

General Certificate of Secondary Education January 2014

Mathematics

Unit T3

(With calculator)

Higher Tier





[GMT31]

GMT31

FRIDAY 10 JANUARY, 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 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-nine 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 6(b) and 24(b).

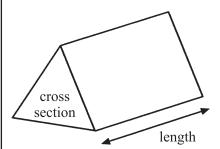
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.



Formula Sheet

Volume of prism = area of cross section \times length



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

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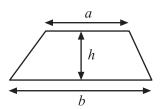
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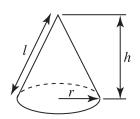
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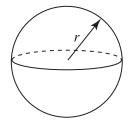
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = πrl

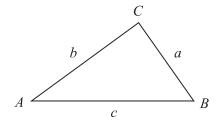


Volume of sphere $= \frac{4}{3}\pi r^3$

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



1	Without using a calculator, show how to find the answer to	Examin	
	$\frac{3}{7} - \frac{1}{5}$	Marks	Remark
	7 3		
	Answer [2]		
	Answer [2]		
		Total Qu	estion 1
		[Turn	over
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2	Hugh is a travelling salesman. He claims 24.6p for each km he travels and £27.60 for meals on each day he is travelling.	Examiner Marks 1	· Only Remark
	If he travels more than 700 km in any week he adds 12.5% to his total claim.		
	Last week Hugh travelled 915 km in 5 days.		
	How much did Hugh claim for last week?		
	Show clearly how you arrived at your answer.		
	Answer £[5]	Total Que	stion 2
		Total Que.	311011 2
3	(a) Write down two numbers which are square roots of 49		
	Answer and [1]		
	(b) Explain the meaning of $0.\dot{1}0\dot{3}$		
		Total Ques	etion 3
	Answer [1]	Total Que:	511011 5
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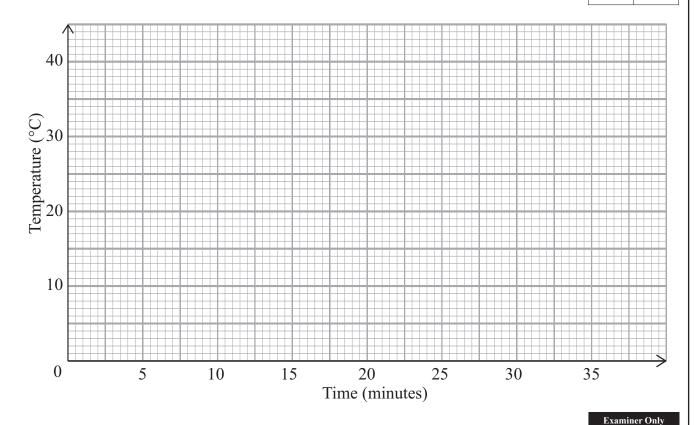
The table shows the temperature of some liquids as they cool in a freezer.

Time (minutes)	5	10	15	18	25	30	30
Temperature (°C)	35	31	24	22	12	7	6



(a) Draw a scatter graph for this data.

[2]



(b) Draw a line of best fit.

[1]

(c) Estimate the time taken for a liquid to reach freezing point $(0 \, ^{\circ}\text{C})$.

Total Question 4

Answer _____ minutes [1]

[Turn over



Twenty two pupils were asked to record the time (in minutes) they spent on **Examiner Only** Marks Remark their homework last Monday night. Their responses are listed below. Construct a stem and leaf diagram to illustrate this data. [3] Total Question 5

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	estion.	Examiner Only Marks Remark
6	(a) Calculate the size of the interior angle of a regular pentagon.	
	Answer ° [2]	
	(b) Three regular pentagons are placed together as shown below.	
	diagram not drawn accurately	
	Explain why you cannot cover a floor with regular pentagonal tiles.	
	Answer	
		Total Question 6
		Turn over

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(a) What mathematical name is given to the pair of acute angles a and bMarks Remark below? bAnswer _____ [1] (b) What mathematical name is given to the pair of acute angles c and dbelow? Total Question 7 Answer _____

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AnswerAngela buys 5 DVDs and 4 CDs. Each DVD costs <i>d</i> pounds. Each CD costs <i>c</i> pounds. Write down an expression for the total		[1] [2]	Total Qu	
AnswerAngela buys 5 DVDs and 4 CDs. Each DVD costs <i>d</i> pounds. Each CD costs <i>c</i> pounds.		[1]		
AnswerAngela buys 5 DVDs and 4 CDs. Each DVD costs <i>d</i> pounds. Each CD costs <i>c</i> pounds.		[1]		
AnswerAngela buys 5 DVDs and 4 CDs. Each DVD costs <i>d</i> pounds. Each CD costs <i>c</i> pounds.		[1]	Total Qu	estion 10
AnswerAngela buys 5 DVDs and 4 CDs. Each DVD costs <i>d</i> pounds. Each CD costs <i>c</i> pounds.		[1]	Total Qu	estion 10
AnswerAngela buys 5 DVDs and 4 CDs.		[1]	Total Qu	estion 10
		[1]	Total Qu	estion 10
		F43	Total Qu	estion 10
· / 1	in this sequence.			
(b) Explain why 101 cannot be a term	in this assumes			
Answer _	······································	[2]		
(a) Write down the first 3 terms of this	sequence.			
The nth term of a sequence is given by	a^2 1			
	Answer $e = $	[3]	Total Qu	estion 9
Solve $/e + 3 = 4e + 5$				
	1 1115 W V I	[<i>3</i>]	Total Qt	iconoli o
(b) Simplify 4 5	Answer	[3]	Total On	lestion 8
(b) Simplify $\frac{d}{d} - \frac{d}{d}$	Answer	[1]		
(a) Factorise $c^2 - 5c$			Examin Marks	er Only Remark
	Solve $7e + 3 = 4e + 5$ The n^{th} term of a sequence is given by n^{th} (a) Write down the first 3 terms of this Answer _	Answer	Answer [1] Answer [1] Answer [3] Solve $7e + 3 = 4e + 5$ Answer $e = $ [3] The n^{th} term of a sequence is given by $n^2 - 1$ (a) Write down the first 3 terms of this sequence. Answer, [2]	Answer

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12	(a) Express 84 as a product of its prime factors in index form.	Examiner Only Marks Remark
	Answer [3]	
	(b) Find the Lowest Common Multiple (LCM) of 63 and 84	
	Answer[2]	Total Question 12
		Total Question 12
13	£4000 is invested in a bank for 3 years and earns 5% per annum compound interest.	
	How much will it earn in interest over the 3 years?	
	Show clearly all your working.	
		Total Question 13
	Answer £ [3]	
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14	On every swing, a p	pendulum reaches 6	50% of the previous distance.			er Only
	The pendulum swin	ngs 1.8 metres on its	s first swing.		Marks	Remark
	How far does it swi	ng during the third	swing?			
	Trow far does it swi	ng daring me ama	5 mg.			
					T + 10	: 14
			Answer	m [2]	Total Qu	estion 14
15	The table below sho	ows the weights of	fish caught in a competition.			
		-	7			
	Weight (g)	Frequency	_			
	$0 < w \le 150$	10	1			
	$150 < w \le 300$	25				
	$300 < w \le 450$	18				
	$450 < w \le 600$	12	_			
	$600 < w \le 750$	10	_			
	$750 < w \le 900$	5				
	() 117 1 1	111	1			
	(a) Write down the	modal class interva	ll.			
			Answer	[1]		
	(b) Write down the	e class interval which	ch contains the median weight.			
			Answer	[1]		
	(c) Calculate an es competition.	timate for the mear	n weight of a fish caught in this			
	1					
					Total Qu	estion 15
8692			Answer	_ g [4]	[Turr	over

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16	gen	tudent wishes to carry out a survey relating to television viewing by the eral public. first question is "What age are you?" Answer	Examiner Only Marks Remark
	(a)	Give one criticism of this question. [1]	
		[*]	
	(b)	Design a more suitable question with appropriate response boxes for her to record the age of those being surveyed.	
		[2]	
			Total Question 16
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17	The radius of the base of a cylindrical oil tank is 60 cm.	Examin Marks	er Only Remark
	(a) Calculate the area of the base of the oil tank.		
	Answer cm ² [2]		
	The height of the oil tank is 70 cm.		
	(b) Calculate the volume of the oil tank. Give your answer in litres .		
	Answer litres [3]		
		Total Qu	estion 17
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18	The sketch shows a field which is in the shape of a right-angled triangle. The side $PQ = 10 \text{m}$ and the side $QR = 26 \text{m}$.	Examiner Only Marks Remark
	Calculate the length of the side PR.	
	Q diagram not drawn accurately 10 m P R	
	Answer m [3]	Total Question 18
19	A glass window is in the shape of a semi-circle with diameter 40 cm.	
	Calculate the perimeter of the semi-circle.	
	diagram not drawn accurately 40 cm	
		Total Question 19
8692	Answer cm [3]	

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20	Use the method of trial and improvement to find the solution of the equation $x^3 + 3x = 47$	Examin Marks	ner Only Remark
	Give your answer correct to 1 decimal place. Show all your working.		
	Show an your working.		
	Answer $x = $ [4]	Total Qu	estion 20
21	E-mand and simulification 11 (20 m d)		
21	Expand and simplify $3(2w-1)-2(w-4)$		
		Total Ou	estion 21
		101111 Q11	
	Answer [2]	[Turr	n over
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22	The first five terms of a sequence are 9, 13, 17, 21, 25. Find an expression, in terms of n , for the n th term of this sequence.	Examiner Only Marks Remark
	Answer [2]	Total Question 22
23	During a very cold winter a glacier increased in volume by 32%. At the end of the winter its volume was found to be 6864 km ³ What was its volume at the start of that winter?	
	13.[2]	
	Answer km ³ [3]	Total Question 23
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Quality of written communication will be assessed in part (b) of this **Examiner Only** Marks Remark question. 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. 0 10 20 30 40 50 60 70 80 Age (years) [3] **(b)** The box plot below shows the age distribution of members of a bowls club. 10 20 30 40 50 60 70 80

Compare the age distributions of the members of the badminton club and the bowls club.

Age (years)

[2]

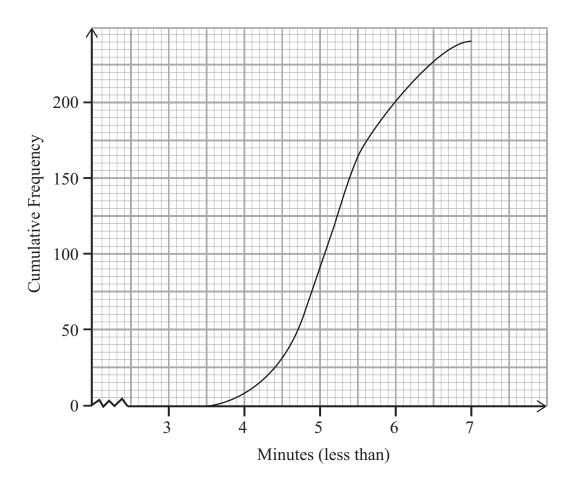
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Total Question 24



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

Examiner Only	
Marks	Remark



(a) Use the graph to estimate the median time.

Answer _____ minutes [1]

(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.

Total Qu	estion	25

Answer ______ % [2]



 $\overline{26}$ PQRS represents a rectangular gate. PS = 200 cm and SR = 300 cm.

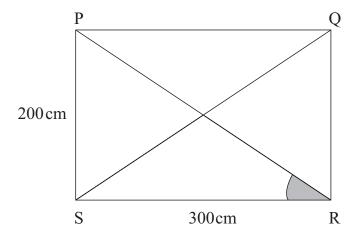


diagram not drawn accurately

(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?

Answer _____ cm [2]

Total Question 26

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Answer $x = $	v =	 3



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The breadth of a cuboid is 1 cm less than the length y cm. The height is 6 cm.

The volume of the cuboid is 72 cm³.

(a) Show that $y^2 - y - 12 = 0$

(b) Solve the equation $y^2 - y - 12 = 0$ by factorising. Explain why only one answer makes sense in the question.

Answer _____

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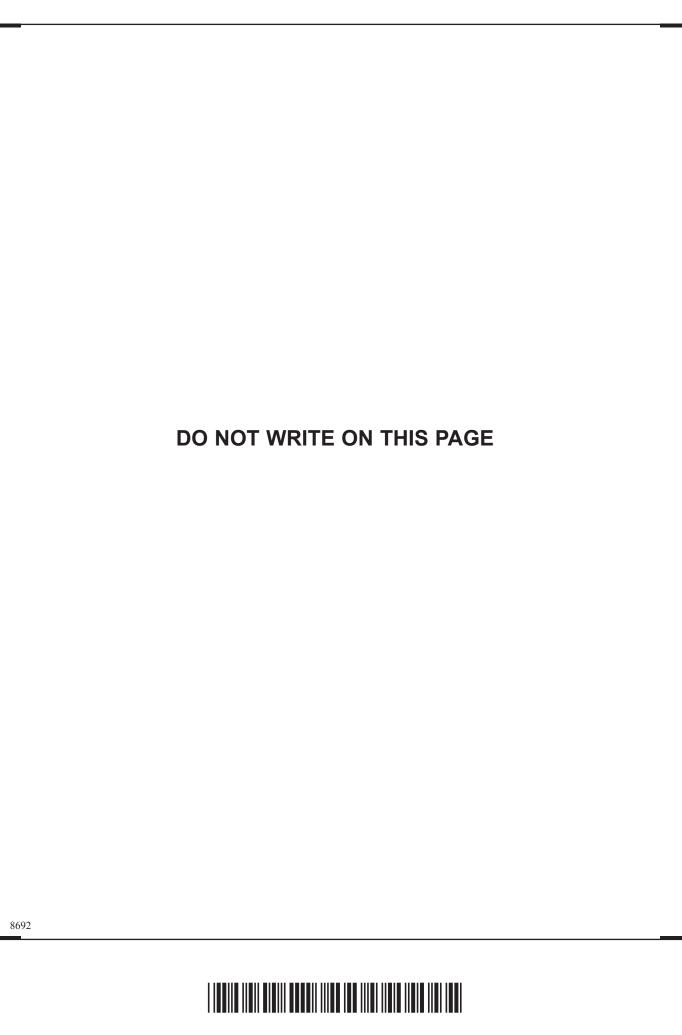
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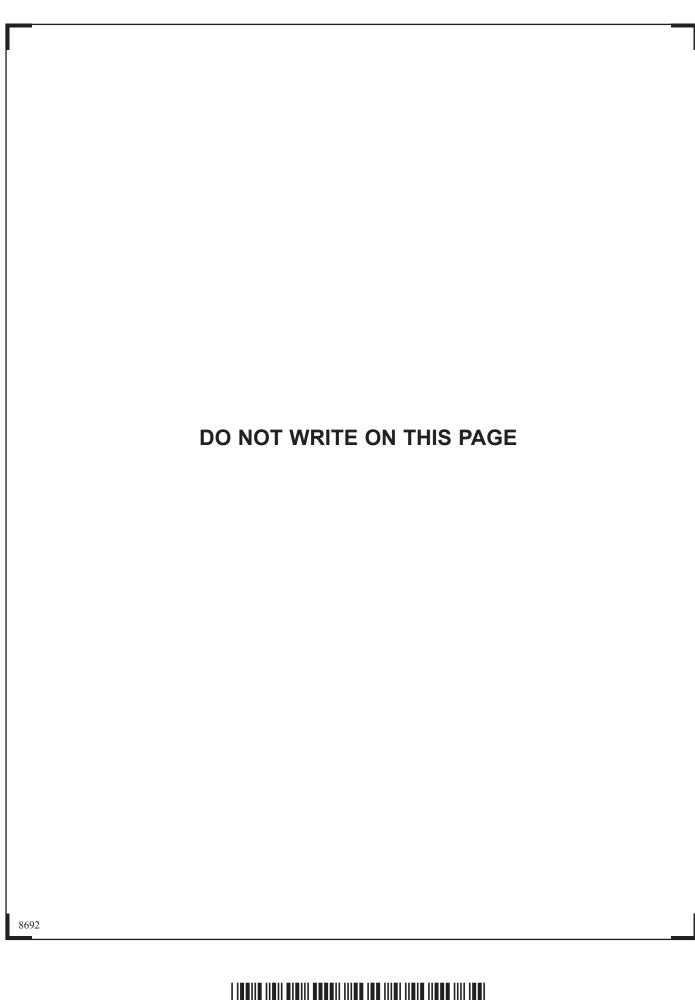
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