Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017

Mathematics

Unit T3 **(With calculator)**
Higher Tier

GMT31

[GMT31]
THURSDAY 25 MAY, 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 boxed area on each page, on blank pages or tracing paper.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all twenty-seven** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

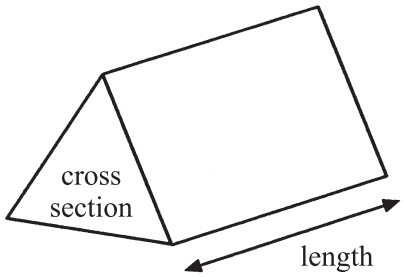
INFORMATION FOR CANDIDATES

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 **17**.
You should have a calculator, ruler, compasses and a protractor.
The Formula Sheet is on page 2.

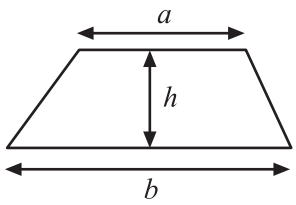
10602

Formula Sheet

Volume of prism = area of cross section × length

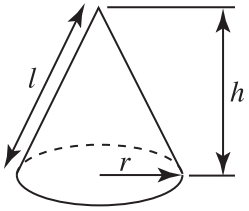


Area of trapezium = $\frac{1}{2}(a+b)h$



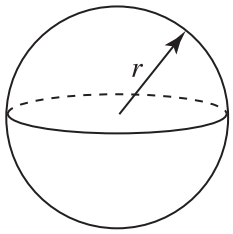
Volume of cone = $\frac{1}{3}\pi r^2 h$

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

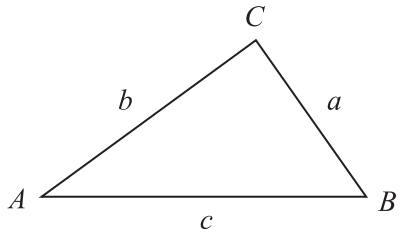


Volume of sphere = $\frac{4}{3}\pi r^3$

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

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(Questions start overleaf)

[Turn over

1 The number of goals scored in each match of a competition was recorded.

Number of goals scored in a match	Frequency
1	9
2	8
3	6
4	3
5	4

Calculate the mean number of goals per match.

Answer _____ [3]

2 A box contains 560 g of cornflakes.

A box on special offer contains an extra 35% of cornflakes.

How many grams of cornflakes are in the special offer box?

Answer _____ g [3]

3 Solve $4(x - 5) = 48$

Answer $x =$ _____ [3]

4 Jill bought 3 oranges at x pence each and 4 melons at $2x$ pence each.

(a) Write down an expression for the total cost in terms of x pence.

Answer _____ [1]

(b) She got £1.04 change from £5

Write down an equation in terms of x.

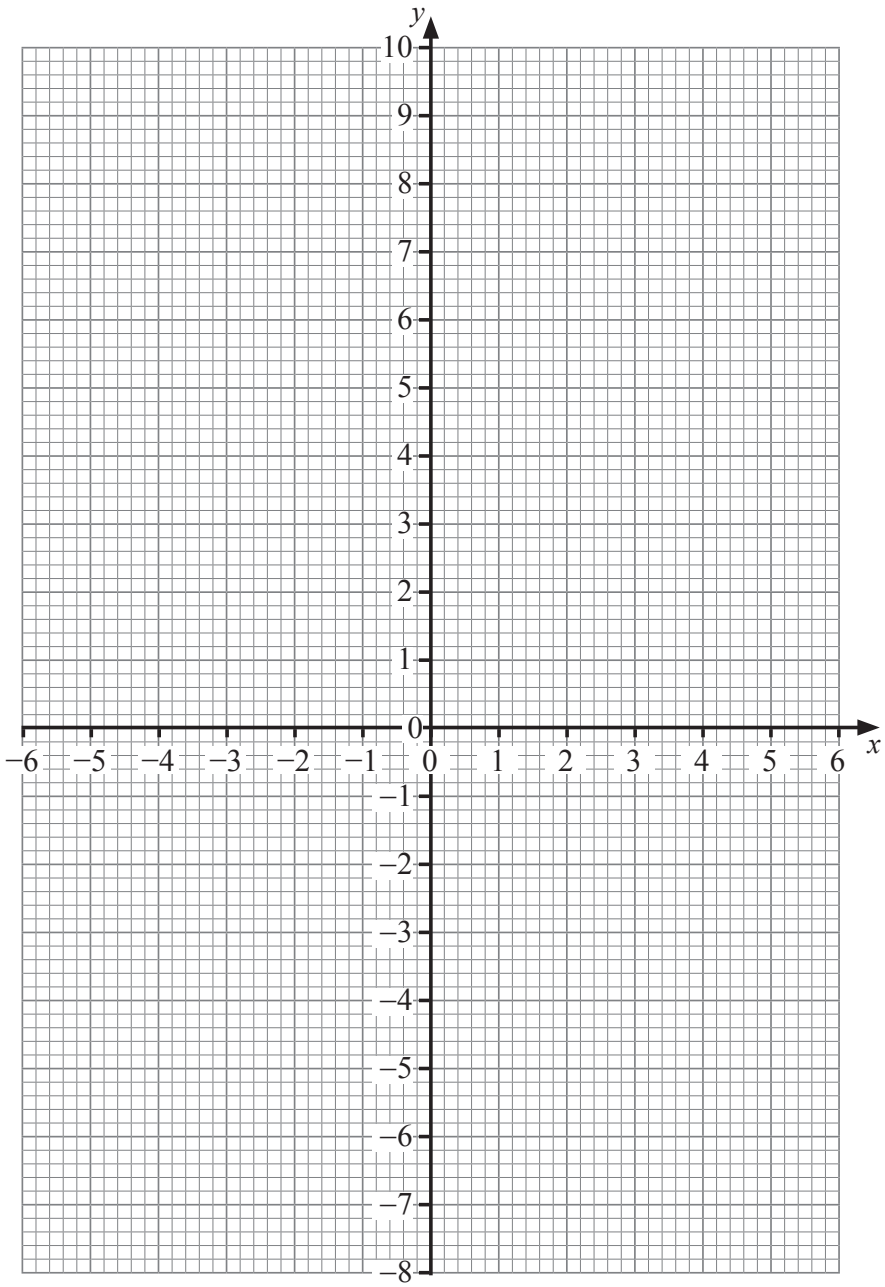
Answer _____ [1]

(c) Solve the equation to find the value of x.

Answer $x =$ _____ [2]

[Turn over

5 **(a)** Draw the graph of $y = 4x - 3$ on the grid below.



[3]

(b) The graph of $y = 4x - 3$ crosses the line $y = 5$ at the point P.

Write down the coordinates of P.

Answer (___ , ___) [1]

6 **(a)** Calculate the circumference of a circle with diameter 2 m.

Answer _____ m [2]

(b) Hence calculate the perimeter of the window below, which is made up of a semicircle and a rectangle.

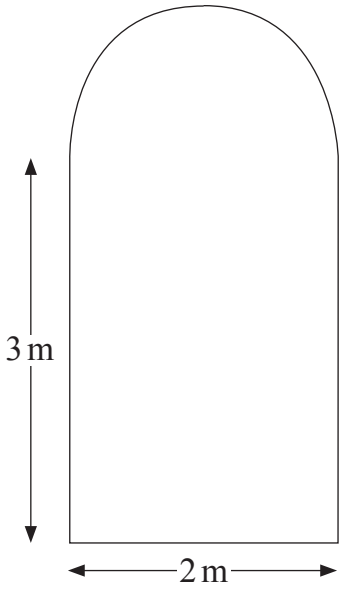


diagram not
drawn accurately

Answer _____ m [2]

[Turn over

7 A salesman recorded the average temperature (°C) and his ice-cream sales (£) during 8 weeks of the summer.

	Week 1	**Week 2**	**Week 3**	Week 4	Week 5	Week 6	Week 7	Week 8
Average Temperature (°C)	**13**	**12**	**14**	16	14	18	17	18
Sales (£)	**238**	**206**	**264**	330	272	398	364	392

(a) The first three points have already been plotted.
Use the data to complete the scatter graph. [2]

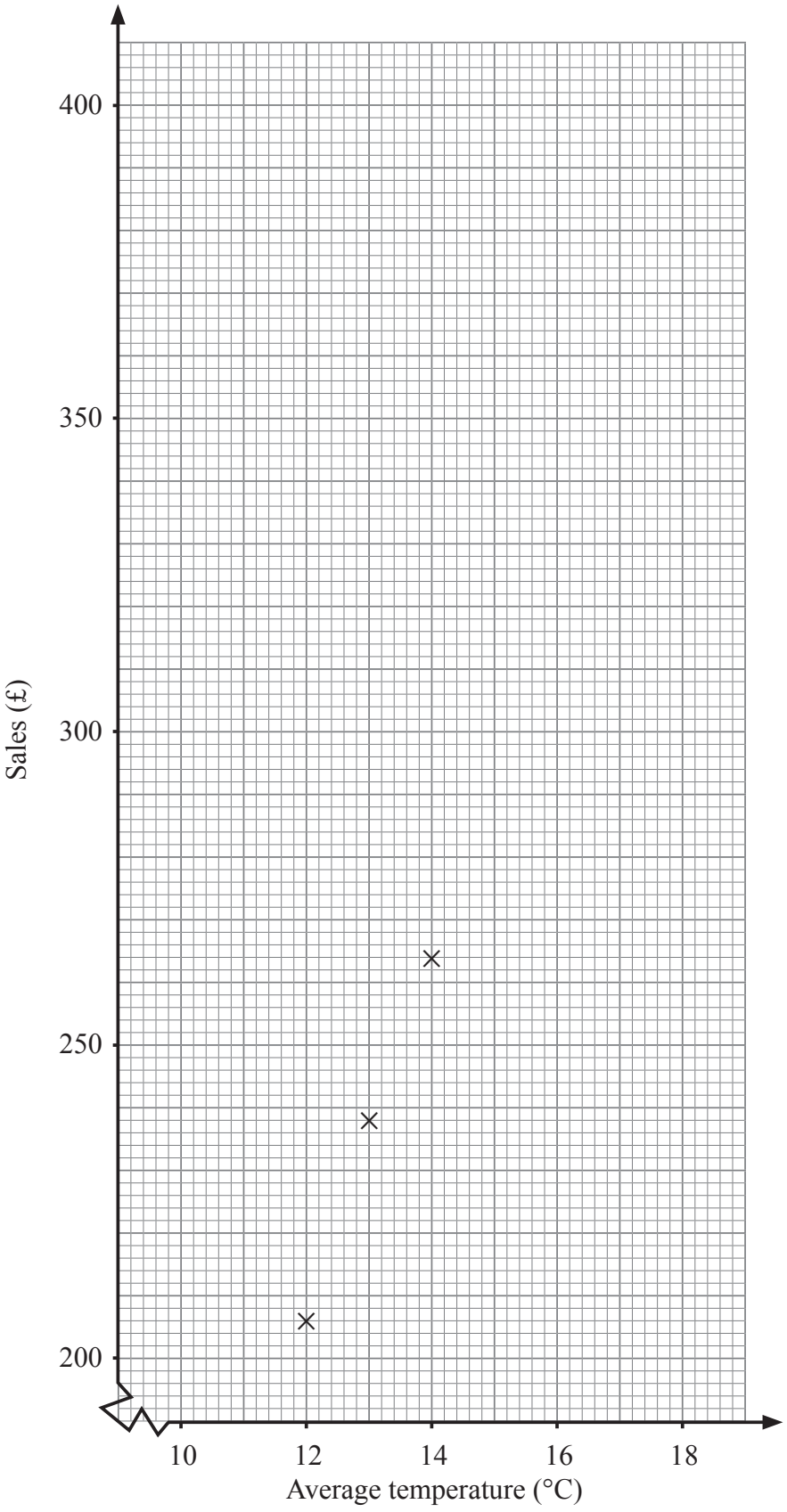
(b) Draw the line of best fit. [1]

(c) In Week 9 the average temperature was 15 °C.
Use the graph to estimate the sales for Week 9

Answer £ _____ [1]

(d) What type of correlation does your graph show?

Answer _____ [1]



[Turn over

8

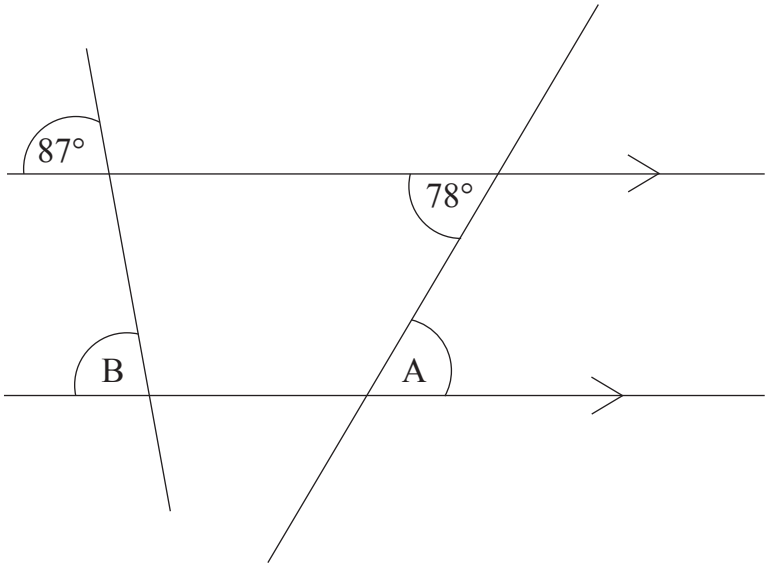


diagram not drawn accurately

Find the size of angle

(a) A Answer _____° [1]

(b) B Answer _____° [1]

9 An equilateral triangle and a regular pentagon are joined together as shown in the diagram.

Calculate the size of angle h.

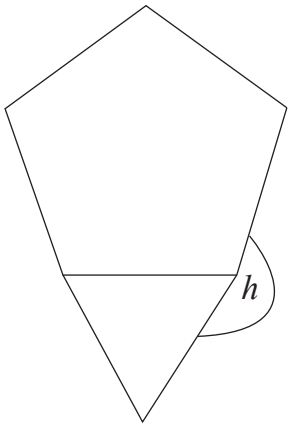
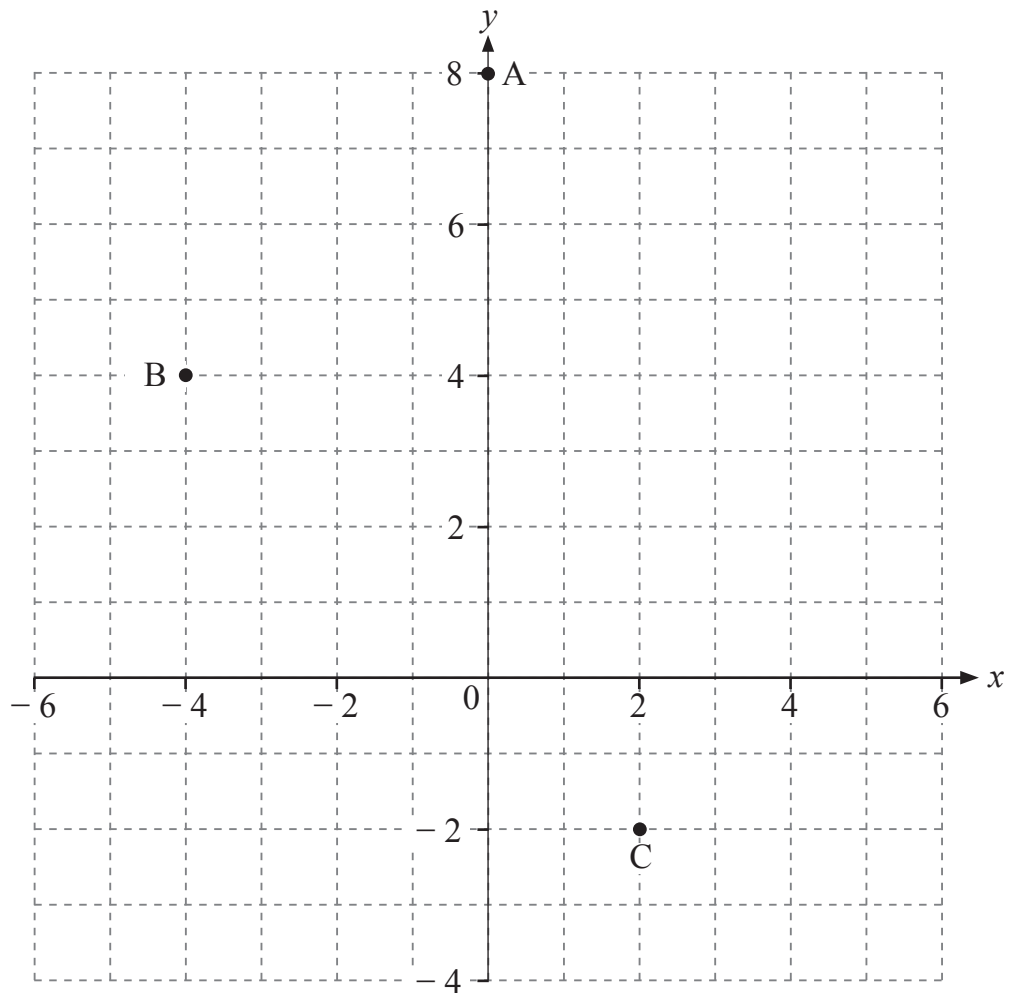


diagram not
drawn accurately

Answer _____ ° [3]

[Turn over

10 The vertices A(0, 8) B(−4, 4) and C(2, −2) of a right-angled triangle are shown.



(a) Write down the coordinates of the midpoint of the line joining A and C.

Answer (_____, _____) [2]

(b) A fourth point D is plotted so that ABCD forms a rectangle. Explain why the coordinates of D must be (6, 2).

[2]

11 Calculate the area of a circle with diameter 8 cm.

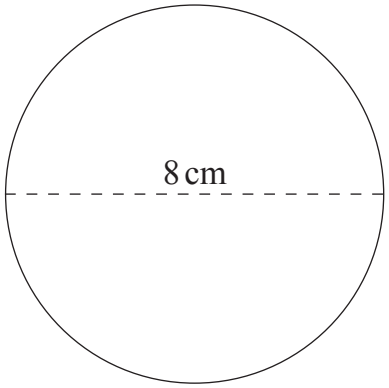
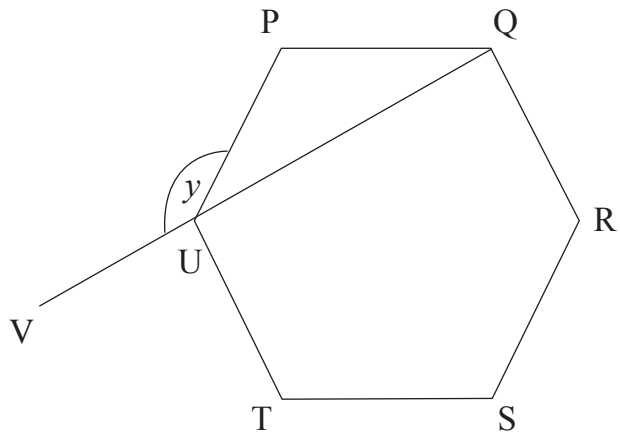


diagram not drawn accurately

Answer _____ [3]

[Turn over

12 PQRSTU is a regular hexagon.
QUV is a straight line.
Show that angle y is 150°
Give reasons for each step of your work.



[4]

13 The area of the right-angled triangle PQR is $24\,m^2$

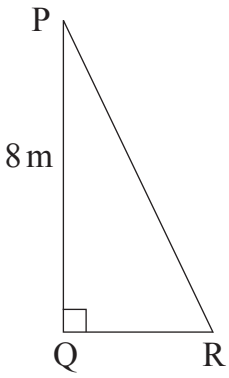


diagram not drawn accurately

Calculate the length of PR.

Show all your working.

Answer _____ m [4]

[Turn over

14 (a) Write 96 as a product of prime factors.

Give your answer in index notation.

Answer _____ [3]

(b) Hence find the highest common factor of 96 and 72

Answer _____ [2]

15 The first four terms of a sequence are

3, 8, 13, 18, ...

Write down the n^{th} term of the sequence.

Answer _____ [2]

16 A solution to the equation $3x^2 + x = 67$ lies between $x = 4$ and $x = 5$
Use trial and improvement to solve this equation.
Give your answer correct to 1 decimal place.
Show all your working.

x	$3x^2 + x$	

Answer $x =$ _____ [3]

Quality of written communication will be assessed in this question.

17 A shopkeeper ordered 1200 Easter eggs at a cost price of £2.40 each.
Before Easter he sold some of them, making a profit of 15% on each egg.
After Easter he had 360 eggs left, and he sold them at a reduced price.
What was the lowest price for each remaining egg to make sure he did not make a loss?

Show each step of your working clearly.

Answer £ _____ [5]

[Turn over

18 During a Science experiment the growth of plants was recorded.
The results are shown in the table below.

growth in cm (G)	number of plants
$0 \leqslant G < 3$	3
$3 \leqslant G < 6$	5
$6 \leqslant G < 9$	4
$9 \leqslant G < 12$	7
$12 \leqslant G < 15$	1

(a) Calculate an estimate of the mean growth of the plants.

Answer _____ cm [4]

(b) Explain why your answer is only an estimate of the mean growth.

_____

_____ [1]

19 **(a)** Expand $(3x - y)^2$

Answer _____ [2]

(b) Factorise $x^2 - 25$

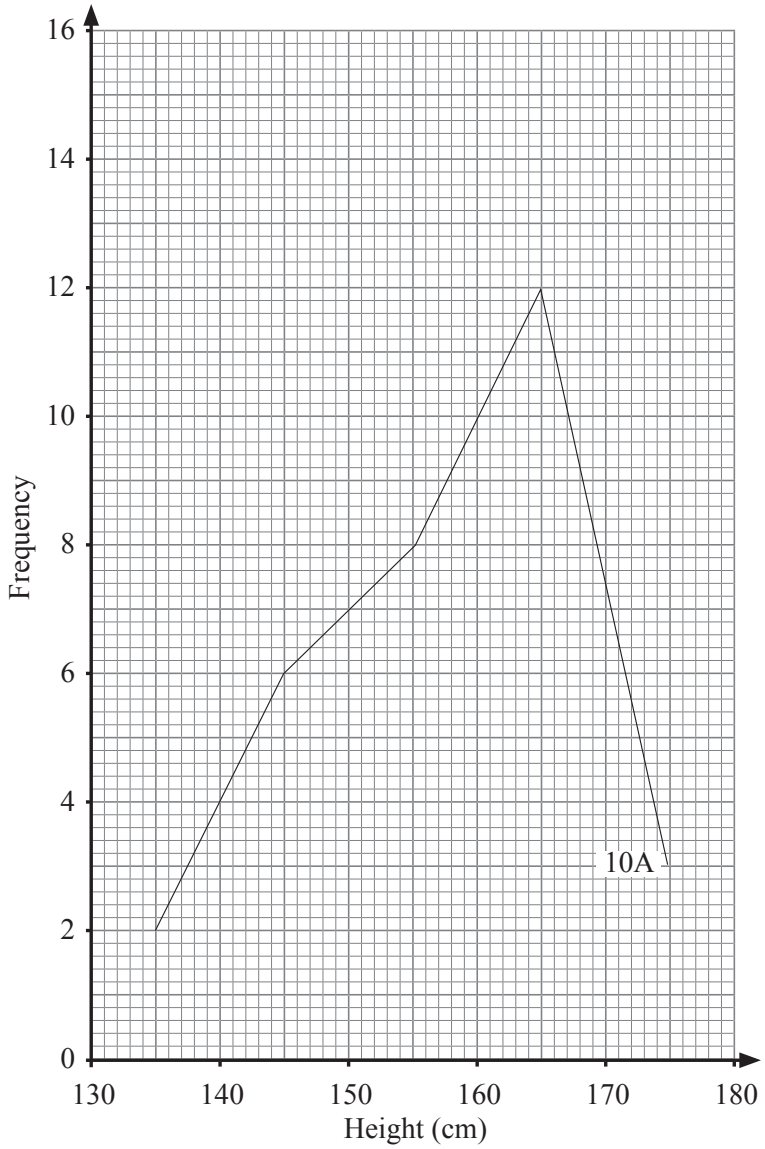
Answer _____ [1]

20 Gillian sold her formal dress online for £130.50
This was one-eighth more than the cost price of the dress.
What was the cost price?

Answer £ _____ [3]

[Turn over

21 The frequency polygon below shows the heights of children in 10A.



The data below lists the heights in cm of children in 10B.

131	134	135	136	139	139	141	142	143
143	145	147	149	151	152	152	154	155
155	155	156	156	156	157	157	157	158
162	165	169	172					

(a) On the grid above draw a frequency polygon to show the heights of the children in 10B, using the same intervals as 10A. [3]

(b) Compare the height of children in 10A with those in 10B.

_____

_____

_____ [2]

22 A number is halved, then five is subtracted. The answer is one-third of the original number.
Write an equation and solve it to find the original number.
A solution by trial and improvement will not be accepted.

Equation _____ [1]

Answer _____ [2]

[Turn over

23 Solve $x - 15 = 5y$
$3x = -8y - 1$

Show all your working.
A solution by trial and improvement will not be accepted.

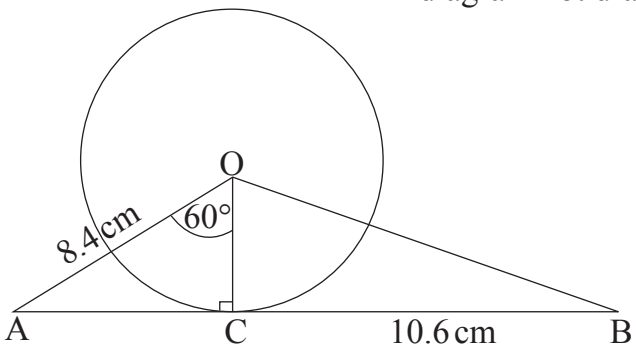
Answer $x =$ _____ $y =$ _____ [4]

24 Solve $x^2 - 5x - 24 = 0$

Answer $x =$ _____ [3]

25

diagram not drawn accurately



This is a circle with O as centre. OA = 8.4 cm, BC = 10.6 cm and angle AOC = 60°

(a) Show that the radius of the circle is 4.2 cm.

[3]

(b) Hence calculate the size of the angle OBC.
Give your answer to an appropriate degree of accuracy.

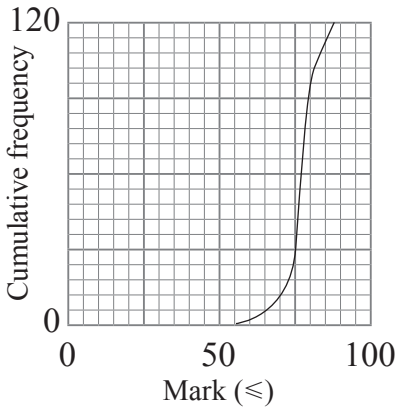
Answer _____° [4]

[Turn over

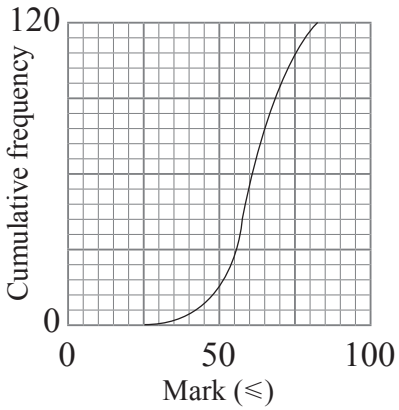
26 The mean of four numbers is x.
y is added to one of the numbers and z is added to each of the other three numbers.
Write an expression for the new mean.

Answer _____ [3]

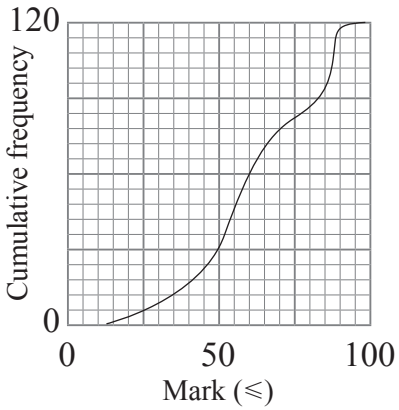
27 Examinations in Chemistry, Physics and Biology were taken by 120 students. Each examination was marked out of 100 and the cumulative frequency graphs below illustrate the results.



Chemistry



Physics



Biology

(a) Which subject has the highest median?

Answer _____ [1]

(b) In which subject was the interquartile range the greatest?

Answer _____ [1]

(c) The pass mark was 50. What percentage of the students did not pass Physics?

Answer _____% [1]

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	**Marks**
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Examiner Number