Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018

Mathematics

Unit T4
(With calculator)
Higher Tier

[GMT41]

GMT41

THURSDAY 24 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 or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-one** 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.

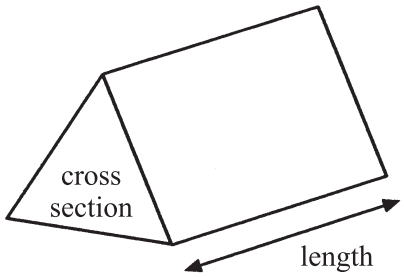
INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed 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 Question **6**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

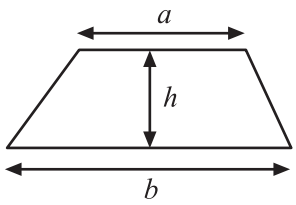
11206

Formula Sheet

Volume of prism = area of cross section × length

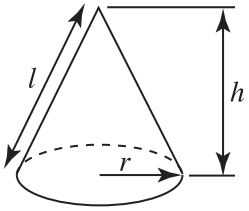


Area of trapezium = $\frac{1}{2}(a+b)h$



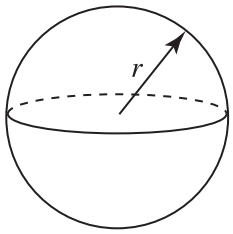
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

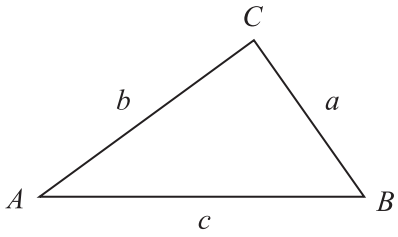


Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

11206

1 A school timetable is being arranged.

The day can be arranged in 30-minute classes or 50-minute classes or 60-minute classes.

No matter which of the three choices is made, the total daily teaching time will be the same.

Ignoring the time for break or lunch, what is the daily teaching time?

You must show all your working.

Answer _____ [4]

[Turn over

2 Solve the equation

$$\frac{2x-1}{3} + \frac{x+2}{2} + \frac{x}{6} = 8$$

Show all your working clearly.

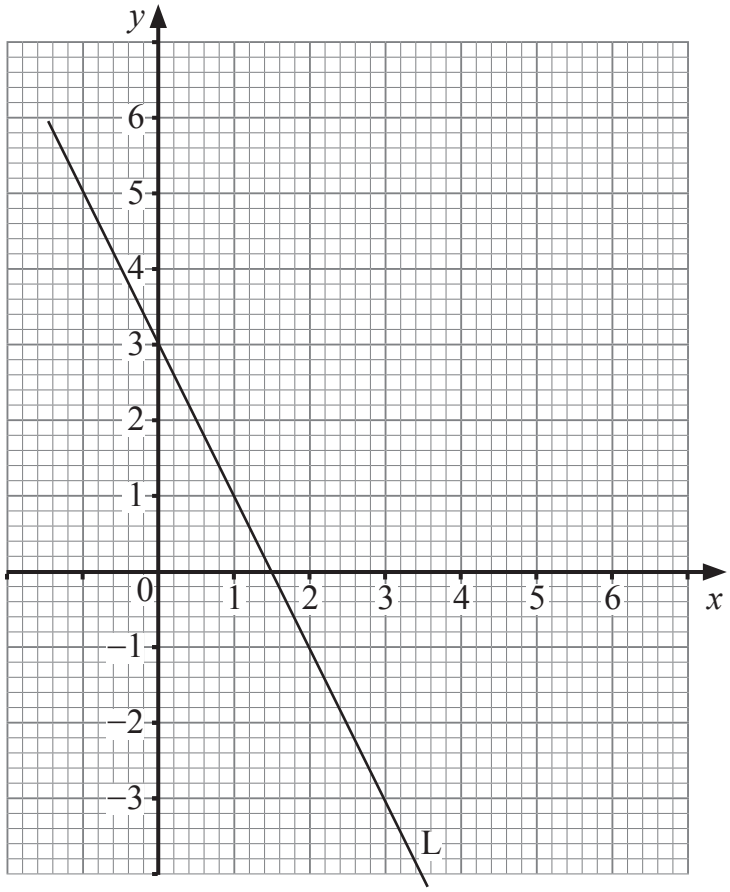
A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [5]

3 Factorise $y^2 - 6y + 8$

Answer _____ [2]

4 Find the equation of the straight line L.



Answer _____ [3]

[Turn over

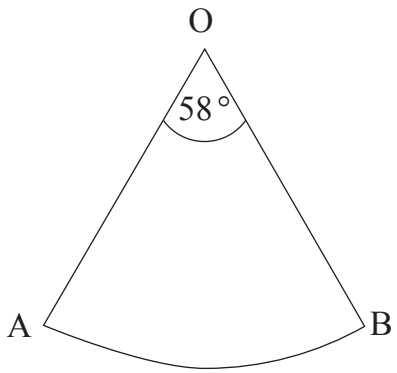
5 A man has mass 74 kg and his son has mass 42 kg, both measured to the nearest kilogram.

What is the maximum difference in mass between the man and his son?

Answer _____ kg [2]

Quality of written communication will be assessed in this question.

6



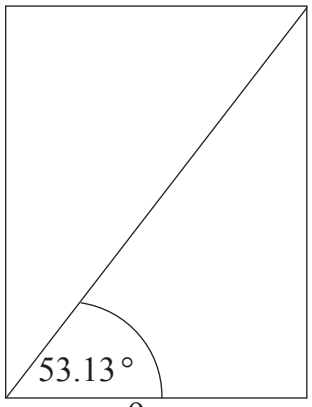
AOB is a sector of a circle with centre O and radius 4cm.

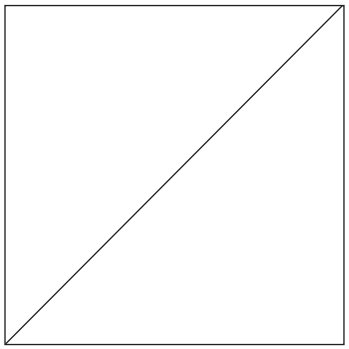
Which is longer, the radius or the arc length AB?

Show working to justify your answer.

Answer _____ [3]

7 A rectangle and a square have the same length of diagonal.





diagrams not drawn accurately

Calculate the length of the side of the square.

Give your answer correct to 1 decimal place.

Answer _____ cm [6]

[Turn over

8 250 phone calls were made by a company one day.

The length of each call was recorded and the results are shown in the table.

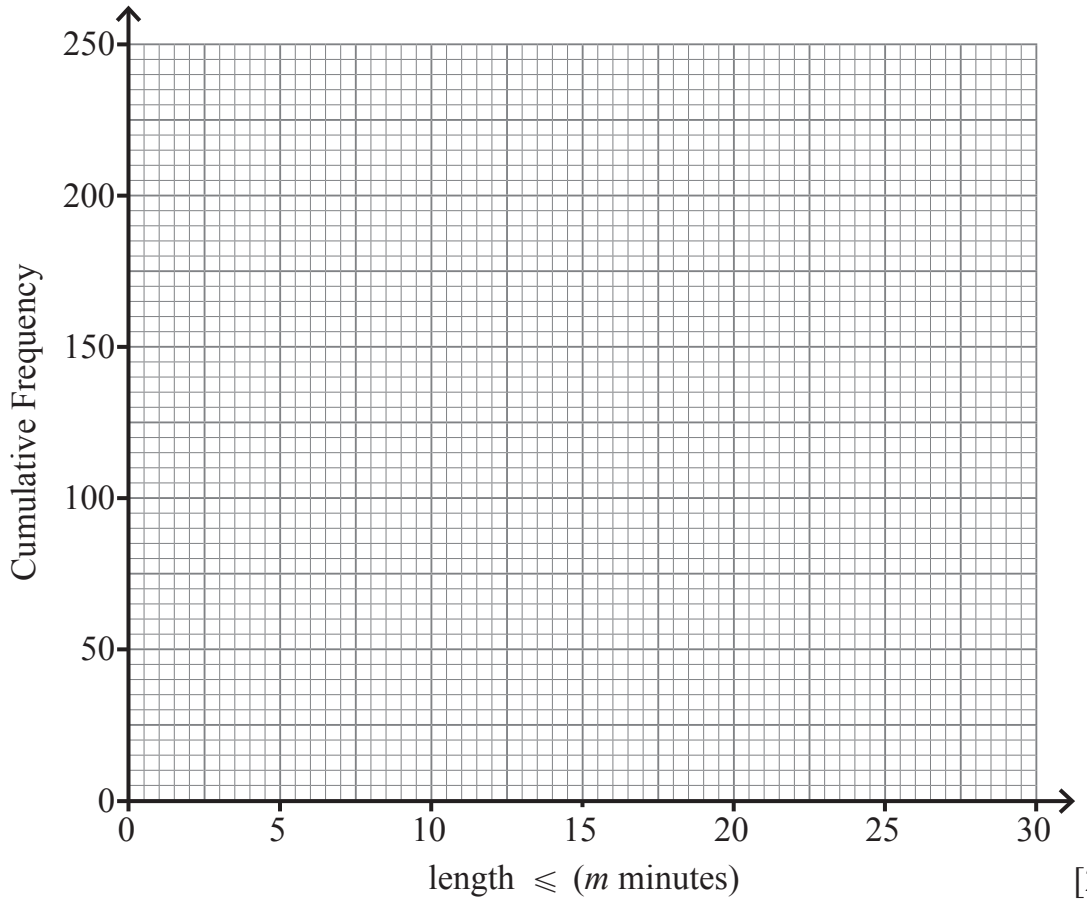
Length m in minutes	Number of phone calls
$0 < m \leqslant 5$	38
$5 < m \leqslant 10$	68
$10 < m \leqslant 15$	66
$15 < m \leqslant 20$	43
$20 < m \leqslant 25$	21
$25 < m \leqslant 30$	14

(a) Complete the cumulative frequency table.

Length $\leqslant m$ minutes	Number of phone calls
5	38
10	
15	
20	
25	
30	

[1]

(b) Draw the cumulative frequency graph on the grid.



[2]

[Turn over

(c) From your graph estimate

(i) the median length of time, Answer _____ minutes [1]

(ii) the range of the hundred longest calls.

Answer _____ minutes [2]

(d) The shortest call lasted 2 minutes and the longest call lasted 30 minutes.

Draw a box plot below the graph (on previous page). [3]

9 Factorise fully

$$4q^2 - r^2$$

Answer _____ [2]

10 The force of attraction, F, between two objects is inversely proportional to the square of the distance, D, between them.

When $F = 60$, $D = 1.5$

(a) Express F in terms of D.

Answer _____ [2]

(b) Find F when $D = 2.5$

Answer _____ [1]

(c) Find D when $F = 375$

Answer _____ [2]

[Turn over

11 A bag contains 36 coins.

All of them are either 2p or 5p coins.

The total value of the money in the bag is £1.23

Find the numbers of 2p and 5p coins.

A solution by trial and improvement will not be accepted.

Answer _____ 2p coins

Answer _____ 5p coins [4]

12

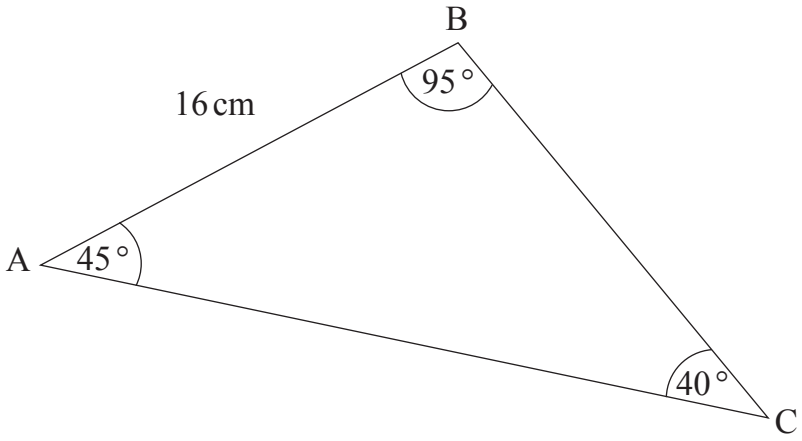


diagram not drawn accurately

Calculate the area of this triangle.

Answer _____ cm^2 [4]

[Turn over

13 The lines STR and BCR are tangents to the circle shown.

Angle RTC = 47 ° and angle ADC = 94 °

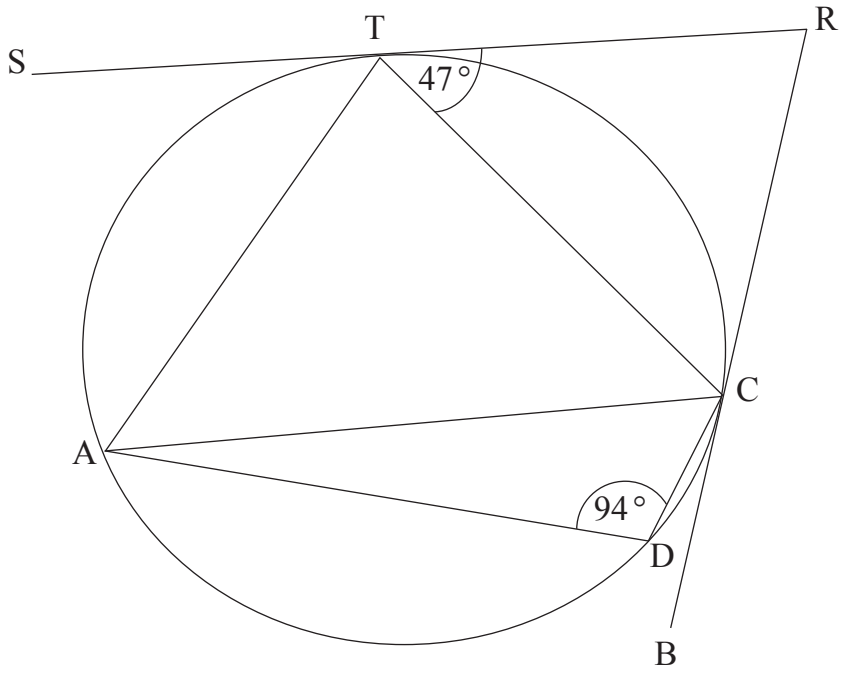


diagram not drawn accurately

John proved that the lines AC and SR are parallel.
He used the following proof but didn't give his reasons.

Using the properties of tangents and circle theorems complete John's argument.

1. Angle RCT = 47 ° because _____

2. Angle RTC = Angle TAC because _____

3. Angle ATC = 86 ° because _____

4. Angle STA = 47 ° because _____

5. So the lines AC and SR are parallel because _____

[5]

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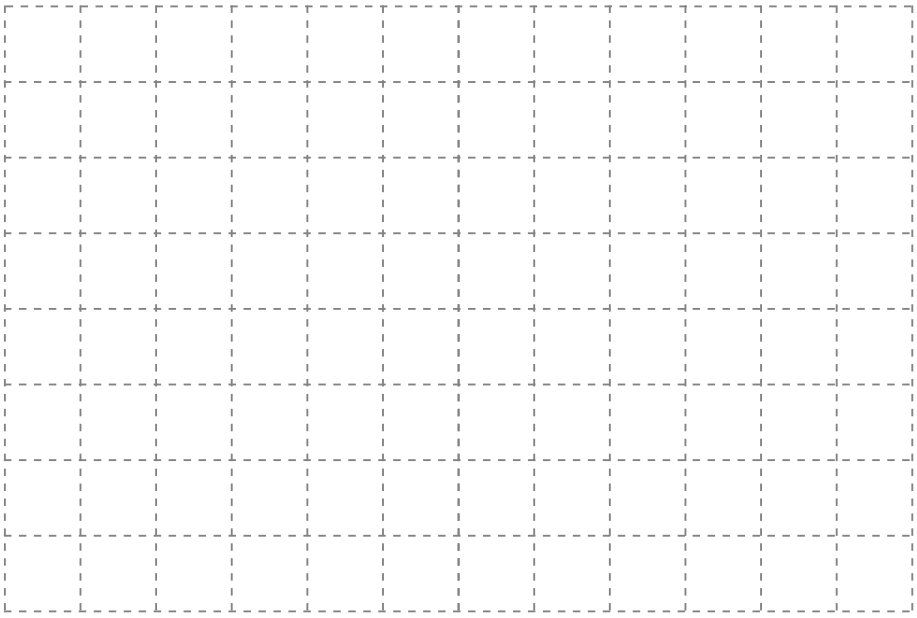
(Questions continue overleaf)

[Turn over

14 The table gives information about the weights of 75 children.

Weight, w kg	Number of Children
$20 \leqslant w < 30$	18
$30 \leqslant w < 36$	15
$36 \leqslant w < 40$	14
$40 \leqslant w < 50$	22
$50 \leqslant w < 65$	6

(a) Illustrate the data by drawing a histogram on the graph paper below.



[3]

(b) A stratified sample of 30 children was taken from those whose weight was less than 40 kg.

Estimate how many of the sample were taken from the interval 30–36

Answer _____ [2]

15 **(a)** Give a reason why a stratified sample is usually better than a random sample.

_____ [1]

(b) Give a reason why someone might choose to take a random sample rather than a stratified sample.

_____ [1]

16 Show that $16^{1\frac{1}{4}} = 32$, without using a calculator.

[3]

[Turn over

17 Solve the equation

$$\frac{3}{3x+5} - \frac{5}{2x+3} = 2$$

Answer _____ [7]

18 **(a)** Find the point of intersection of the line $y = \frac{1}{4}x + 6$ and the line $3x - 2y + 6 = 0$

Answer _____ [4]

(b) Find the equation of the line L which is perpendicular to the line $3x - 2y + 6 = 0$ and passes through the point $(3, -5)$

Answer _____ [4]

[Turn over

19 A student prepared a frequency table for an experiment involving measuring weights, w, in grams.

w (grams)	Frequency
$0 \leqslant w < 10$	5
$10 \leqslant w < a$	9
$a \leqslant w < 25$	27
$25 \leqslant w < 30$	14
$30 \leqslant w < 40$	17

The frequency density for the third group in the table was twice the frequency density for the second group.

(a) Find the value of a.

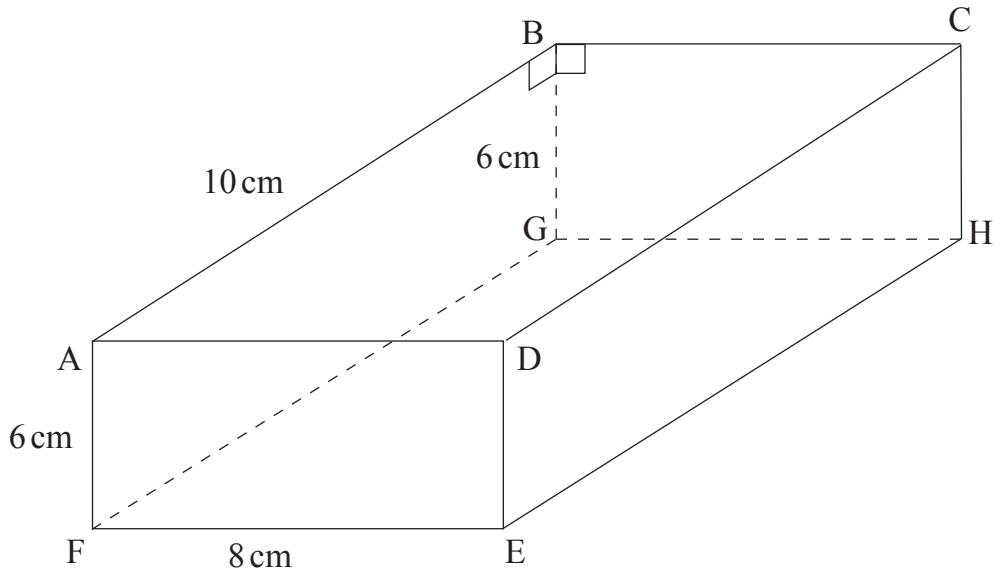
Answer $a =$ _____ [3]

(b) Using this value of a calculate an estimate for the interquartile range of his data.

Answer _____ [5]

20 In the solid shown, ABCDEFGH is a cuboid.

Find the size of the angle between the lines EB and EC.



Answer _____ ° [5]

[Turn over

21 Solve the simultaneous equations

$$y + 4xy - y^2 = -12 \qquad \text{and} \qquad 2x + y = 2$$

A solution by trial and improvement will not be accepted.

Answer _____ [8]

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

Examiner Number