



Rewarding Learning

General Certificate of Secondary Education
January 2014

Centre Number

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Candidate Number

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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)**.

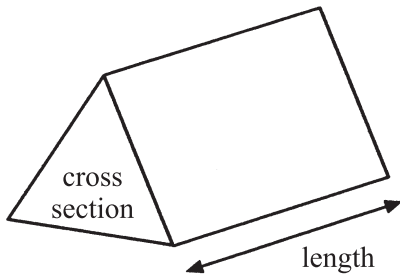
You should have a calculator, ruler, compasses and a protractor.

The Formula Sheet is on page 2.

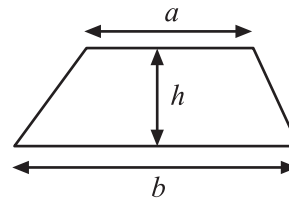


Formula Sheet

Volume of prism = area of cross section \times length

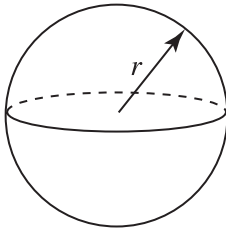


Area of trapezium = $\frac{1}{2}(a + b)h$



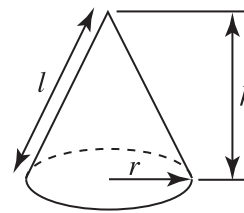
Volume of sphere = $\frac{4}{3}\pi r^3$

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

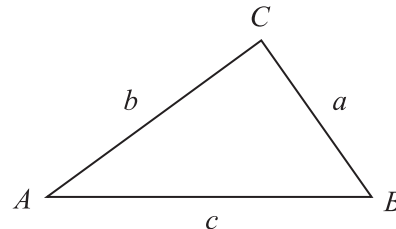


Volume of cone = $\frac{1}{3}\pi r^2 h$

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



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



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.

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]

Examiner Only	
Marks	Remark
Total Question 2	

3 (a) Write down two numbers which are square roots of 49

Answer _____ and _____ [1]

(b) Explain the meaning of $0.\dot{1}0\dot{3}$

Answer _____ [1]

Total Question 3	

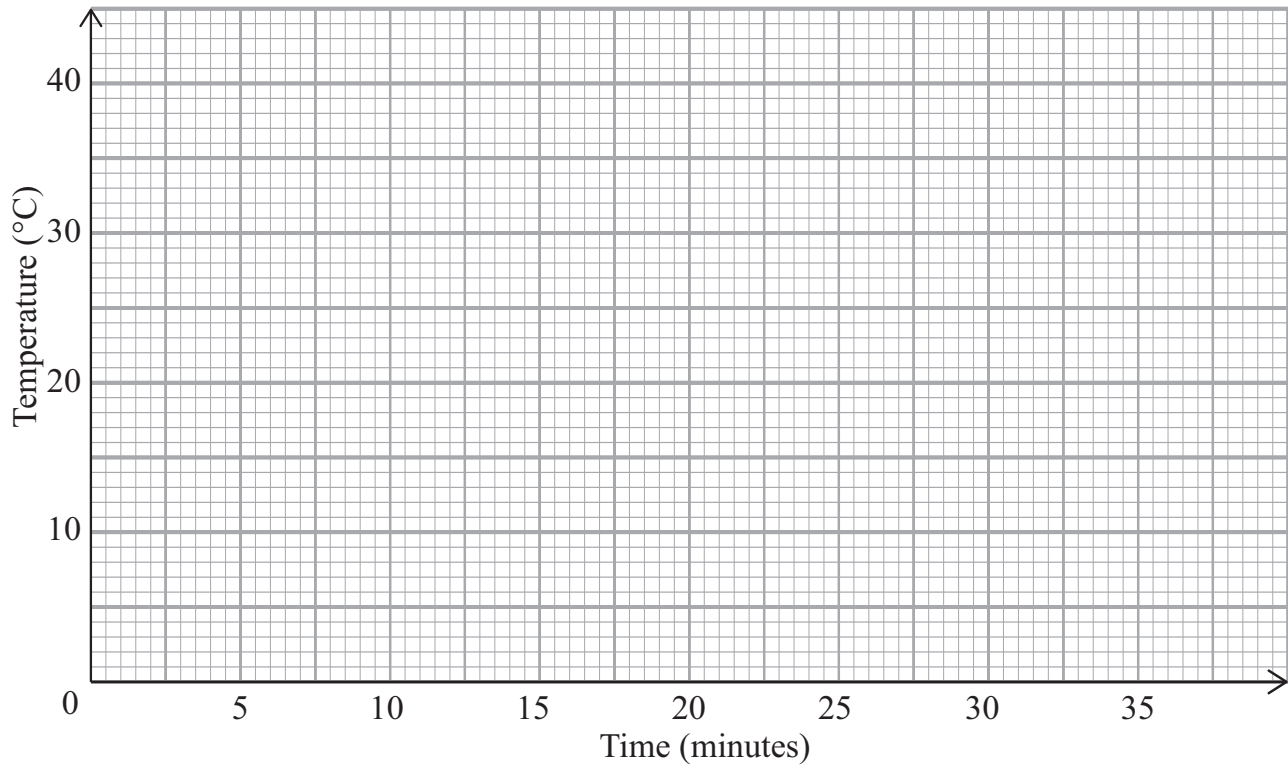


4 The table shows the temperature of some liquids as they cool in a freezer.

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

Examiner Only	
Marks	Remark

(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 °C).

Answer _____ minutes [1]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over



- 5 Twenty two pupils were asked to record the time (in minutes) they spent on their homework last Monday night. Their responses are listed below.

40 55 80 60 50 55 65 40 120 100 90
 55 60 110 100 120 75 50 80 85 60 45

Construct a stem and leaf diagram to illustrate this data.

[3]

Examiner Only	
Marks	Remark
Total Question 5	



Quality of written communication will be assessed in part (b) of this question.

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.

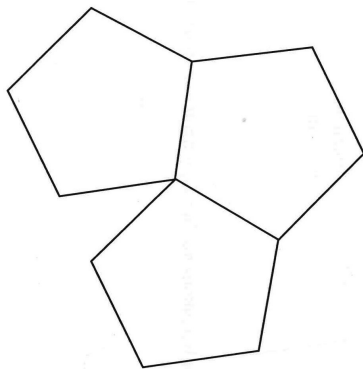


diagram not
drawn accurately

Explain why you cannot cover a floor with regular pentagonal tiles.

Answer _____
_____ [2]

Examiner Only

Marks

Remark

Total Question 6

[Turn over





8 (a) Factorise $c^2 - 5c$

Answer _____ [1]

(b) Simplify $\frac{d}{4} - \frac{d}{5}$

Answer _____ [3]

Examiner Only

Marks Remark

Total Question 8

9 Solve $7e + 3 = 4e + 5$

Answer $e =$ _____ [3]

Total Question 9

10 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]

(b) Explain why 101 cannot be a term in this sequence.

Answer _____ [1]

Total Question 10

11 Angela buys 5 DVDs and 4 CDs.

Each DVD costs d pounds.

Each CD costs c pounds.

Write down an expression for the total cost.

Answer _____ [2]

Total Question 11

[Turn over



14 On every swing, a pendulum reaches 60% of the previous distance.

The pendulum swings 1.8 metres on its first swing.

How far does it swing during the third swing?

Answer _____ m [2]

Examiner Only

Marks Remark

Total Question 14

15 The table below shows the weights of fish caught in a competition.

Weight (g)	Frequency
$0 < w \leq 150$	10
$150 < w \leq 300$	25
$300 < w \leq 450$	18
$450 < w \leq 600$	12
$600 < w \leq 750$	10
$750 < w \leq 900$	5

(a) Write down the modal class interval.

Answer _____ [1]

(b) Write down the class interval which contains the median weight.

Answer _____ [1]

(c) Calculate an estimate for the mean weight of a fish caught in this competition.

Total Question 15

Answer _____ g [4]

[Turn over



- 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 $QR = 26\text{ m}$.

Calculate the length of the side PR .

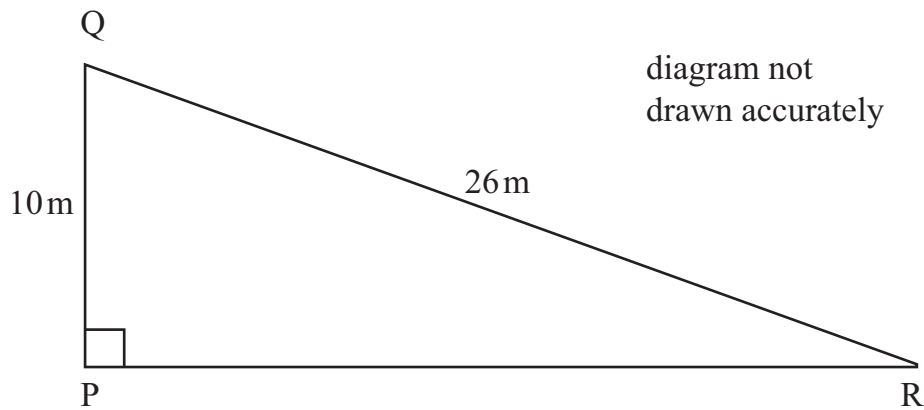


diagram not
drawn accurately

Answer _____ m [3]

Examiner Only	
Marks	Remark
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.

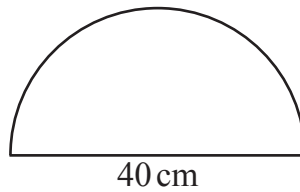


diagram not
drawn accurately

Answer _____ cm [3]

Total Question 19	



- 20 Use the method of trial and improvement to find the solution of the equation $x^3 + 3x = 47$
Give your answer correct to 1 decimal place.
Show all your working.

Answer $x =$ _____ [4]

Examiner Only

Marks Remark

Total Question 20

- 21 Expand and simplify $3(2w - 1) - 2(w - 4)$

Answer _____ [2]

Total Question 21

[Turn over



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
Total Question 22	

Answer _____ [2]

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?

Total Question 23	

Answer _____ km^3 [3]



Quality of written communication will be assessed in part (b) of this question.

24 The information given below relates to the ages (in years) of members of a badminton club.

Lower Quartile = 28

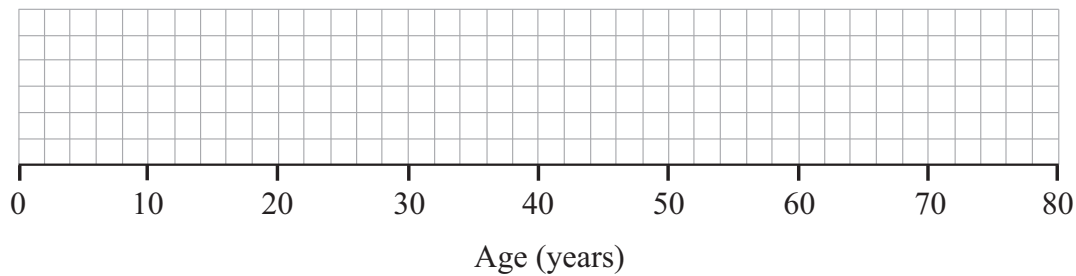
Median = 32

Upper Quartile = 54

Youngest = 12

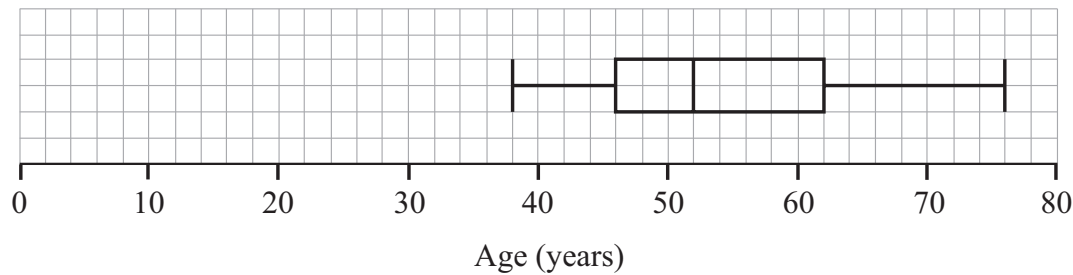
Range = 58

(a) Draw a box plot to show this information.



[3]

(b) The box plot below shows the age distribution of members of a bowls club.



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

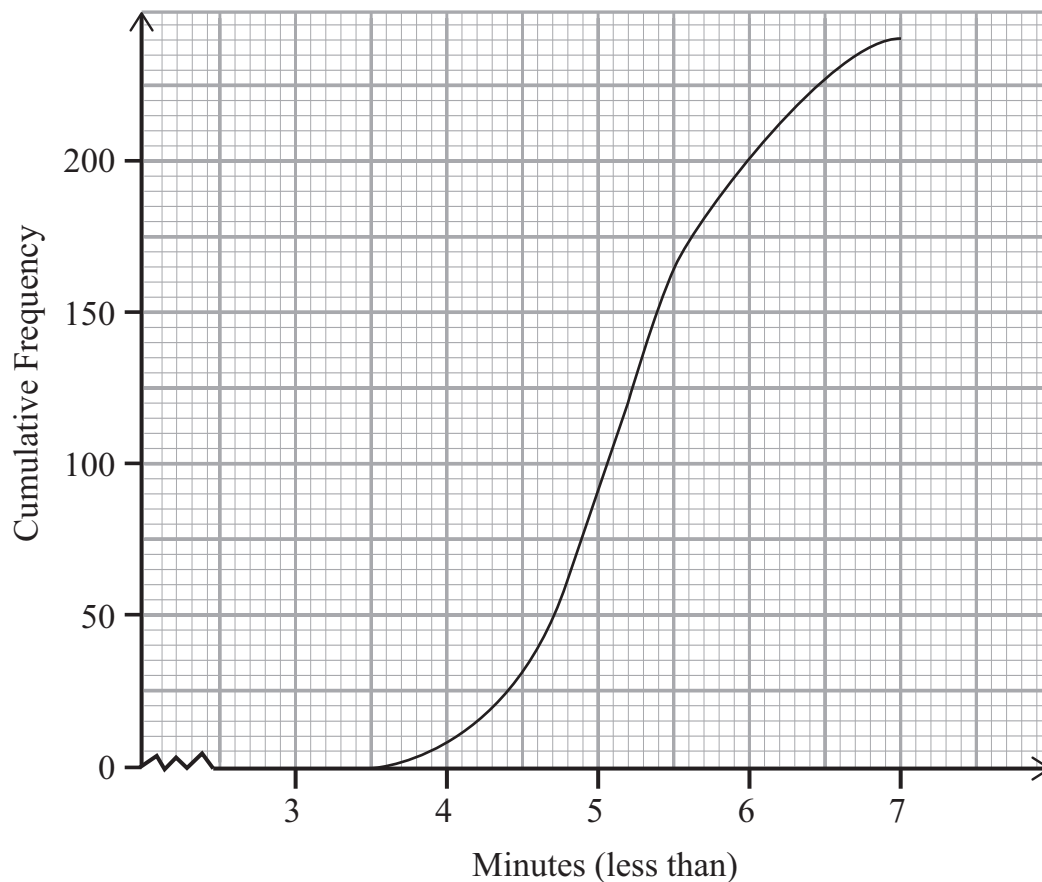
[2]

Examiner Only	
Marks	Remark
Total Question 24	

[Turn over



- 25 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 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.

Answer _____ % [2]

Examiner Only	
Marks	Remark
Total Question 25	



26 PQRS represents a rectangular gate. PS = 200 cm and SR = 300 cm.

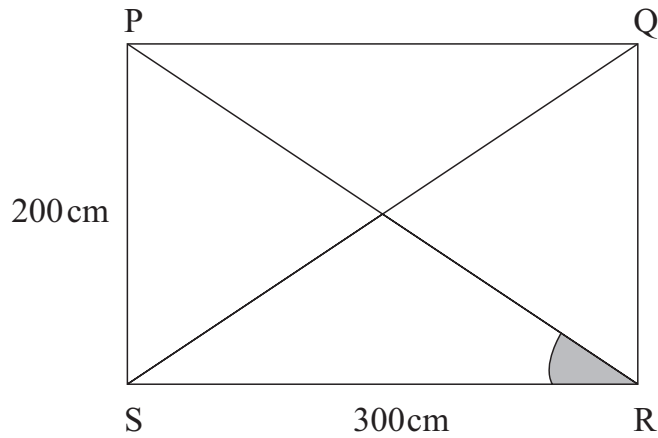


diagram not
drawn accurately

(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]

Examiner Only

Marks	Remark

Total Question 26

[Turn over



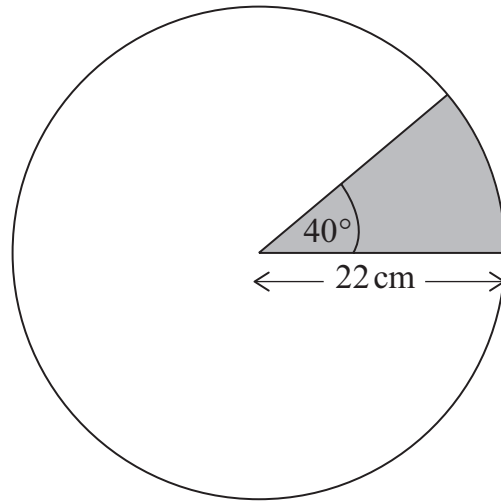


diagram not
drawn accurately

A large circular pizza has radius 22 cm.
Josh cuts a sector with angle 40° from the pizza.
Calculate the area of this sector.

Answer _____ cm^2 [3]

Examiner Only	
Marks	Remark
Total Question 27	
Total Question 28	

- 28 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]



29 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 cm^3 .

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

[3]

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

Answer _____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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Total Question 29	



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Question Number	Marks
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Total Marks	
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Examiner Number

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