Centre Number

Candidate Number

Rewarding Learning

**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.
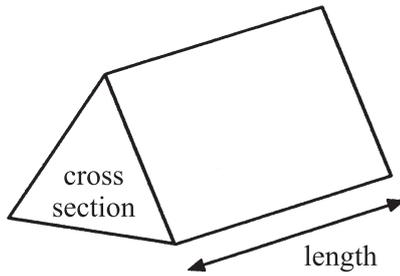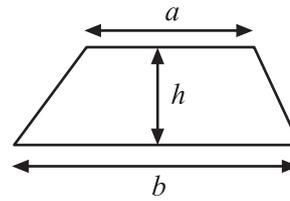The Formula Sheet is on page 2.

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24GMT3101

Formula Sheet

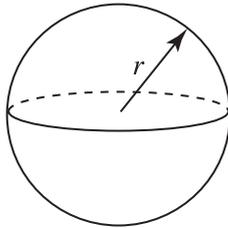**Volume of prism** = area of cross section × length

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

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

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

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

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

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

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

In any triangle *ABC*

Sine Rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2} ab \sin C$

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24GMT3102

1 Without using a calculator, show how to find the answer to

$$\frac{3}{7} - \frac{1}{5}$$

Answer _____ [2]

Total Question 1

[Turn over

8692

24GMT3103

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]

Total Question 2

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

Answer ———— and ———— [1]

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

Total Question 3

Answer ———————————— [1]

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24GMT3104

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

(a) Draw a scatter graph for this data. [2]
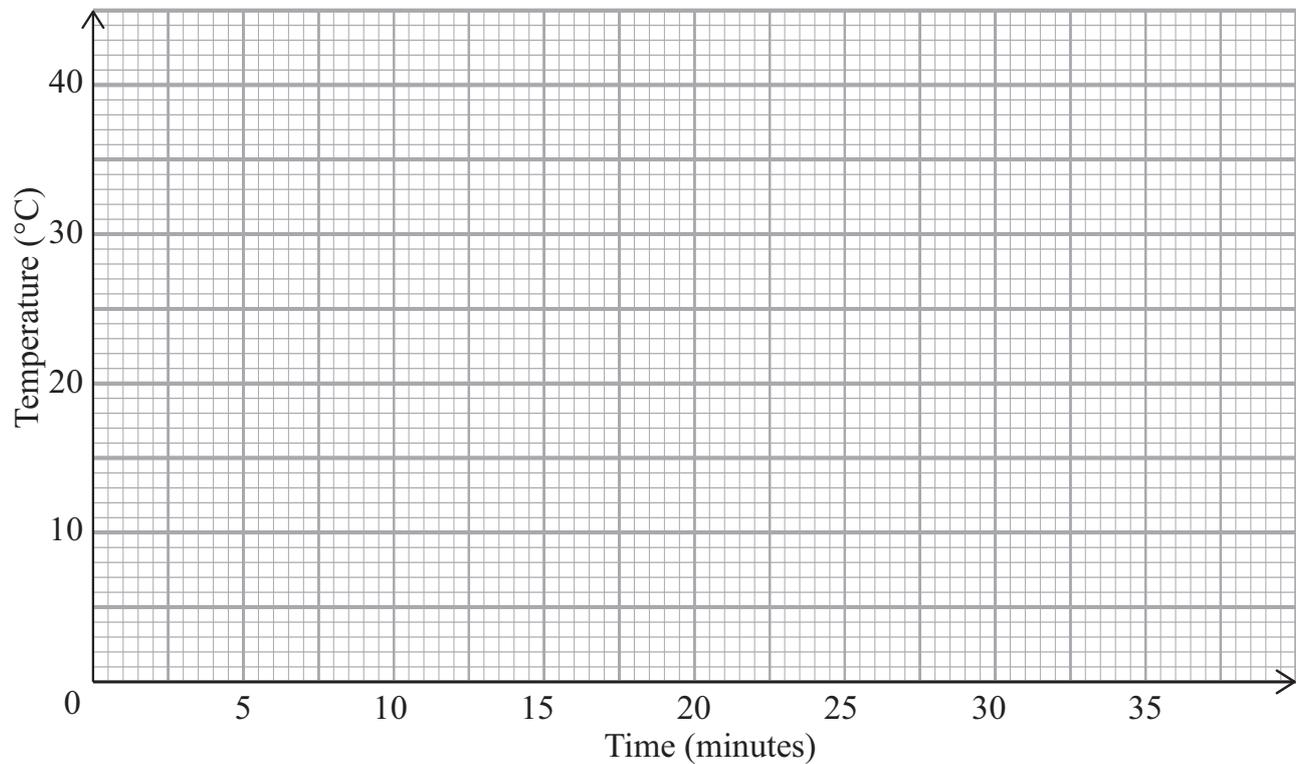
(b) Draw a line of best fit. [1]

(c) Estimate the time taken for a liquid to reach freezing point (0 °C).

Answer _____ minutes [1]

[Turn over

8692

24GMT3105

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]

Total Question 5

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24GMT3106

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]

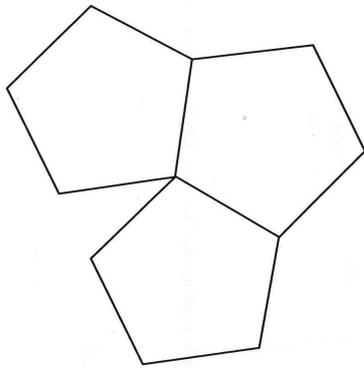**(b)** Three regular pentagons are placed together as shown below.

diagram not
drawn accurately

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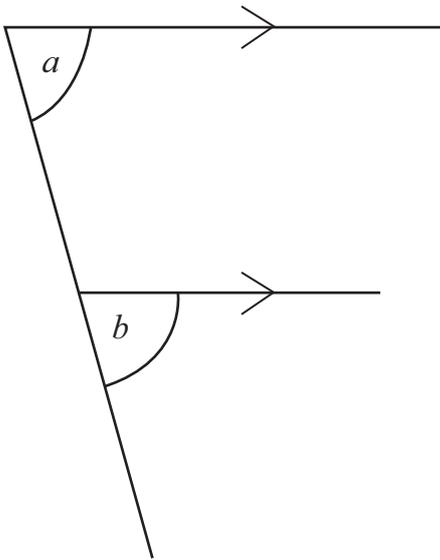
Answer _____

_____ [2]
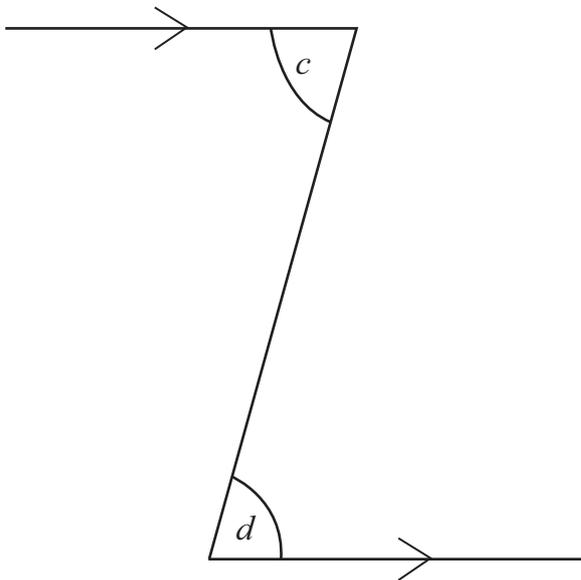
Total Question 6

[Turn over

8692

7 **(a)** What mathematical name is given to the pair of acute angles *a* and *b* below?

Answer _____ [1]

(b) What mathematical name is given to the pair of acute angles *c* and *d* below?

Total Question 7

Answer _____ [1]

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

Answer _____ [1]

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

Answer _____ [3]

Total Question 8

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

Answer $e =$ _____ [3]

Total Question 9

10 The nth 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

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24GMT3109

12 (a) Express 84 as a product of its prime factors **in index form**.

Answer ——————————— [3]

(b) Find the Lowest Common Multiple (LCM) of 63 and 84

Answer ——————— [2]

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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24GMT3110

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]

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.

Answer _____ g [4]

Examiner Only — Marks — Remark

Total Question 14

Total Question 15

[Turn over

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24GMT3111

16 A student wishes to carry out a survey relating to television viewing by the general public.

Her first question is

    "What age are you?"   **Answer**

(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

Marks	Remark

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24GMT3112

17 The radius of the base of a cylindrical oil tank is 60 cm.

(a) Calculate the area of the base of the oil tank.

Answer _____ cm² [2]

The height of the oil tank is 70 cm.

(b) Calculate the volume of the oil tank. Give your answer in **litres**.
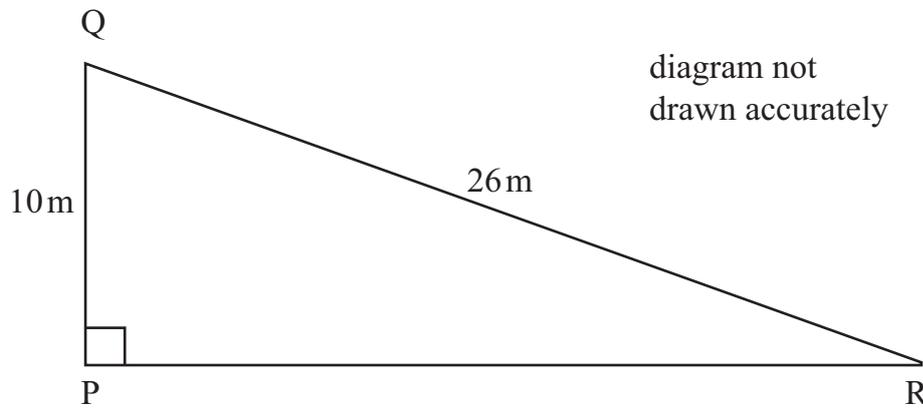
Answer _____ litres [3]

Total Question 17

[Turn over

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24GMT3113

18 The sketch shows a field which is in the shape of a right-angled triangle. The side PQ = 10 m and the side QR = 26 m.

Calculate the length of the side PR.

Q

diagram not
drawn accurately

26 m

10 m

P   R

Answer _____ m [3]

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

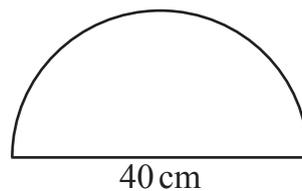40 cm

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Answer _____ cm [3]

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]

Total Question 20

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

Total Question 21

Answer ————— [2]   **[Turn over**

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24GMT3115

22 The first five terms of a sequence are 9, 13, 17, 21, 25.
Find an expression, in terms of *n*, for the nth term of this sequence.

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?

Answer ⎯⎯⎯⎯⎯ km^3 [3]

Total Question 23

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24GMT3116

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.
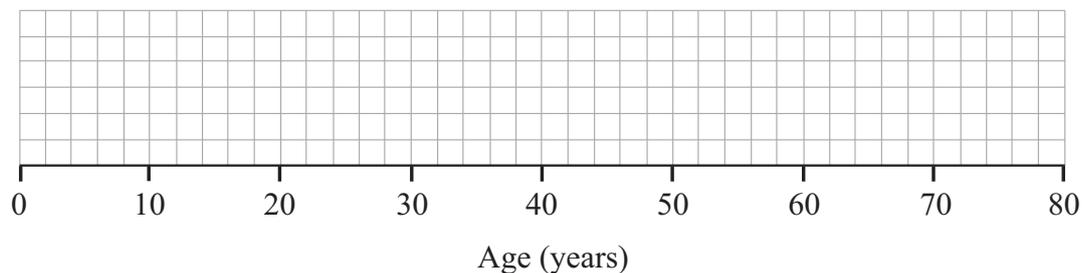
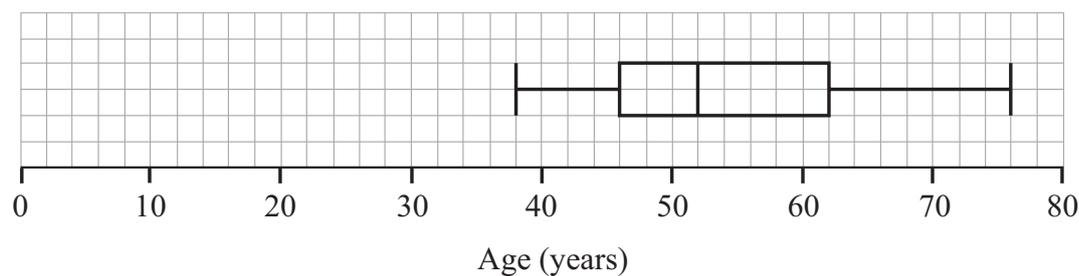Lower Quartile = 28
Median = 32
Upper Quartile = 54
Youngest = 12
Range = 58

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

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.

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 24

_____ [2]

[Turn over

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25 The cumulative frequency curve represents the times taken to run 1500 m by each of the members of a running club.
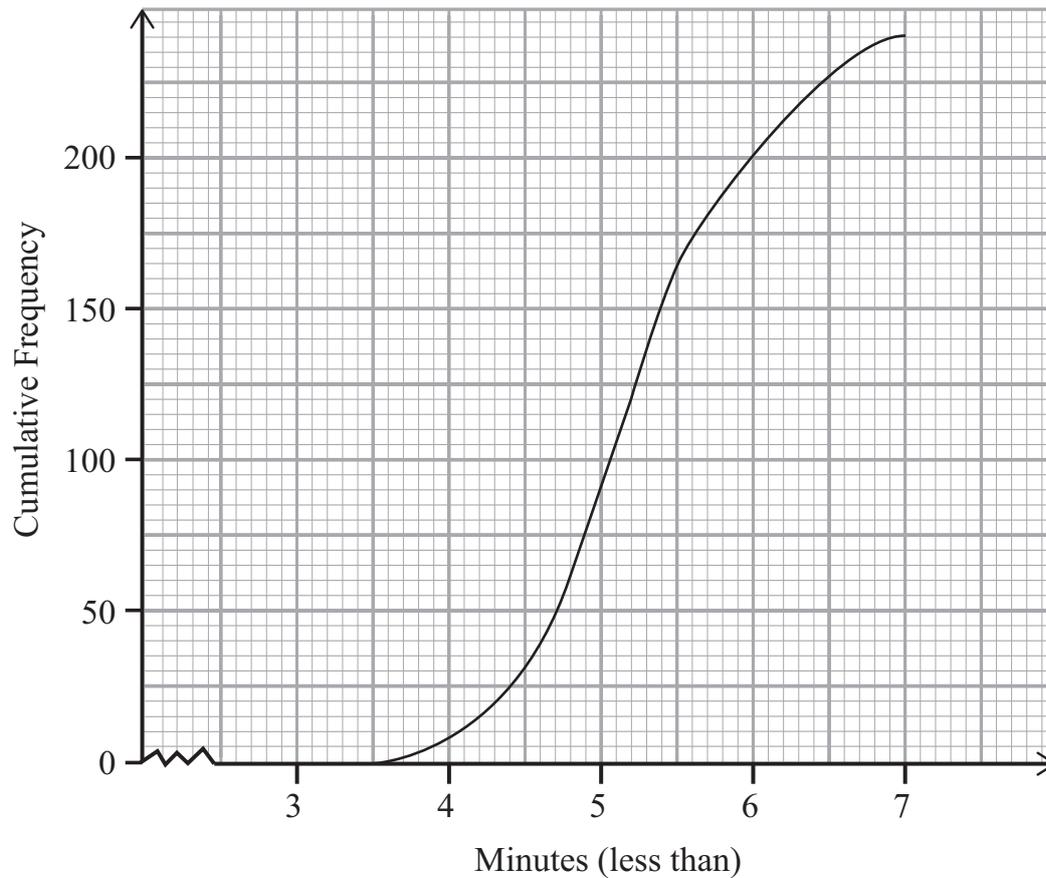
(a) Use the graph to estimate the median time.

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.

Total Question 25

Answer _____ % [2]

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24GMT3118

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

P   Q

200 cm   diagram not
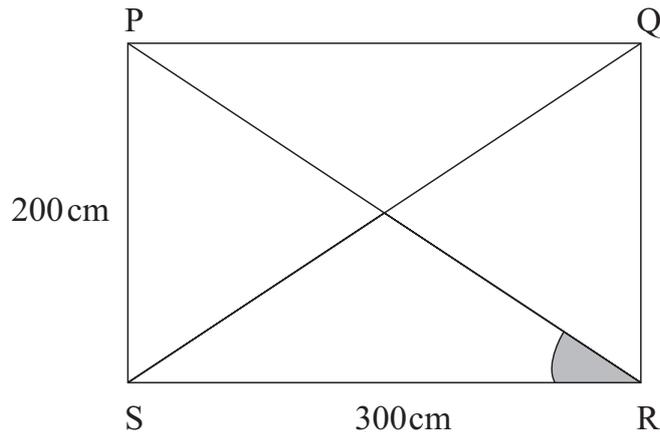   drawn accurately

S   300 cm   R

(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

[Turn over
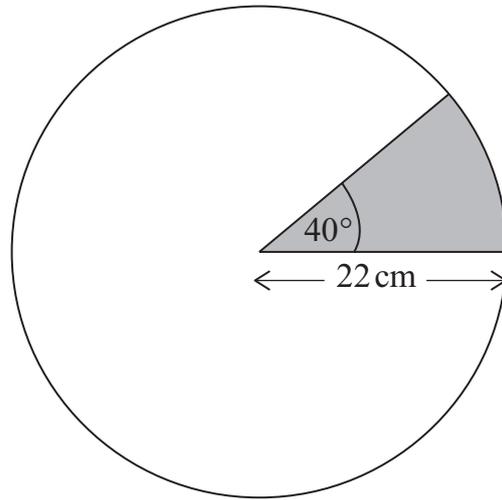
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24GMT3119

27

diagram not drawn accurately

40°

← 22 cm →

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 _____ cm² [3]

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]

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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 cm³.

(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]

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Total Question 29

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