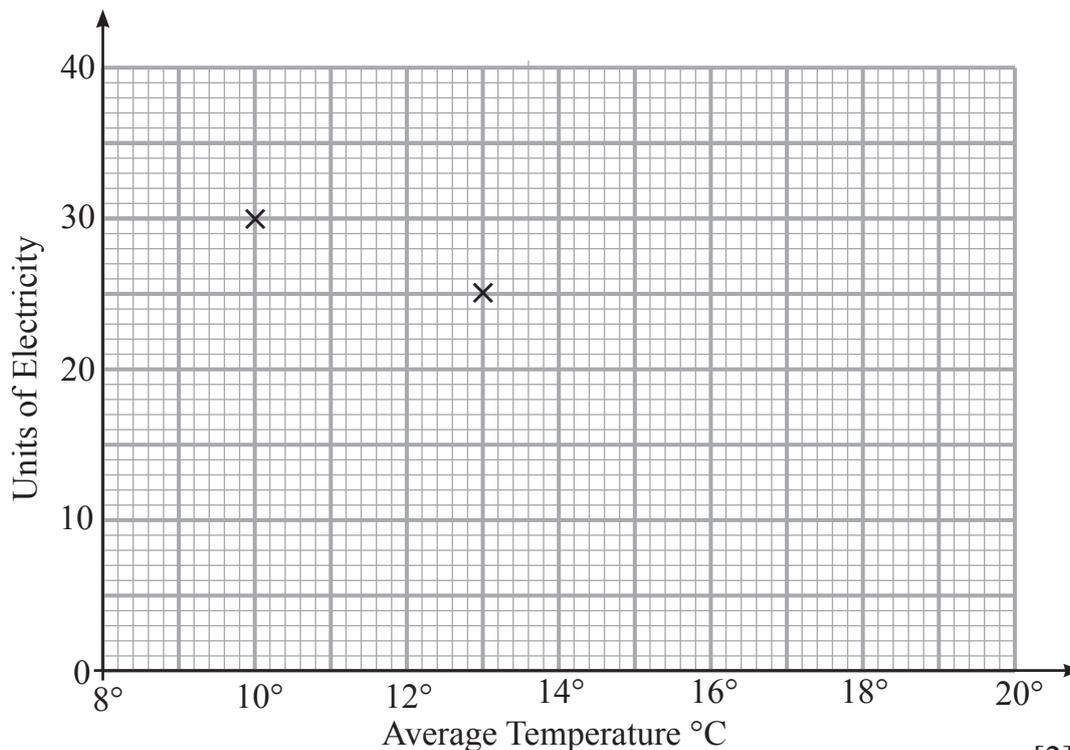
Answer _____ [6]

Total Question 1

[Turn over

8123

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 (°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).

[2]

(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 °C.
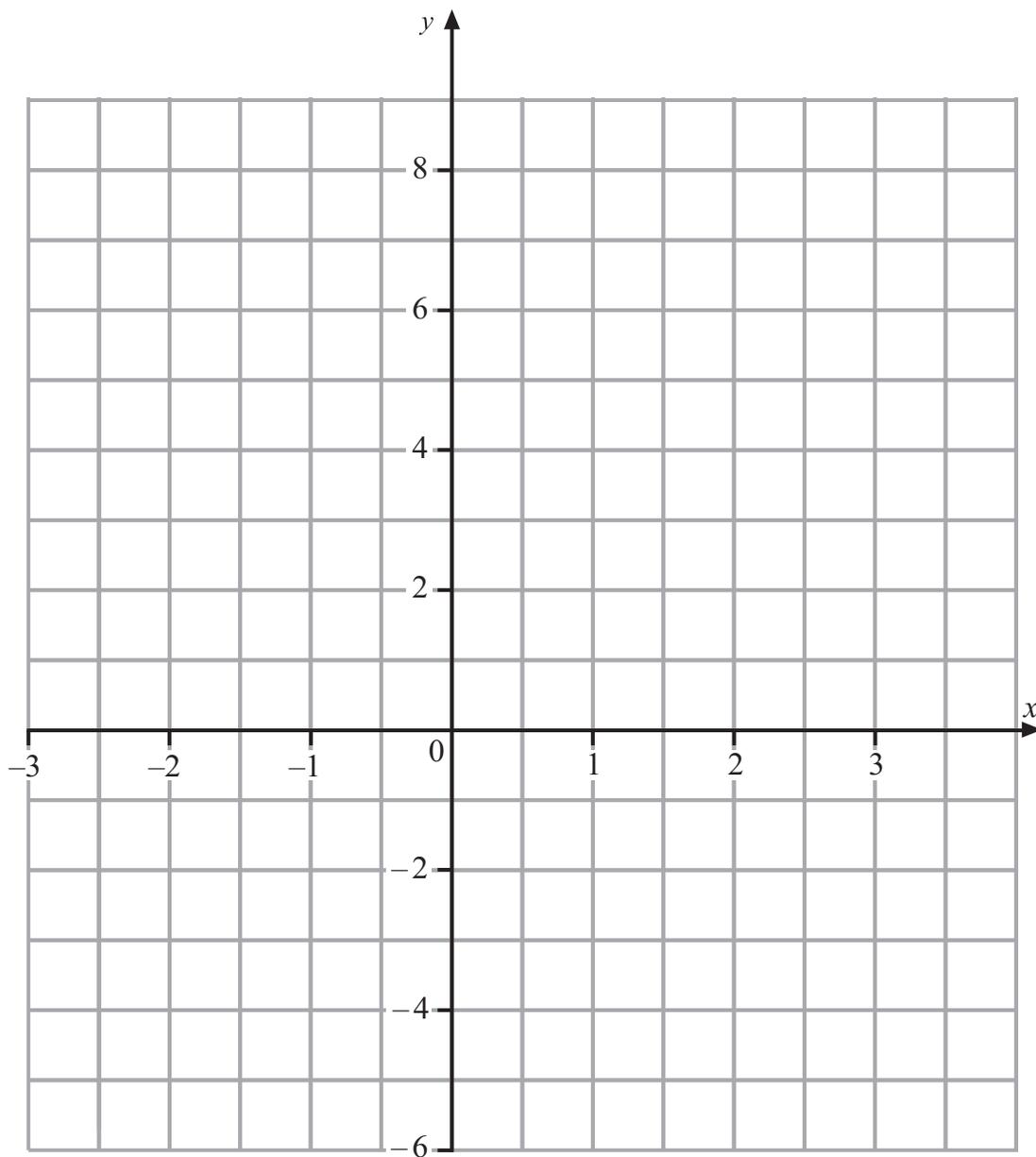
Answer _____ units [1]

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

y

8

6

4

2

x

−3   −2   −1   0   1   2   3

−2

−4

−6

[3]

Total Question 3

[Turn over

8123

4 A circle has a radius of 11.7 cm.

Work out the circumference of the circle.

Answer _____ [3]

Total Question 4

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

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

Show your working.

Answer _____ [2]

(b) Write down the meaning of $0.5\dot{7}$

Answer _____ [1]

Total Question 5

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6   AB is a straight line. Three angles are shown.
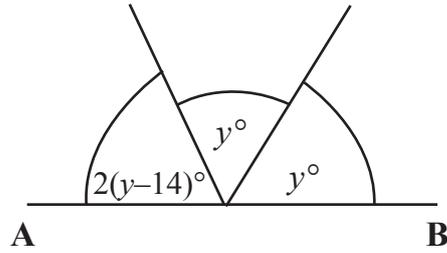
diagram
not drawn
accurately

$y°$

$2(y–14)°$ $y°$

A   **B**

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

Answer _____ [1]

(b) Solve your equation to find y.

Answer $y =$ _____ [3]

Total Question 6

[Turn over

8123

7 The diagram below shows part of a regular polygon.

Each interior angle is 156°.
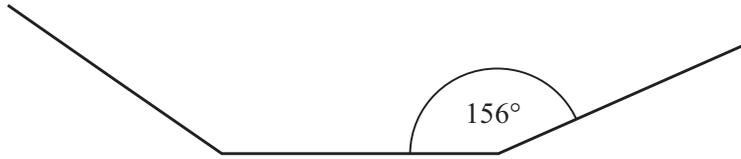
(a) Calculate the size of the exterior angle of the polygon.

Answer _____° [2]

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

Answer _____ [2]

Total Question 7

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8 Factorise fully

(a) $12p + 8$ Answer _____ [1]

(b) $25 - a^2$ Answer _____ [1]

Total Question 8

[Turn over

8123

9 The table shows the marks achieved by a class of girls in a test.

Marks	Number of girls
1–10	3
11–20	8
21–30	7
31–40	7
41–50	4
51–60	2

(a) Draw a grouped frequency diagram.

[3]

(b) Write down the modal class.

Answer _____ [1]

(c) Calculate an estimate for the mean mark in the test.

Answer _____ [4]

(d) Which group contains the median mark?

Answer _____ [1]

Total Question 9

[Turn over

8123

28GMT3111

10

N

×
A

N

×
B

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°.

The bearing of the lighthouse from B is 278°.

On the diagram above, locate and mark the position of the lighthouse, H.
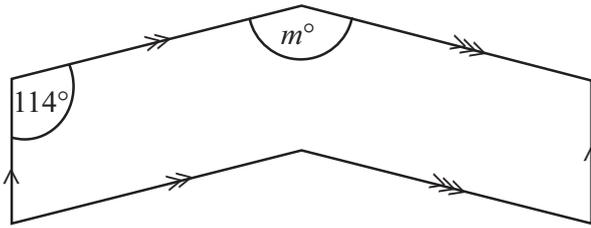
[2]

Total Question 10

8123

11

diagram
not drawn
accurately

m°

114°

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

An angle of 114° is as shown on the diagram.

Find the size of the angle marked *m*.

Answer *m* = _____ [2]

Total Question 11

[Turn over

8123

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

Answer _____ [3]

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

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14

25 cm

The cylinder above has a capacity of 3 litres. It is 25 cm high.

Find the radius of the cylinder.

Answer _____ cm [4]

Total Question 14

[Turn over

8123

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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]

Total Question 15

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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]

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

[Turn over

8123

18 Write 90 as a product of prime factors.

Answer _____ [2]

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

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20 (a) Expand and simplify

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

                      Answer _____ [2]

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

                      Answer _____ [2]

(b) Write down the nth term for the sequence

    2,   8,   14,   20, ...

                      Answer _____ [2]

Total Question 20

8123

21

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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?

Answer £ _____ [3]

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
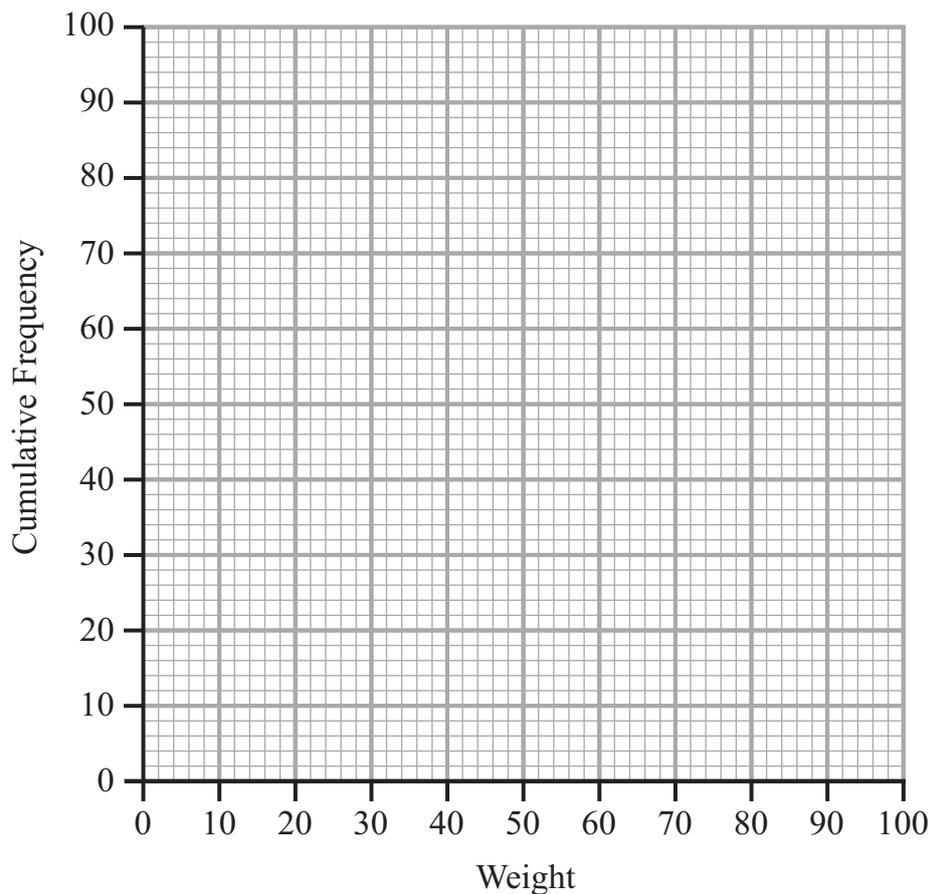
Answer _____ [2]

Total Question 22

[Turn over

8123

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

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

(a) Complete the Cumulative Frequency column in the table. [1]

(b) Hence draw the Cumulative Frequency graph on the axes provided.

[3]

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(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]

Total Question 23

[Turn over

8123

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 $\dfrac{x-1}{3} + \dfrac{3x-2}{4} = \dfrac{4}{3}$

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

Total Question 24

Answer $x =$ _____ [4]

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Quality of written communication will be assessed in this question.
Show your working.

25

P

Q

7.5 m

R   S
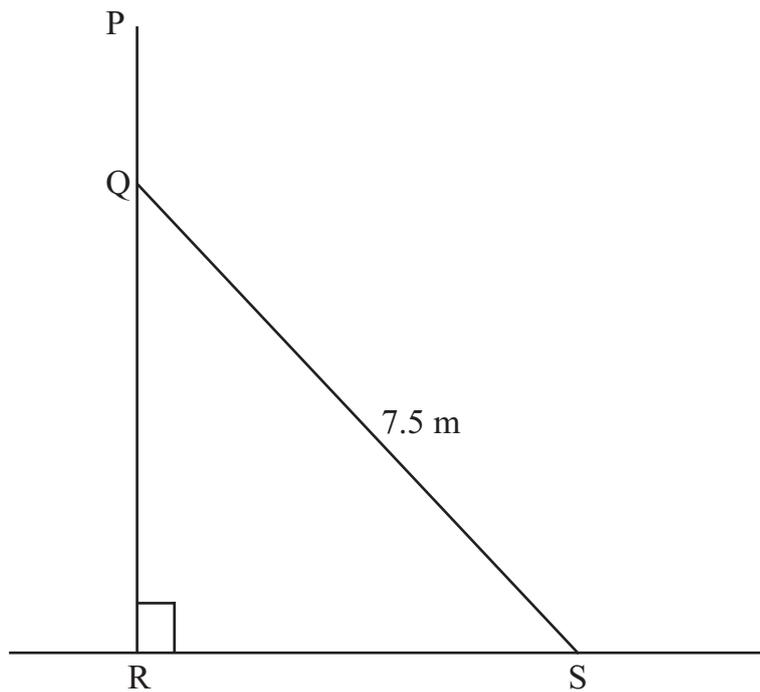
The diagram represents a vertical wall PQR.
RS is horizontal ground.
SQ is a metal support of length 7.5 metres.
The height of the wall is 10 metres.
For the support to be effective, the length PQ must be at least 3 metres.
Show that when the angle RSQ = 67° the support will be effective.

[4]

Total Question 25

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