

New Specification



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General Certificate of Secondary Education  
2011

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71	
Candidate Number	

## Mathematics

Unit T4

(With calculator)

Higher Tier

[GMT41]

TUESDAY 31 MAY

9.15 am–11.15 am



For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
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11	
12	
13	
14	
15	
16	
17	
18	
19	

<b>Total Marks</b>	
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**TIME**

2 hours.

**INSTRUCTIONS TO CANDIDATES**

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all nineteen** 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 **question 11**.

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

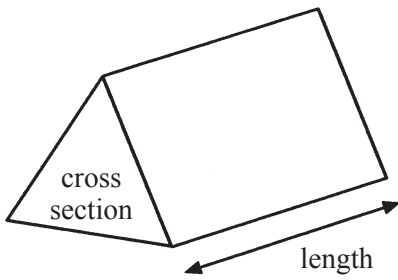
The Formula Sheet is overleaf.



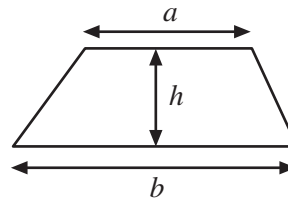
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# Formula Sheet

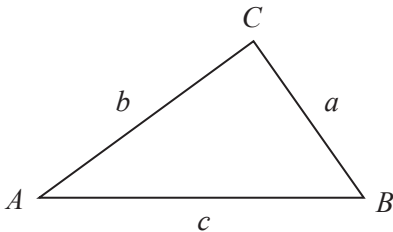
**Volume of prism** = area of cross section  $\times$  length



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

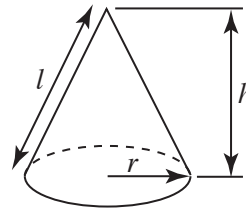
**Quadratic Equation**

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

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

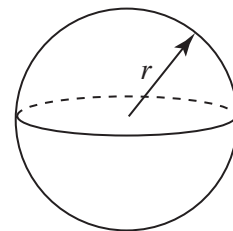
**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

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



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

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



Answer **all** questions.

- 1** The angle of elevation of the top of a telephone mast is  $23^\circ$  from a point 60 metres from the base of the mast on horizontal ground. Calculate the height of the mast.

Answer \_\_\_\_\_ m [4]

Examiner Only	
Marks	Remark

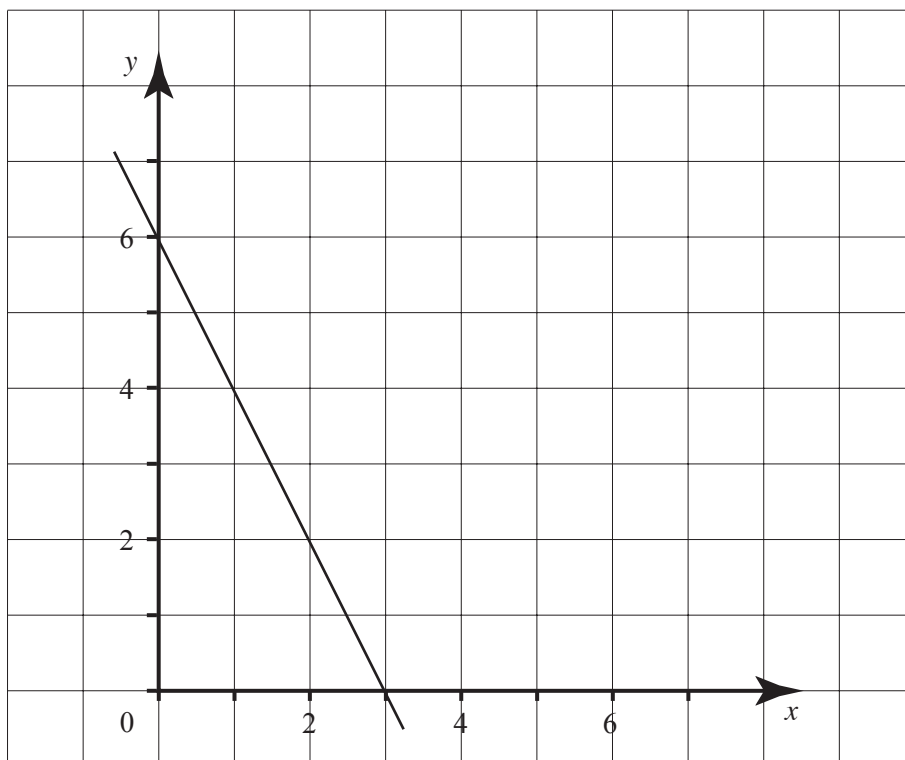
2 (a) Solve the equation  $\frac{2x-4}{5} + \frac{x+11}{2} = 2$

Show your working.

A solution by trial and improvement will not be accepted.

Answer  $x =$  \_\_\_\_\_ [4]

(b)

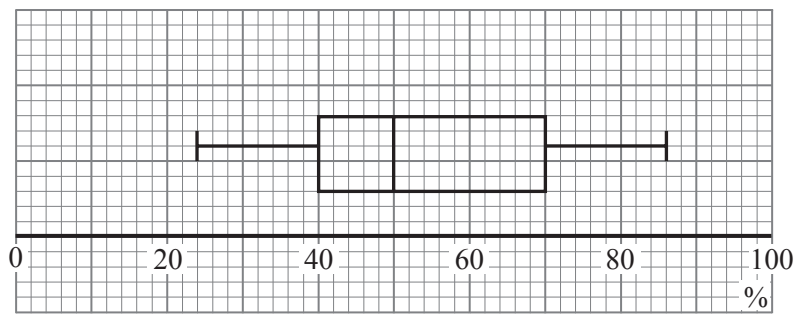


Write down the equation of this line in the form  $y = mx + c$ .

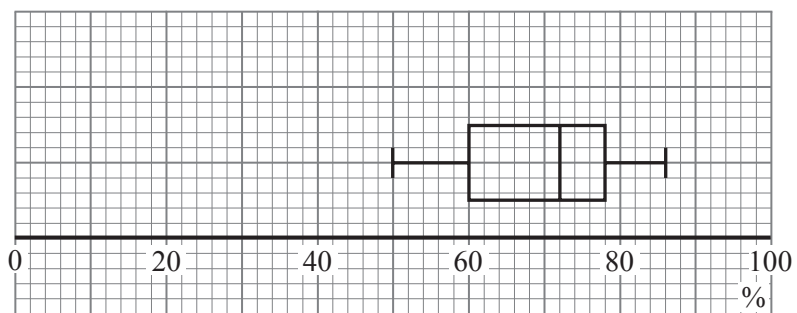
Answer \_\_\_\_\_ [3]

3 The box plots show the distribution of test results for two different classes.

**Class P**



**Class Q**



Comment on **two** differences between the classes.

1. \_\_\_\_\_ [1]

2. \_\_\_\_\_ [1]

Examiner Only	
Marks	Remark

4 Bags of coal weigh 12 kg, to the nearest kg.

Find the least and greatest total weight of 9 of these bags.

Answer least \_\_\_\_\_ kg

greatest \_\_\_\_\_ kg [2]

Examiner Only

Marks Remark

5 (a) In the diagram O is the centre of the circle.

SOQ is a straight line.

Angle ORQ =  $41^\circ$  and angle PQS =  $24^\circ$

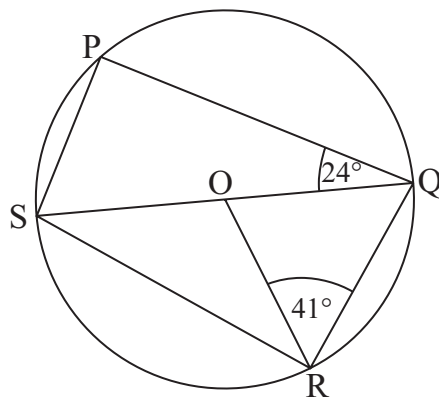


diagram not  
drawn accurately

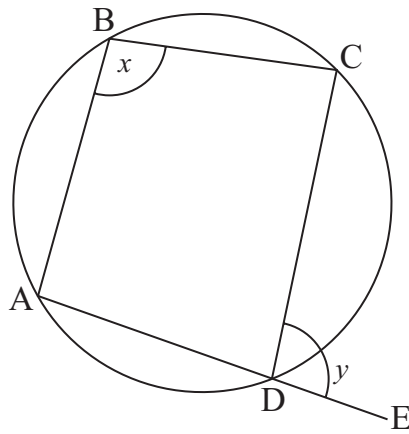
Find the size of the following angles:

(i) OQR = \_\_\_\_\_  $^\circ$  [1]

(ii) PSQ = \_\_\_\_\_  $^\circ$  [1]

(iii) PSR = \_\_\_\_\_  $^\circ$  [1]

- (b) Show that the exterior angle of the cyclic quadrilateral equals the interior opposite angle (i.e.  $x = y$ ).



[3]

- 6 A tea set has a sale price of £63.36 which is a saving of 12% on the original price.

What was the original price of the tea set?

Answer £ \_\_\_\_\_ [3]

7 The graph opposite shows the cumulative frequency of scores obtained in a darts tournament.

(a) Use the graph to estimate

(i) the median,

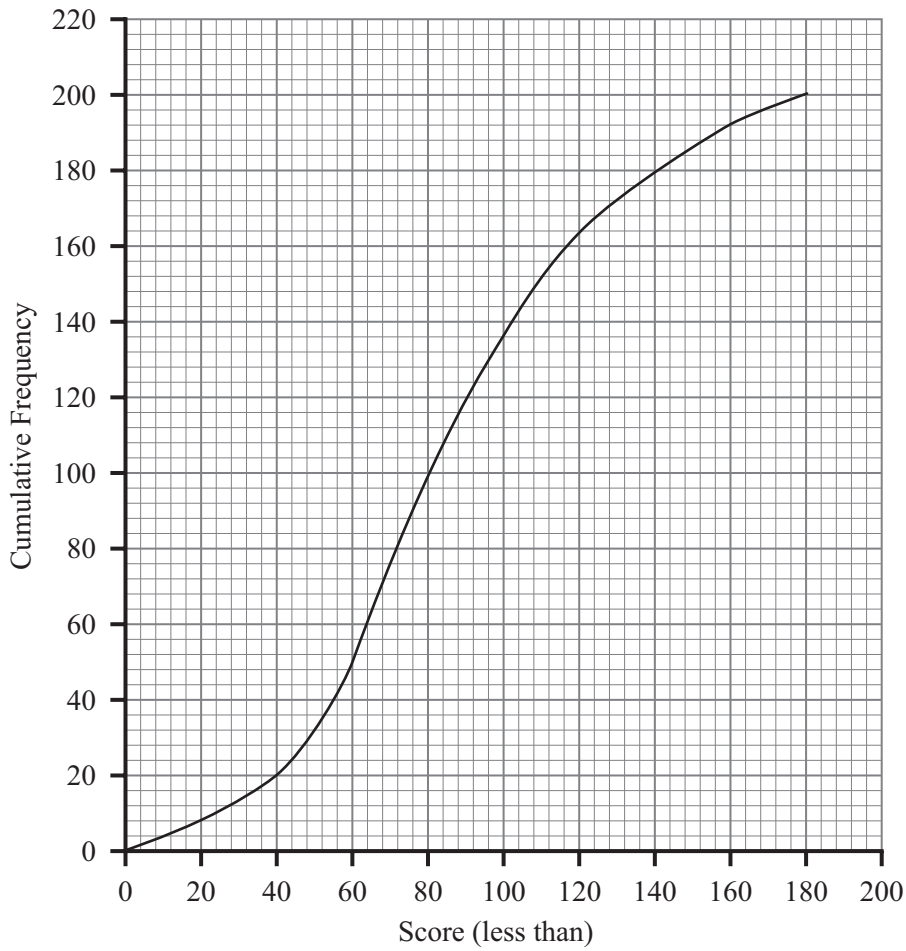
Answer \_\_\_\_\_ [1]

(ii) how many scores were more than 150

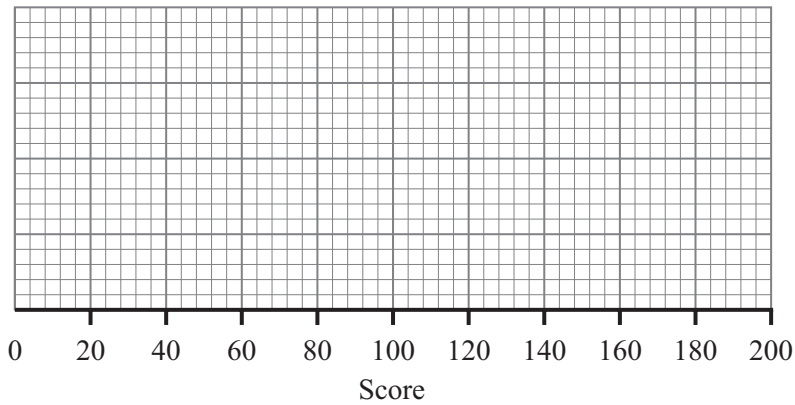
Answer \_\_\_\_\_ [2]

Examiner Only	
Marks	Remark





(b) From the graph draw a box plot.



[3]

Examiner Only	
Marks	Remark

8 (a) Factorise  $9a^2 - 3ay$

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

(b) (i) Factorise  $x^2 + x - 6$

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

(ii) Hence solve the equation  $x^2 + x - 6 = 0$

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

(c) Solve the simultaneous equations  $4x + 3y = 1$   
 $2x - y = -2$

**Show your working.**

**A solution by trial and improvement will not be accepted.**

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

Examiner Only

Marks Remark

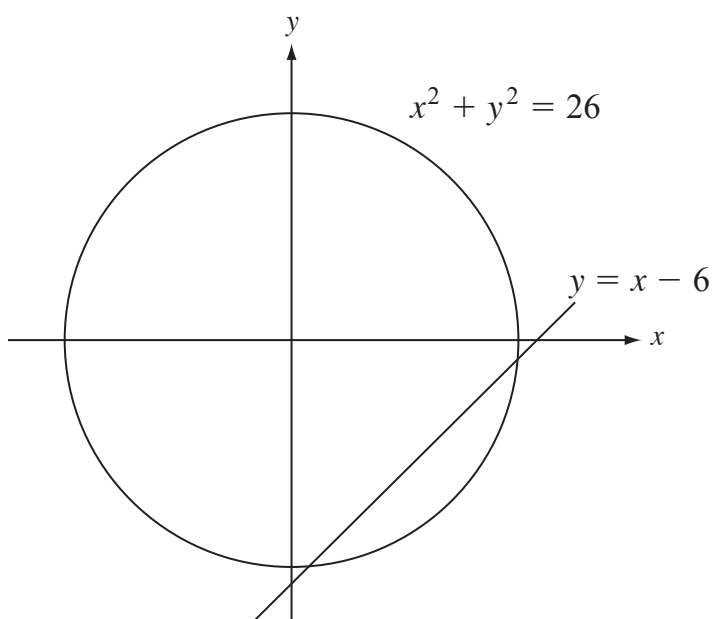
- 9 Each year a car lost 20% of its value at the beginning of the year. After how many whole years was it worth less than half of its original value?

**Show your working.**

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

Examiner Only	
Marks	Remark

- 10 The diagram shows the intersection of the line  $y = x - 6$  with the circle with equation  $x^2 + y^2 = 26$



- (a) Show that the  $x$  co-ordinates of the points of intersection of the line with the circle can be found from the solutions to the equation  $x^2 - 6x + 5 = 0$

[3]

- (b) Hence find the co-ordinates of the points of intersection of the line and the circle.

Answer (\_\_\_\_, \_\_\_\_) (\_\_\_\_, \_\_\_\_) [3]

Quality of written communication will be assessed in this question.

Examiner Only

Marks Remark

11 The table shows information about 600 workers in a factory.

Age, $a$ years	Number of Males	Number of Females
$20 \leq a < 30$	99	26
$30 \leq a < 40$	142	48
$40 \leq a < 50$	124	64
$50 \leq a < 60$	55	22
$60 \leq a < 70$	20	0

The manager wants to carry out a survey of the workers' views on the workplace. He decides to choose a sample of 80 workers to take part in the survey.

(a) From an alphabetical list of workers' names, he selects every 5th name until he has 80 names.

Explain why this may not produce a fair sample.

Answer \_\_\_\_\_

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

(b) Explain how to take a stratified sample of 80 workers for this data.

[2]



14 (a) Simplify

$$\frac{x^2 + 3xy - 5x - 15y}{2x^2 - 10x}$$

Answer \_\_\_\_\_ [4]

(b) Hence write down a negative value of  $x$  and the corresponding positive value of  $y$  for which

$$\frac{x^2 + 3xy - 5x - 15y}{2x^2 - 10x} = 0$$

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

Examiner Only

Marks Remark

15 The table gives information about the weights of 100 children.

Weight, $w$ kg	Number of children
$20 \leq w < 30$	16
$30 \leq w < 35$	28
$35 \leq w < 40$	36
$40 \leq w < 60$	18
$60 \leq w < 65$	2

Examiner Only	
Marks	Remark

(a) Illustrate the data by drawing a histogram, **A**, on the graph paper opposite. [3]

(b) A stratified sample of 20 children was taken from those whose weight was less than 40 kg.

How many of the sample were taken from the interval  $35 \leq w < 40$ ?

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

(c) The histogram **B**, already drawn, illustrates the weights of a different group of 100 children. Compare this histogram with the one you have drawn. Give **two** comparisons.

1. \_\_\_\_\_ [1]

2. \_\_\_\_\_ [1]

(d) Suggest a reason for the difference in the two histograms.

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

(e) Calculate an estimate for the mean weight of the children in histogram **B**.

Answer \_\_\_\_\_ kg [4]





16 (a) Evaluate  $289^{\frac{1}{2}}$

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

(b) (i)  $m, n$  are integers and  $2^m = \frac{1}{4^n}$

Write  $m$  in terms of  $n$

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

(ii)  $m, n$  are integers and  $2^m = \frac{1}{2}\left(\frac{1}{4^n}\right)$

Write  $m$  in terms of  $n$

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

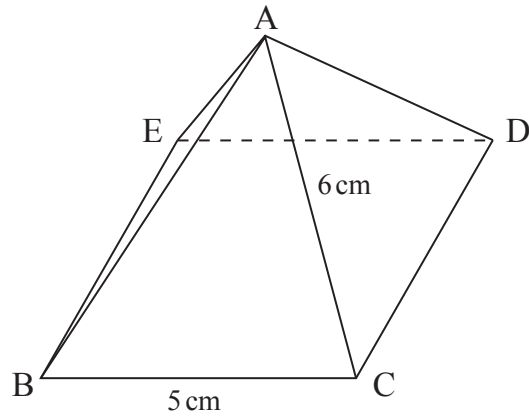
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17 Solve  $\frac{10}{2x-5} + \frac{7}{x+2} = 3$

Answer \_\_\_\_\_ [6]

Examiner Only

Marks	Remark
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The square-based pyramid has four faces which are isosceles triangles.

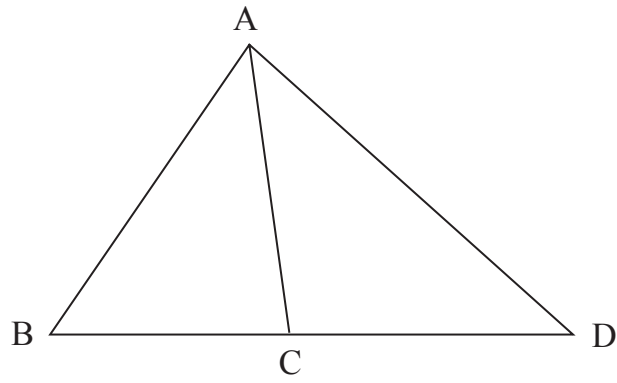
Calculate the angle between  $AB$  and the base.

Answer \_\_\_\_\_<sup>°</sup> [4]

Examiner Only

Marks	Remark

19



$AB = 6.2$  cm, angle  $BAC = 35^\circ$  and the area of triangle ABC is  $9.2$  cm<sup>2</sup>.

$AD = 10.5$  cm and  $CD = 6.4$  cm.

Calculate the area of the triangle ACD.

Answer \_\_\_\_\_ cm<sup>2</sup> [8]

Examiner Only	
Marks	Remark

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**THIS IS THE END OF THE QUESTION PAPER**

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