Centre Number

Candidate Number

Rewarding Learning

General Certificate of Secondary Education
2017

Mathematics

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

ML

[GMT31]

THURSDAY 25 MAY, 9.15am–11.15am

TIME

2 hours, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

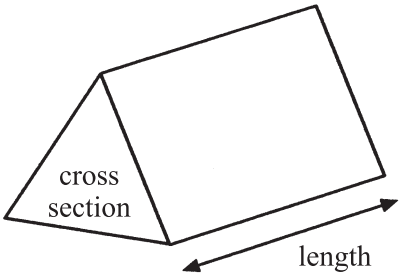
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Complete in black ink only.
Answer **all twenty-seven** questions.
All working should be clearly shown in the spaces provided. Marks may be awarded for partially 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.

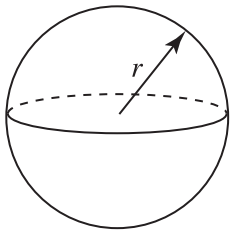
Formula Sheet

Volume of prism = area of cross section × length



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

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

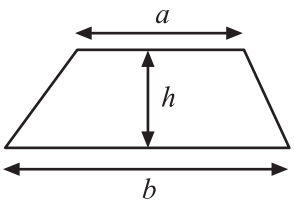


Quadratic Equation

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

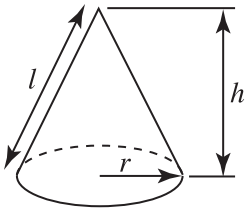
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

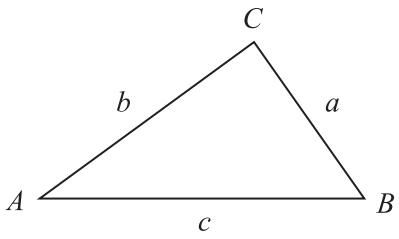


Volume of cone $= \frac{1}{3}\pi r^2 h$

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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(Questions start overleaf)

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

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.

Show your work.

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?

Show your work.

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

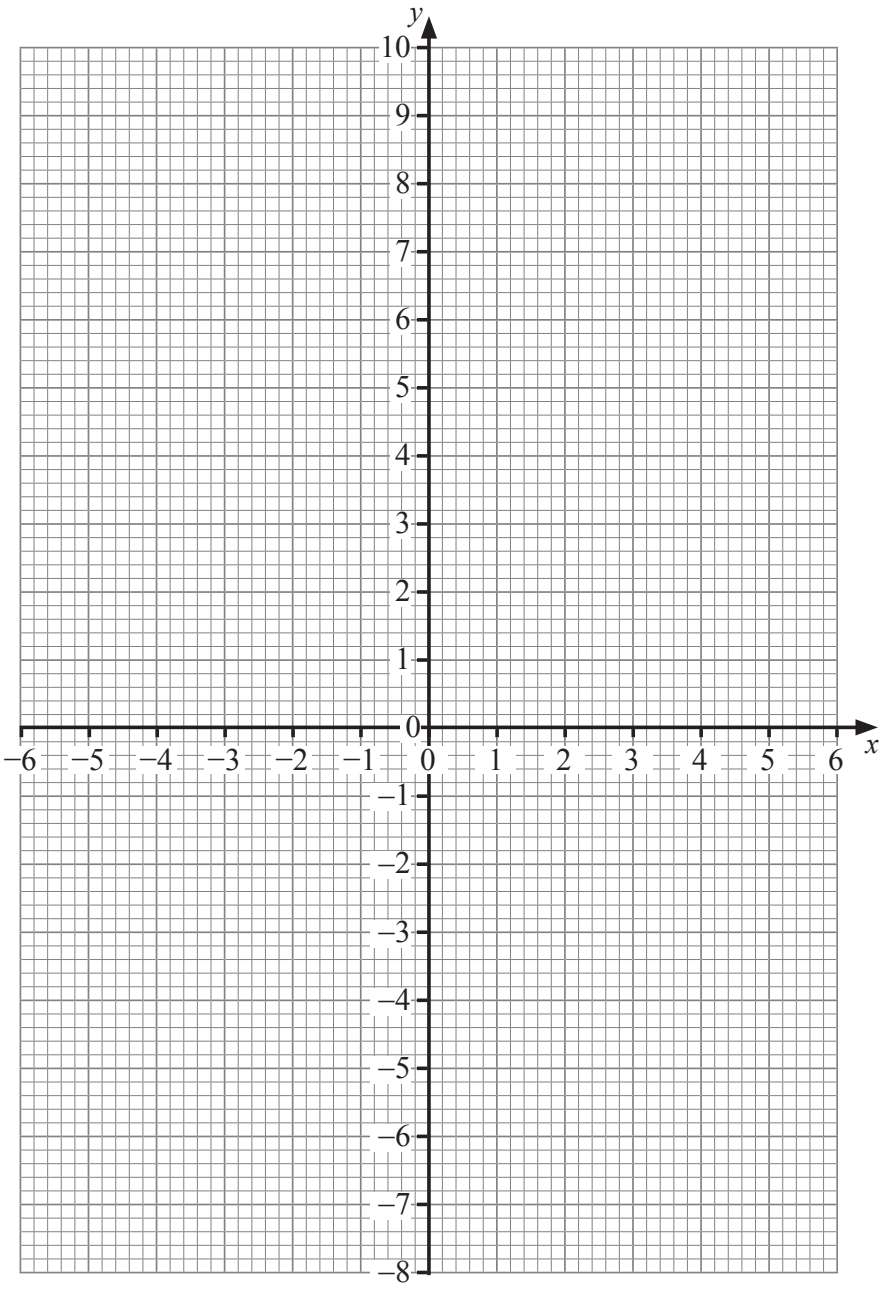
Write down an equation in terms of x.

Answer _____ [1]

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

Answer $x =$ _____ [2]

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) Use the answer from **6(a)** to calculate the perimeter of the window below. It is made up of a semicircle and a rectangle.

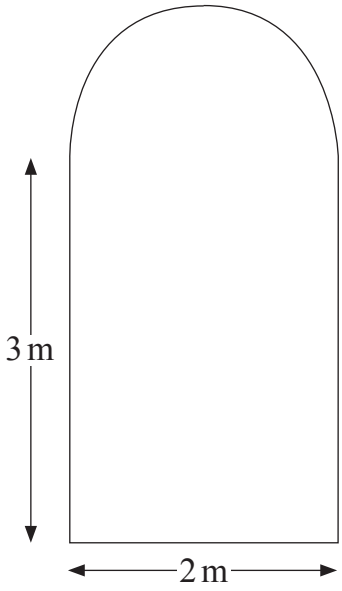


diagram not
drawn accurately

Answer _____ m [2]

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 on the scatter graph.
Use the data above to complete the scatter graph. [2]

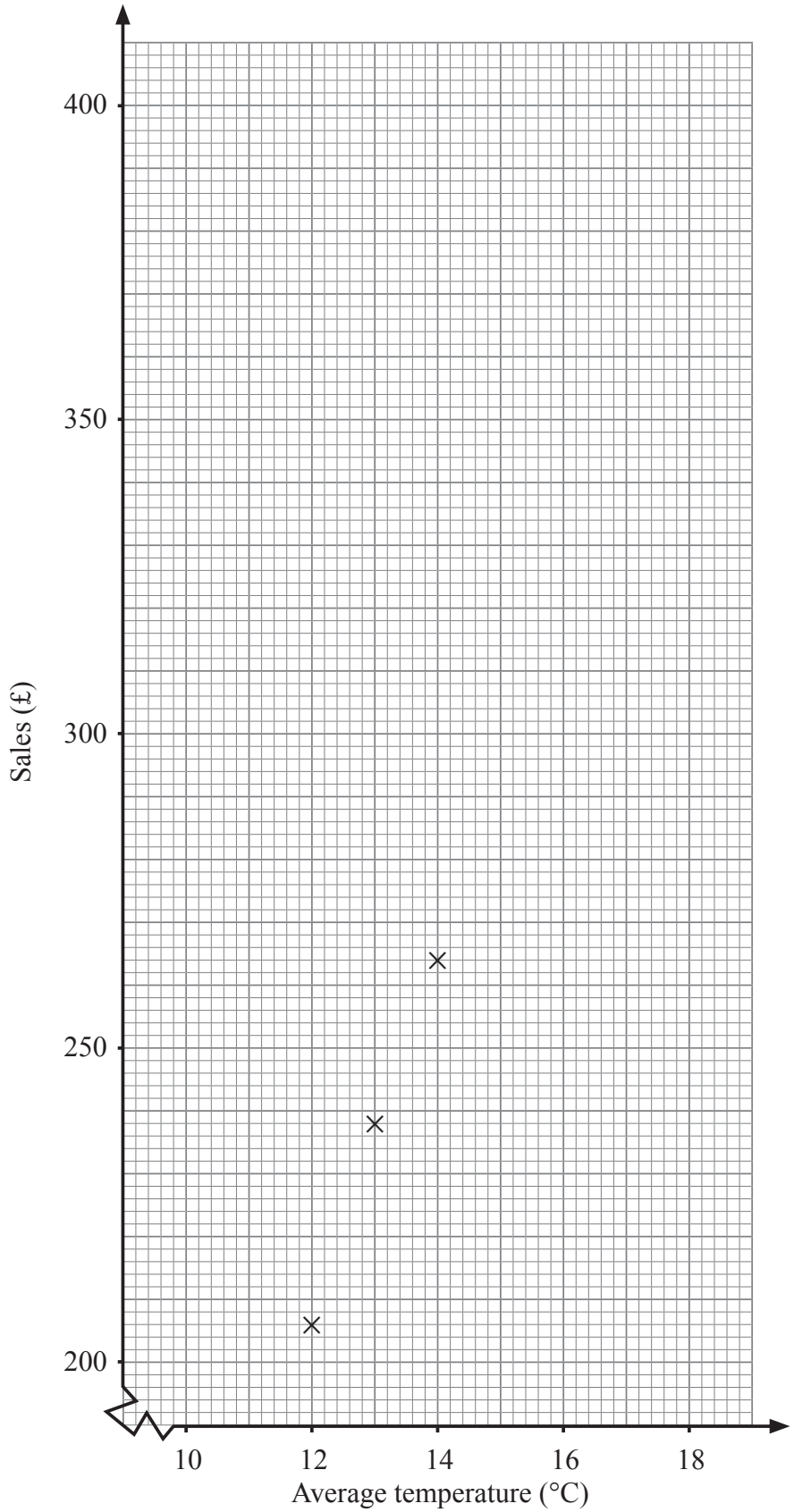
(b) Draw the line of best fit. [1]

(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]



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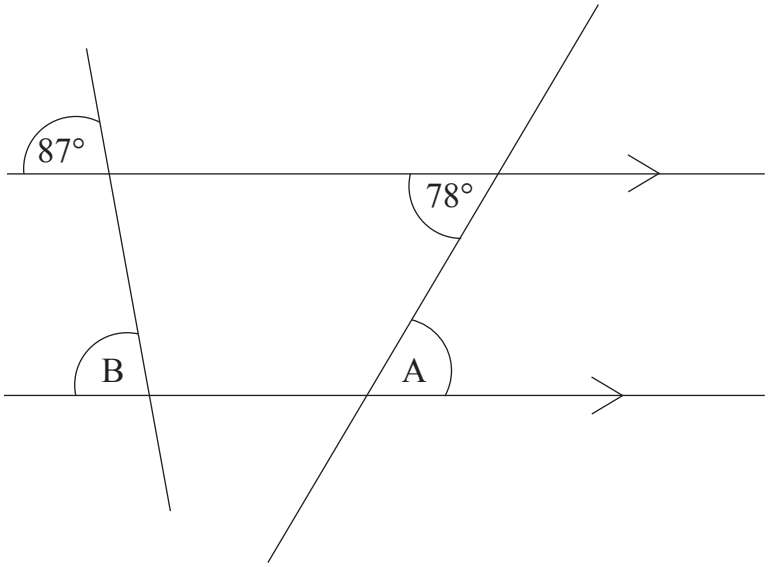


diagram not drawn accurately

Find the size of angle

(a) A Answer _____° [1]

Find the size of angle

(b) B Answer _____° [1]

9 Look at the diagram below. An equilateral triangle and a regular pentagon are joined together.

Calculate the size of angle h.

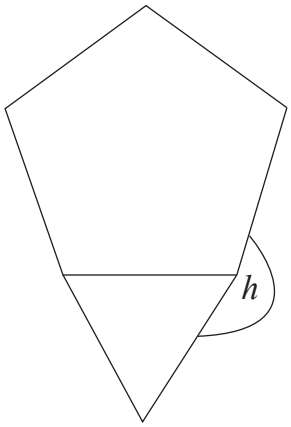
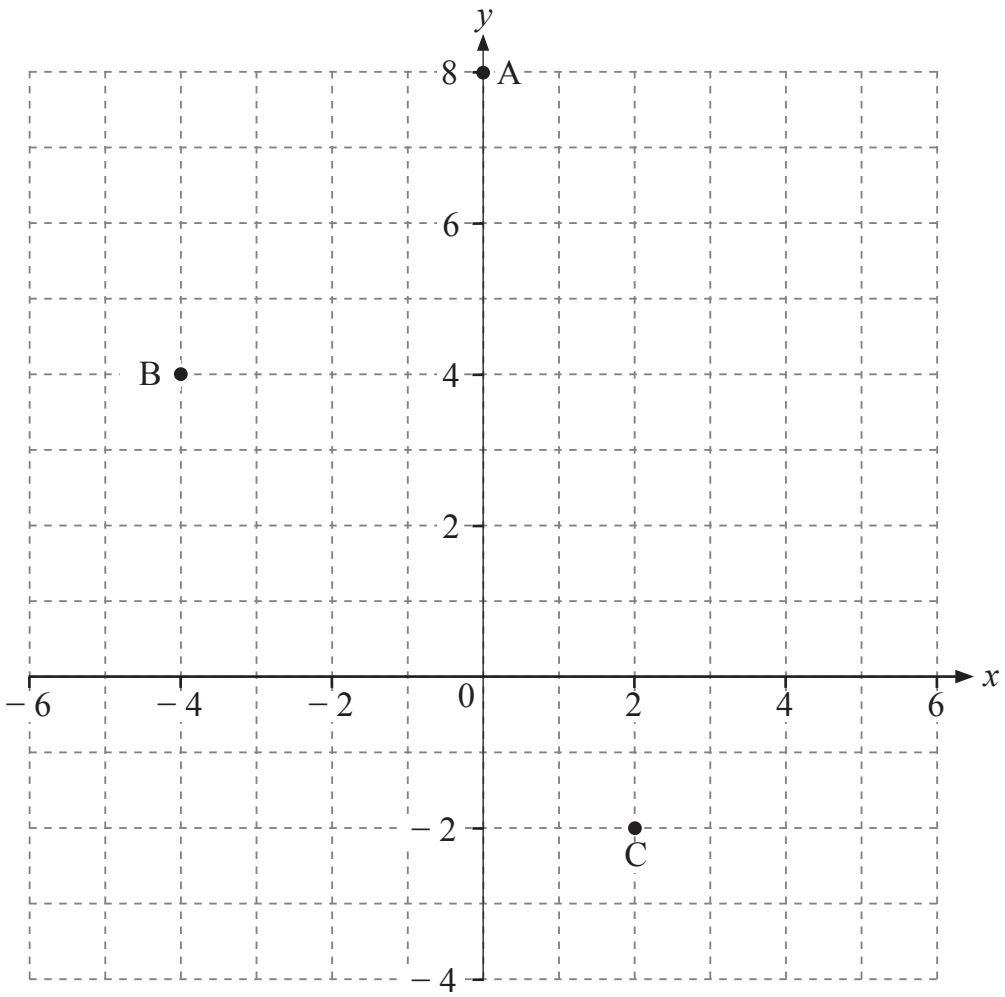


diagram not
drawn accurately

Answer _____ ° [3]

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



(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.

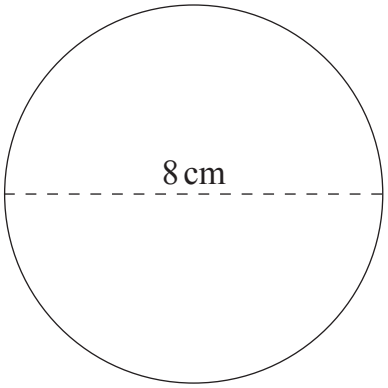
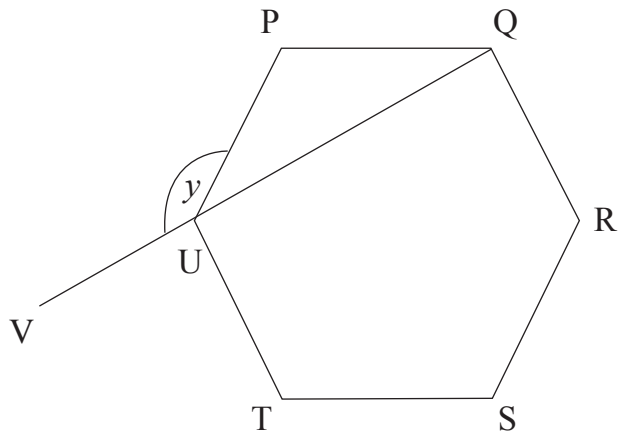


diagram not drawn accurately

Answer _____ [3]

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



[4]

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

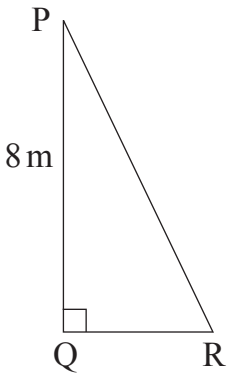


diagram not drawn accurately

Calculate the length of PR.

Show all your working out.

Answer _____ m [4]

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

Write down your answer in index notation.

Answer _____ [3]

(b) Use the answer from **14(a)** to 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 The answer to the equation $3x^2 + x = 67$ lies between $x = 4$ and $x = 5$
Use trial and improvement to solve this equation.
Write down your answer correct to 1 decimal place.
Show all your working out.

x	$3x^2 + x$	

Answer $x =$ _____ [3]

Quality of written communication will be assessed in this question.

17 A shopkeeper bought 1200 Easter eggs.
Each egg cost £2.40
He sold most of them before Easter.
He made a profit of 15% on each egg.
He had 360 eggs left after Easter. He sold these eggs at a reduced price.
What was the **lowest** price he could sell each of these eggs for, to make sure he did not make a loss?

Show each step of your working clearly.

Answer £ _____ [5]

18 During a Science experiment the growth of plants was written down.
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 $x^2 - 25$

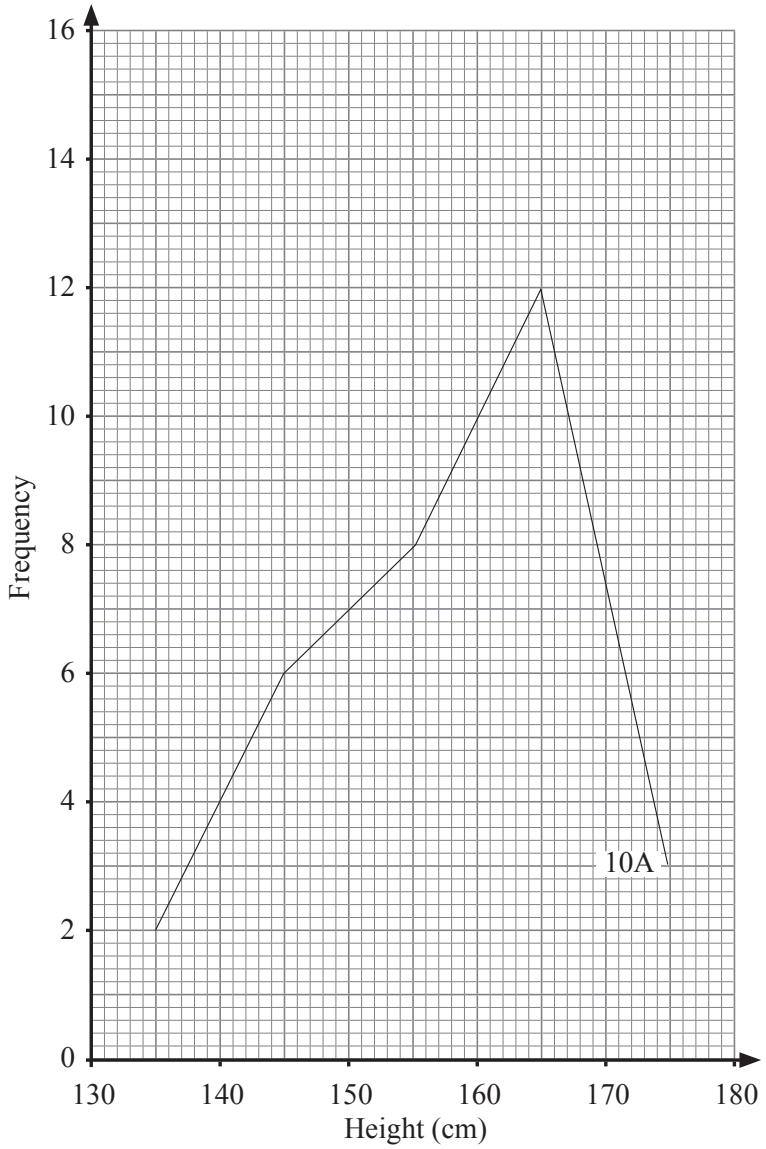
Answer _____ [1]

---

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]

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 to find the original number**.**
Use the equation to work out the original number.
A solution by trial and improvement will not be accepted.

Equation _____ [1]

Answer _____ [2]

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

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

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

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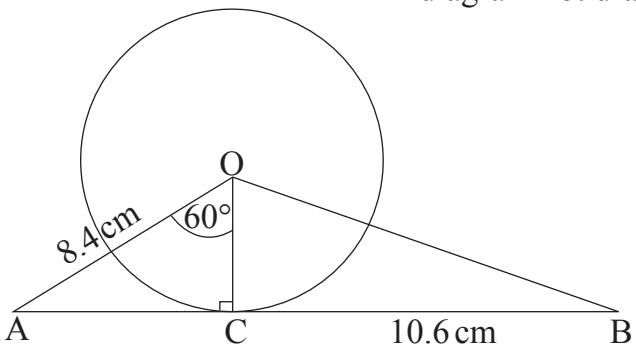
24 Solve $x^2 - 5x - 24 = 0$

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]

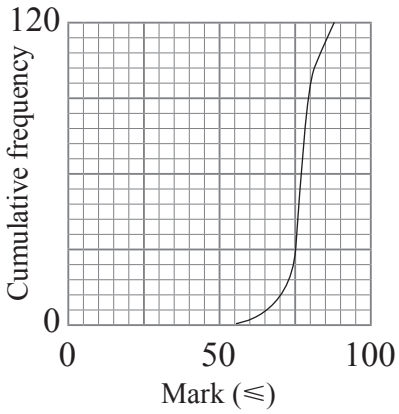
(b) Use the answer from **25(a)** to calculate the size of the angle OBC.
Give your answer to an appropriate degree of accuracy.

Answer _____° [4]

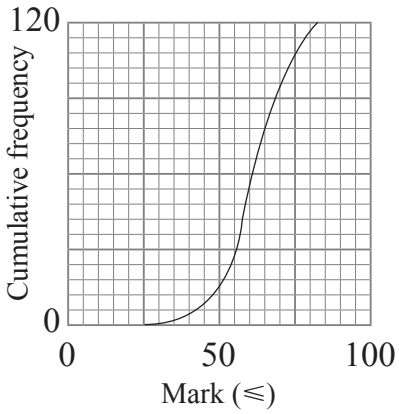
26 The mean of four numbers is x.
y is added to one of the numbers and z is added to each of the other three numbers.
Write an expression for the new mean.

Answer _____ [3]

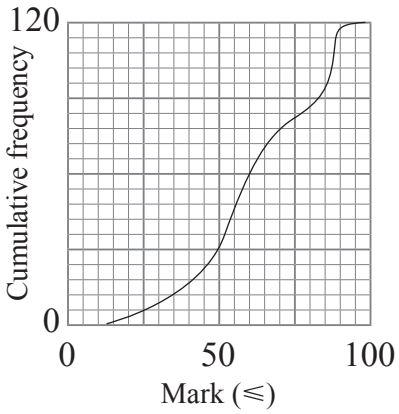
27 Examinations in Chemistry, Physics and Biology were taken by 120 students. Each examination was marked out of 100 and the cumulative frequency graphs below show the results.



Chemistry



Physics



Biology

(a) Which subject has the highest median?

Answer _____ [1]

(b) Which subject has the greatest interquartile range?

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