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Candidate Number

#### General Certificate of Secondary Education January 2014

### **Mathematics**

Unit T4

(With calculator)



[GMT41]





\*GMT41\*

FRIDAY 10 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 with a gel pen**.

Answer all twenty 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 3(b) and 10.

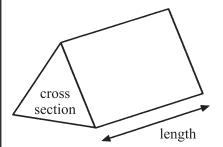
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

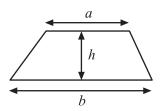


# **Formula Sheet**

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



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



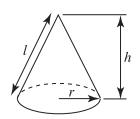
**Volume of cone** =  $\frac{1}{3}\pi r^2 h$ 

**Curved surface area of cone** =  $\pi rl$ 

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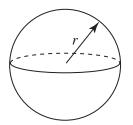
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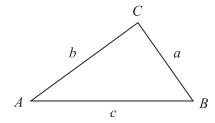


Volume of sphere  $= \frac{4}{3}\pi r^3$ 

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

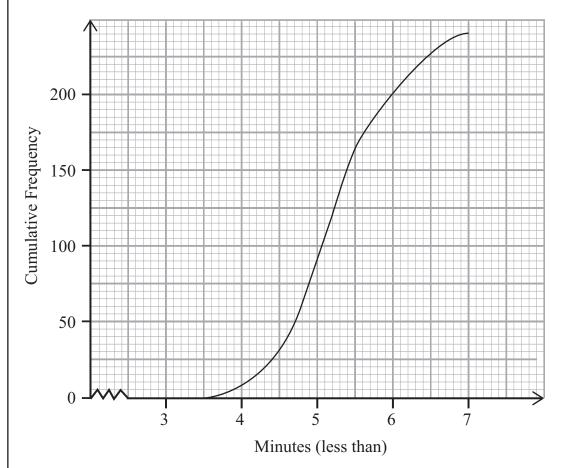
| 1    | On every swing, a pendulum reaches 60% of the previous distance.           | Examin<br>Marks | er Only<br>Remark |
|------|--|-----------------|-------------------|
|      | The pendulum swings 1.8 metres on its first swing.                         |                 |                   |
|      | After how many swings will the distance first fall below 20 cm?            |                 |                   |
|      |  |                 |                   |
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|      |  |                 |                   |
|      | Answer swings [2]  | Total Qu        | estion 1          |
|      |  |                 |                   |
| 2    | During a very cold winter a glacier increased its volume by 32%.           |                 |                   |
|      | At the end of the winter its volume was found to be 6864 km <sup>3</sup> . |                 |                   |
|      | What was its original volume at the start of that winter?                  |                 |                   |
|      |  |                 |                   |
|      |  |                 |                   |
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|      |  | T . 10          |                   |
|      |  | Total Qu        | lestion 2         |
|      |  | Turr            | n over            |
| 8693 | Answer km <sup>3</sup> [3]   | Liuii           | 1 0 4 61          |

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## Quality of written communication will be assessed in part (b) of this **Examiner Only** Marks Remark question. 3 The information given below relates to the ages (in years) of members of a badminton club. Lower Quartile = 28 Median = 32Upper Quartile = 54 Youngest = 12Range = 58(a) Draw a box plot to show this information. 20 30 50 10 40 60 70 80 Age (years) [3] **(b)** The box plot below shows the age distribution of members of a bowls club. 0 10 20 30 40 50 60 70 80 Age (years) Compare the age distributions of the members of the badminton club and the bowls club. Total Question 3

The cumulative frequency curve represents the times taken to run 1500 m by each of the members of a running club.

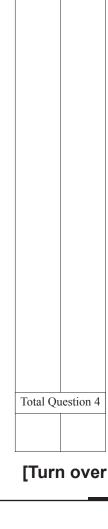


(a) Use the graph to estimate the interquartile range.

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

(b) Any member taking more than  $5\frac{1}{2}$  minutes has to do extra training. Use the graph to estimate the percentage of runners who have to undertake extra training.

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



Examiner Only



PQRS represents a rectangular gate.  $PS = 200 \, \text{cm}$  and  $SR = 300 \, \text{cm}$ .

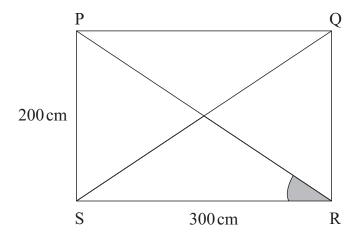


diagram not drawn accurately

(a) Calculate the size of angle PRS

Answer \_\_\_\_\_ ° [3]

**(b)** The measurements of the gate are all to the nearest centimetre. What is the smallest possible perimeter of the gate?

Total Question 5

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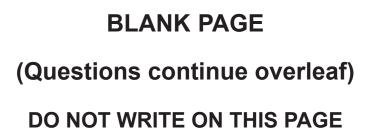
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Marks Remark

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





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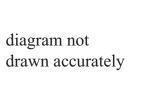
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(a) R, S, T and U are points on the circumference of a circle, centre O. The angle RUS is 46° and the angle URT is 36°



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| R $S$   |   |
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| 46°     |   |
|         |   |
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|         |   |
|         |   |
| U       |   |

Calculate

(i) the angle RTS,

Answer \_\_\_\_\_ ° [1]

(ii) the angle ROS,

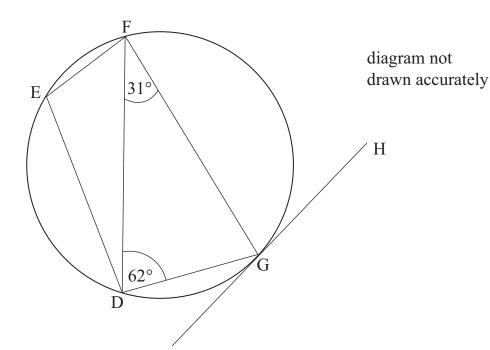
Answer \_\_\_\_\_ ° [1]

(iii) the angle SUT.

Answer \_\_\_\_\_ ° [1]



(b) D, E, F and G are points on the circumference of the circle below. The angle FDG = 62° and the angle DFG = 31° HG is a tangent to the circle.



(i) Write down the size of angle FGH.

Answer \_\_\_\_\_ ° [1]

(ii) Calculate the size of angle DEF.

Answer \_\_\_\_\_ ° [2]

| Total Qu | estion 6 |
|----------|----------|
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| 7    | The stra       | aight line, L, passes through the points $(0, -2)$ and $(3, 2)$ . |     | Examin<br>Marks | er Only<br>Remark |
|------|----------------|---|-----|-----------------|-------------------|
|      | (a) Wo         | ork out the gradient of L.  |     |                 |                   |
|      |                |   |     |                 |                   |
|      |                |   |     |                 |                   |
|      |                |   |     |                 | ı                 |
|      |                |   |     |                 | ı                 |
|      |                |   |     |                 | ı                 |
|      |                | Answer  | [2] |                 | ı                 |
|      | <b>(b)</b> Sho | ow that the equation of L is $4x - 3y = 6$                        |     |                 | ı                 |
|      | ( )            |   |     |                 | ı                 |
|      |                |   |     |                 |                   |
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|      |                |   |     |                 |                   |
|      |                |   |     |                 | ı                 |
|      |                |   | [2] |                 | ı                 |
|      | (c) Wr         | rite down the equation of another line that is parallel to L.     |     |                 | ı                 |
|      |                |   |     |                 |                   |
|      |                | Answer  | [1] |                 |                   |
|      | / P. XXI       |   |     |                 |                   |
|      | <b>(d)</b> Wr  | rite down the gradient of a line perpendicular to L.              |     |                 |                   |
|      |                |   |     | Total Qu        | estion 7          |
|      |                |   |     |                 |                   |
| 8693 |                | Answer  | [1] |                 |                   |

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| 8 | (a) | Solve the simultaneous equations    |
|---|-----|-------------------------------------|
|   |     | Show your working.                  |
|   |     | A solution by trial and improvement |
|   |     | will not be accepted.               |

$$3x + 2y = 10$$
$$2x - 6y = 3$$

Answer  $x = ______, y = _____[3]$ 

**(b)** Hence write down the coordinates of the point of intersection of the two lines whose equations are

$$3x + 2y = 10$$
 and  $2x - 6y = 3$ 

| Total Qu | estion | 8  |
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Marks Remark

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| The breadth of a cuboid is 1 cm less than the length $y$ cm.  |     |       | ner Only |
|---|-----|-------|----------|
| The height is 6 cm.   |     | Marks | Remark   |
| The volume of the cuboid is 72 cm <sup>3</sup> .  |     |       |          |
| (a) Show that $y^2 - y - 12 = 0$  |     |       |          |
|   |     |       |          |
|   |     |       |          |
|   |     |       |          |
|   |     |       |          |
|   |     |       |          |
|   | [3] |       |          |
| <b>(b)</b> Solve the equation $y^2 - y - 12 = 0$ by factorising. Explain why only one answer makes sense in the question. |     |       |          |
|   |     |       |          |
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Total Question 9

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| Answer |  |  |  |
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| Qu | ality | of written communication will be assessed in this question.  | Examin    | -         |
|----|-------|--|-----------|-----------|
| 10 | (a)   | The test results for a class are recorded as   | Marks     | Remark    |
|    |       | 26 26 29 32 37 38 40 41 99   |           |           |
|    |       | Why would the mean <b>not</b> be the <b>most suitable</b> average to use when commenting on these results?           |           |           |
|    |       |  |           |           |
|    |       |  |           |           |
|    |       |  |           |           |
|    |       | [1]  |           |           |
|    | (b)   | In another test the results are recorded as  |           |           |
|    |       | 18 18 18 18 19 27 29 36 39 47 59 62  |           |           |
|    |       | Which average would be <b>least suitable</b> to use when commenting on these results? Give a reason for your answer. |           |           |
|    |       |  |           |           |
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|    |       | because  | Total Que | estion 10 |
|    |       | [1]  |           |           |
|    |       |  | [Turr     | over      |

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| 11   | A park keeper wishes to estimate the number of frogs in a large pond. He catches 180 frogs, tags them and returns them to the pond. Later he catches 80 frogs and records that 24 of them are tagged. |     | Examine<br>Marks | Remark    |
|------|---|-----|------------------|-----------|
|      | Estimate the number of frogs in the pond.   |     |                  |           |
|      |   |     |                  |           |
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|      | Answer  | [2] |                  |           |
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| 12   | its diam | ectrical resistance, <i>R</i> ohms, of a wire varies inversely as the square of meter, <i>d</i> mm.  6 mm in diameter, made from a certain alloy has a resistance of as. | Examiner Only  Marks Remark |
|------|----------|--|-----------------------------|
|      | (a) Exp  | press $R$ in terms of $d$ .  |                             |
|      | - ·      | Answer $R = $ [3]  |                             |
|      | (b) (i)  | Work out the electrical resistance of a wire made from the same alloy whose diameter is 9 mm.  |                             |
|      | (ii)     | Another wire made from the same alloy has an electrical resistance of 20 ohms.  Work out the diameter of this wire.  |                             |
|      |          | Answer mm [2]  | Total Question 12           |
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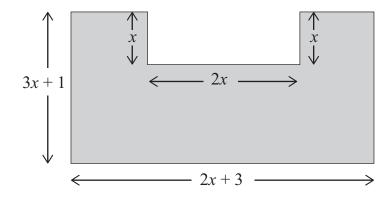
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A rectangular piece of card has a length of (2x + 3) cm and a width of (3x + 1) cm.

A rectangle of length 2x cm and width x cm is cut from it as shown in the diagram.

The remaining piece of card, shown shaded in the diagram, has an area of 25 cm<sup>2</sup>.



(a) Show that  $4x^2 + 11x - 22 = 0$ 

**(b)** Solve the equation  $4x^2 + 11x - 22 = 0$  to find the value of x. Give your answer to 3 significant figures.

Answer  $x = ___[3]$ 

Total Question 13

20

[3]

Remarks

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Marks Remark

| 14   | Without using a cafind the value of | calculator and showing every step clearly in your wo | orking, | Examin<br>Marks | er Only<br>Remark |   |
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|      | THE WIP THING OF                    | $\left(2\frac{1}{4}\right)^{-1.5}$                   |         |                 |                   |   |
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|      |                                     | Answer   | [4]     |                 |                   |   |
|      |                                     |  | []      |                 |                   |   |
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| 15 | Town B is 73 km from Town A on a bearing of 069° | Examiner Only  Marks Remark |
|----|--|-----------------------------|
|    | Town C is 64km from A on a bearing of 112°       |                             |
|    | N B diagram not drawn accurately                 |                             |
|    | C Calculate  (a) the distance between B and C,   |                             |
|    | Answer km [3] (b) the area of triangle ABC,      |                             |
|    | Answer $_{km^2}$ [2]                             |                             |

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(c) the bearing of B from C. **Examiner Only** Marks Remark Total Question 15 Answer \_\_\_\_\_ ° [4] **16** ABCDEF is a ramp which is in the shape of a triangular prism. AB = 120 cm, FC = 90 cm and BC = 30 cm. Angle  $FCB = 90^{\circ}$ Calculate the angle between EB and the base DCFE. В A F E Total Question 16 Answer \_\_\_\_\_ ° [3] [Turn over 8693

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17 (a) The weights of packages passing through a Post Office in one day are recorded below.

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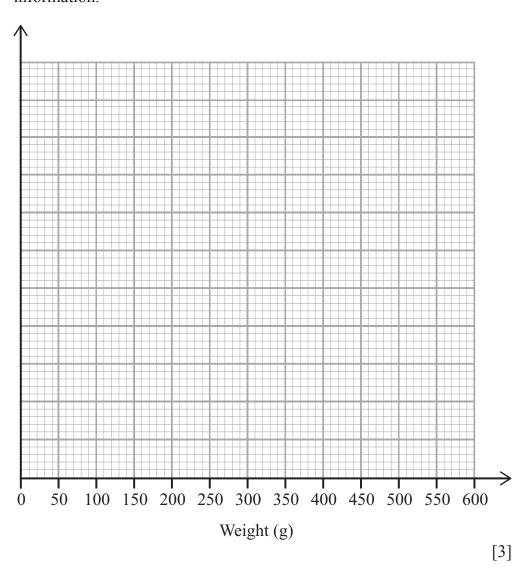
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| 160       |
| 540       |
| 360       |
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On the axes below draw a clearly labelled histogram to illustrate this information.



**(b)** The histogram illustrates how much time cars spent in a car park. **Examiner Only** Marks Remark frequency density 2 140 40 60 80 100 160 0 20 120 180 time (minutes) (i) Calculate an estimate for the mean time. Answer \_\_\_\_\_ minutes [4] (ii) Half the cars using the car park were there for more than M minutes. Calculate an estimate for the value of M. Total Question 17 Answer \_\_\_\_\_ minutes [3] [Turn over 8693

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| 18   | Solve the simultaneous equations | Examin    | er Only<br>Remark |
|------|----------------------------------|-----------|-------------------|
|      | $y - 2x = 6$ $x^2 + y^2 = 20$    | Marks     | Remark            |
|      |                                  |           |                   |
|      |                                  |           |                   |
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|      | Answer [7]                       |           |                   |
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| Question<br>Number      | Marks |
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Total Marks

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