Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016

Mathematics

Unit T3
(With calculator)
Higher Tier

GMT31

[GMT31]

THURSDAY 26 MAY, 9.15am–11.15am

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

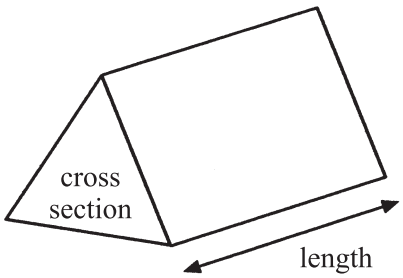
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page, on blank pages or tracing paper.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all twenty-eight** 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

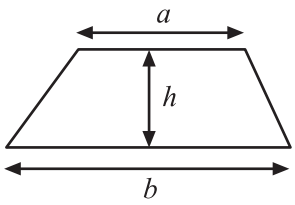
The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Functional Elements will be assessed in this paper.
Quality of written communication will be assessed in **Questions 5 and 15**.
You should 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

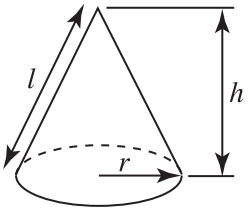


Area of trapezium $= \frac{1}{2}(a+b)h$



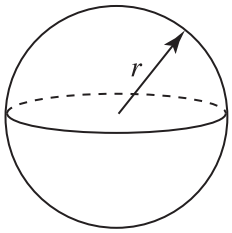
Volume of cone $= \frac{1}{3}\pi r^2 h$

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

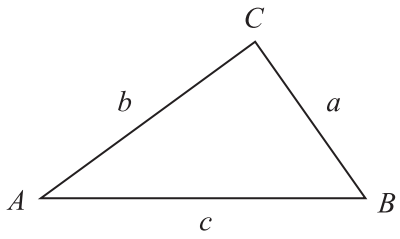


Volume of sphere $= \frac{4}{3}\pi r^3$

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

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 lengths of twigs measured to the nearest tenth of a centimetre are given below.

4.3	4.7	2.9	1.0	5.8
4.2	3.6	1.9	2.7	3.0
2.6	3.7	4.3	2.7	2.8

Draw a stem and leaf diagram to show this data.

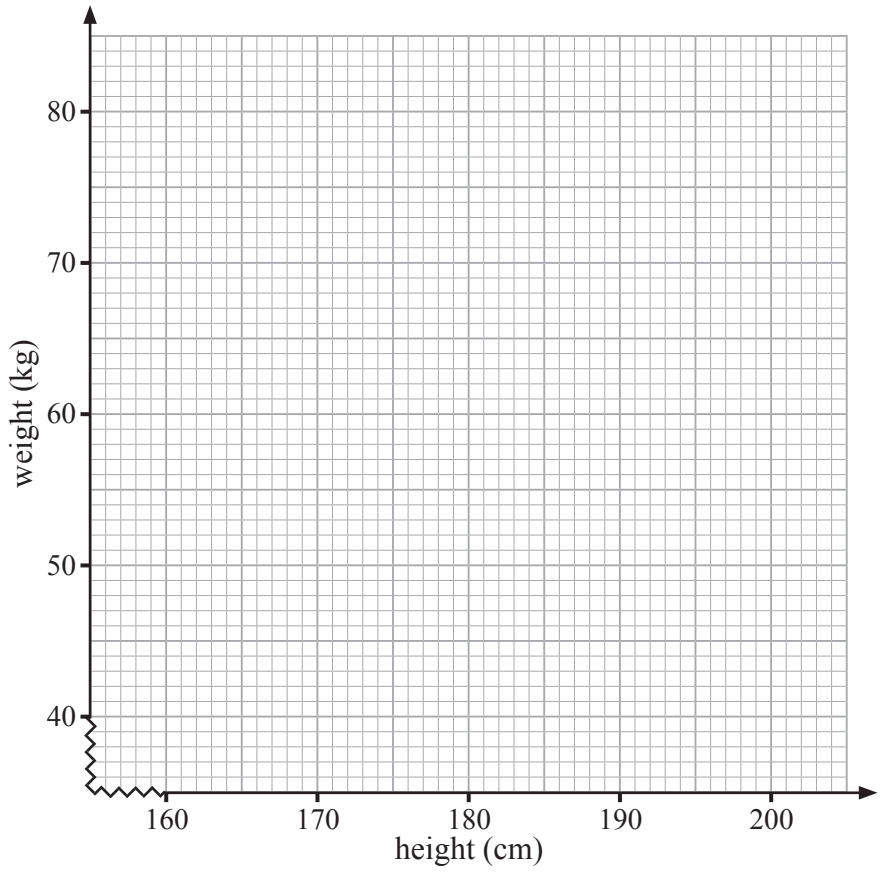
[3]

2 The heights and weights of 7 people are given.

height (cm)	165	197	178	168	180	174	190
weight (kg)	45	77	58	50	65	60	63

(a) Using the grid below show this information on a scatter diagram.

Mark your points clearly.



[2]

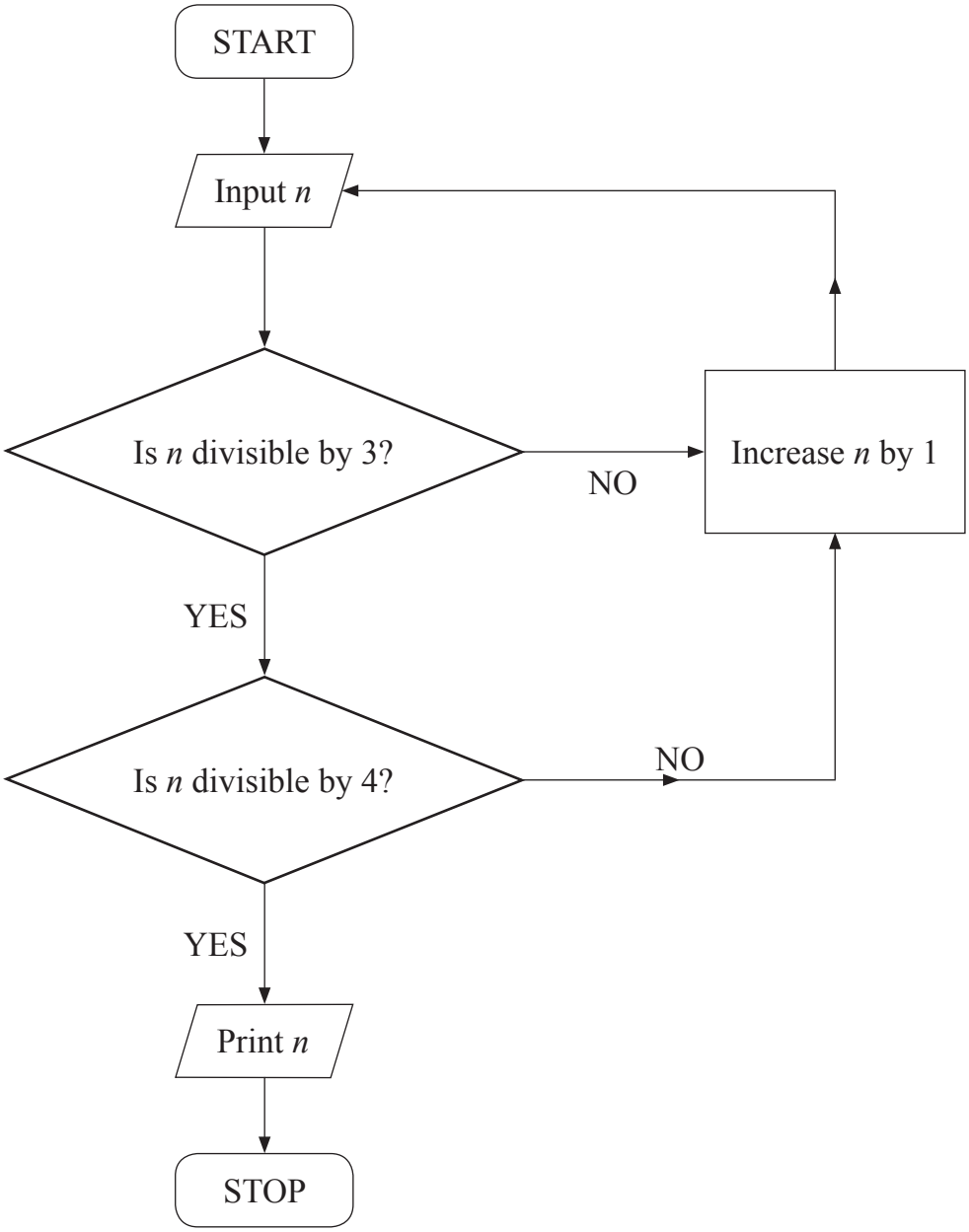
(b) Draw a line of best fit on the scatter diagram. [1]

(c) Use your line of best fit to estimate the weight of a person whose height is 185 cm.

Answer _____ kg [1]

[Turn over

3



Starting with $n = 19$, use the flow chart to find the number printed.

Answer number printed _____ [2]

4 The diagram shows two congruent circles inside a rectangle.

The rectangle measures 12 cm by 7 cm.

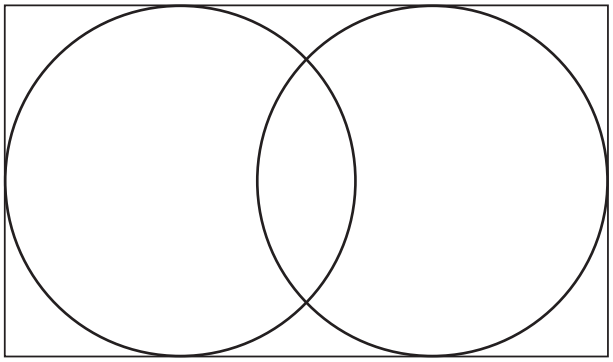


diagram not drawn accurately

Calculate the distance between the centres of the two circles.

Answer _____ cm [2]

Quality of written communication will be assessed in this question.

5 Larry and Jake each measure the length of a different slug. They both say that their slug is 6 cm to the nearest centimetre. Does this mean that both slugs are exactly the same length?

Explain your answer clearly.

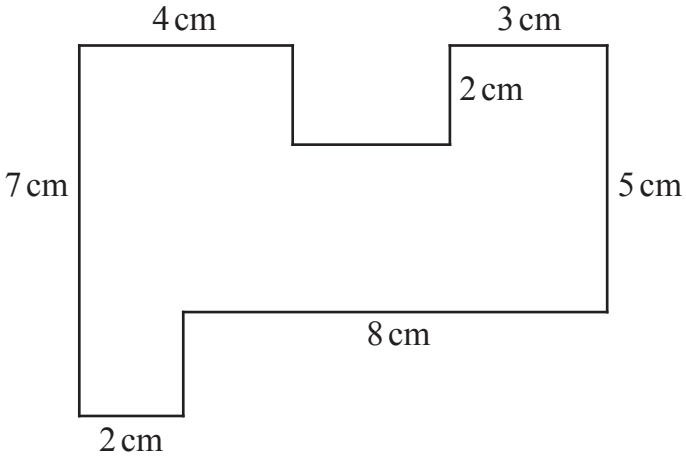
_____

_____ [2]

[Turn over

6 Calculate the area of the shape shown below.

diagram not drawn to scale



Answer _____ cm^2 [3]

7 Two points P(–4, –1) and Q(–8, 5) are joined by a straight line.

Work out the coordinates of the midpoint of the line PQ.

Answer (_____, _____) [2]

8 Last week a dentist noted that, of all her treatments,

$\frac{1}{3}$ were fillings, $\frac{1}{4}$ were extractions, $\frac{1}{8}$ were denture treatment and the rest were cleaning.

What fraction were cleaning?

Answer _____ [2]

9 **(a)** Jenna writes down all the whole numbers from 1 to 15

What percentage of these numbers are prime numbers?

Answer _____ % [2]

(b) Sam buys apples at £5 per dozen (12) and sells them at 55p each.

What is his percentage profit?

Answer _____ % [3]

[Turn over

10 A sheet of paper is 300 mm long and 210 mm wide.

Find in its simplest form the ratio of the length of the sheet to the width of the sheet.

Answer _____ [2]

11 **(a)** Factorise

(i) $6a + 15$

Answer _____ [1]

(ii) $4x - x^2$

Answer _____ [1]

(b) Solve $6x - 7 = 14 - x$

Answer $x =$ _____ [3]

(c) Simplify $\frac{y}{3} - \frac{y}{5}$

Answer _____ [2]

12 Calculate the perimeter of a semicircle of diameter 14 cm.

Answer _____ cm [3]

13 Sara uses $\frac{3}{5}$ of a tube of sun cream each day on holiday.

How many tubes of sun cream will she need to buy for a 7 day holiday?

Answer _____ [2]

[Turn over

14 The amount of pocket money (p) for each of a group of students is shown below.

Money (£)	Frequency
$0 < p \leqslant 3$	6
$3 < p \leqslant 6$	18
$6 < p \leqslant 9$	16
$9 < p \leqslant 12$	22
$12 < p \leqslant 15$	13
$15 < p \leqslant 18$	4

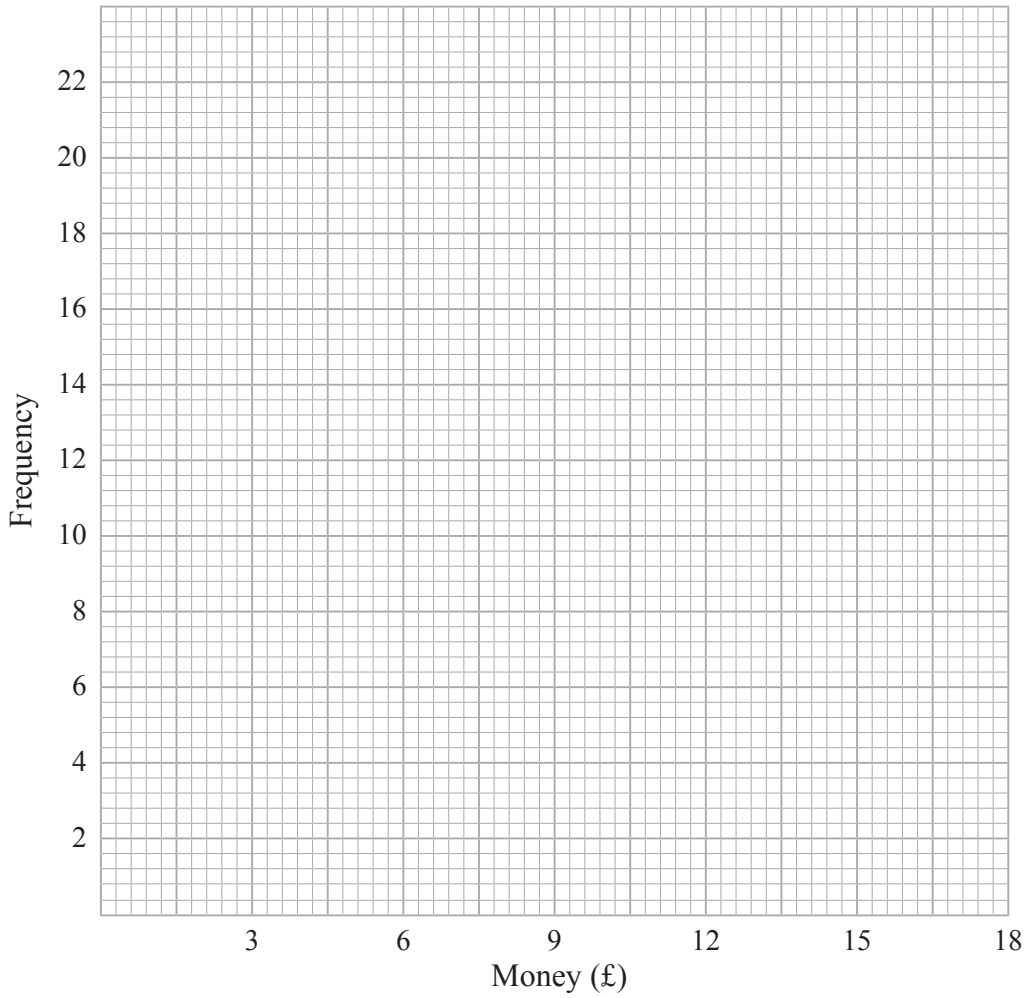
(a) Calculate an estimate for the mean amount of pocket money.

Answer £ _____ [4]

(b) Which class interval contains the median amount of pocket money?

Answer _____ [1]

(c) On the grid below draw a frequency polygon to show this data.

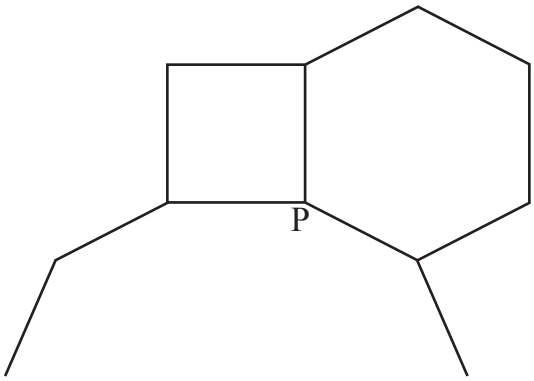


[2]

Quality of written communication will be assessed in this question.

15 Three regular polygons meet at point P as shown.

diagram not drawn accurately



One polygon is a square and another polygon is a regular hexagon. How many sides has the third polygon?

Explain your working clearly.

Answer _____ sides [4]

16

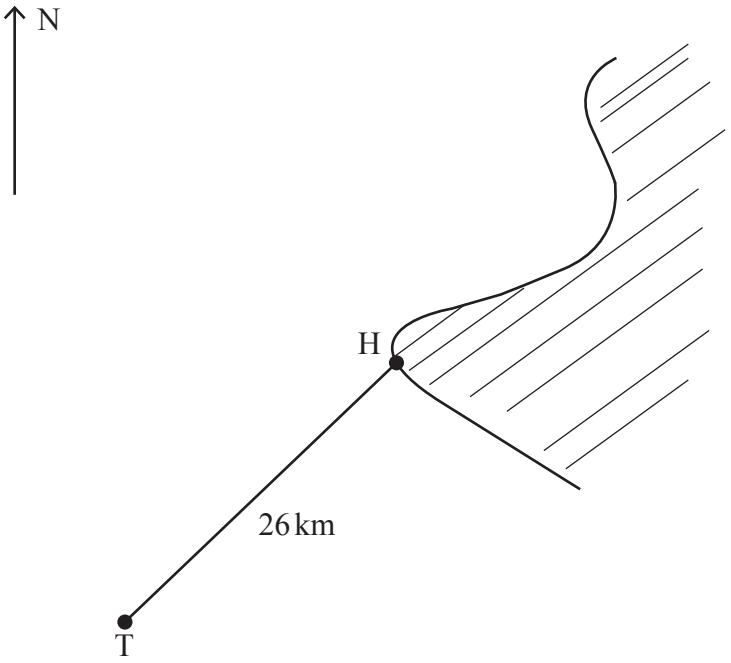


diagram not
drawn accurately

A trawler T has sailed 26 km from a harbour H. It is now 10 km west of the harbour.

Calculate how far south it is from the harbour.

Answer _____ km [3]

[Turn over

17 **(a)** Write 108 as a product of prime factors.

Give your answer in index notation.

Answer _____ [3]

(b) Find the LCM of 108 and 60

Answer _____ [2]

(c) Find the HCF of 108 and 60

Answer _____ [1]

18 **(a)** What is the n^{th} term for the sequence?

12, 24, 36, 48, ...

Answer _____ [1]

(b) What is the n^{th} term for the sequence?

13, 9, 5, 1, –3, ...

Answer _____ [2]

19 In a swimming club $\frac{2}{5}$ of the members are Juniors.

The remaining 90 members are Seniors.

How many members are there in the club?

Answer _____ [3]

[Turn over

20 **(a)** Expand and simplify $8(a - 2) - 3(2a - 6)$

Answer _____ [2]

(b) Solve $\frac{2x}{3} - 7 = 5$

Answer $x =$ _____ [2]

21

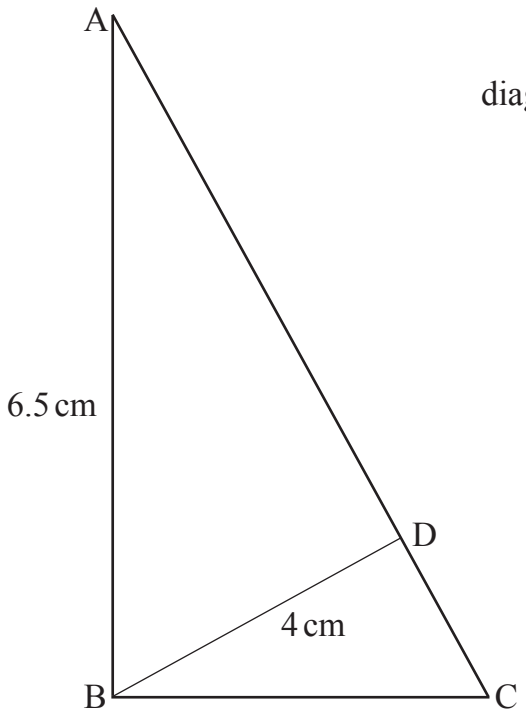


diagram not drawn accurately

ABC and BDA are right-angled triangles.

AB = 6.5 cm and BD = 4 cm.

Calculate the length of CD.

Answer _____ cm [6]

[Turn over

22

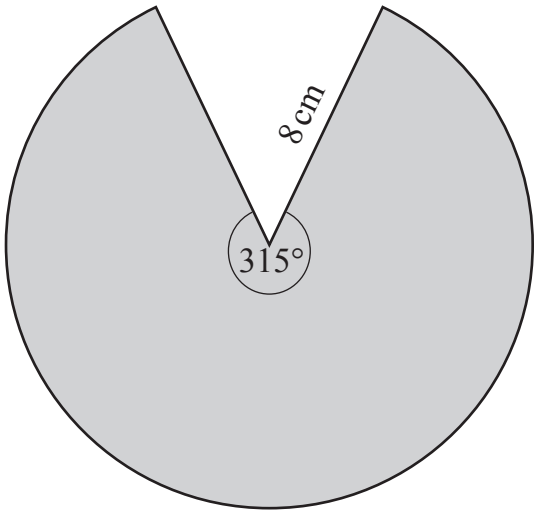


diagram not drawn accurately

Calculate the area of the shaded sector.

Answer _____ cm^2 [3]

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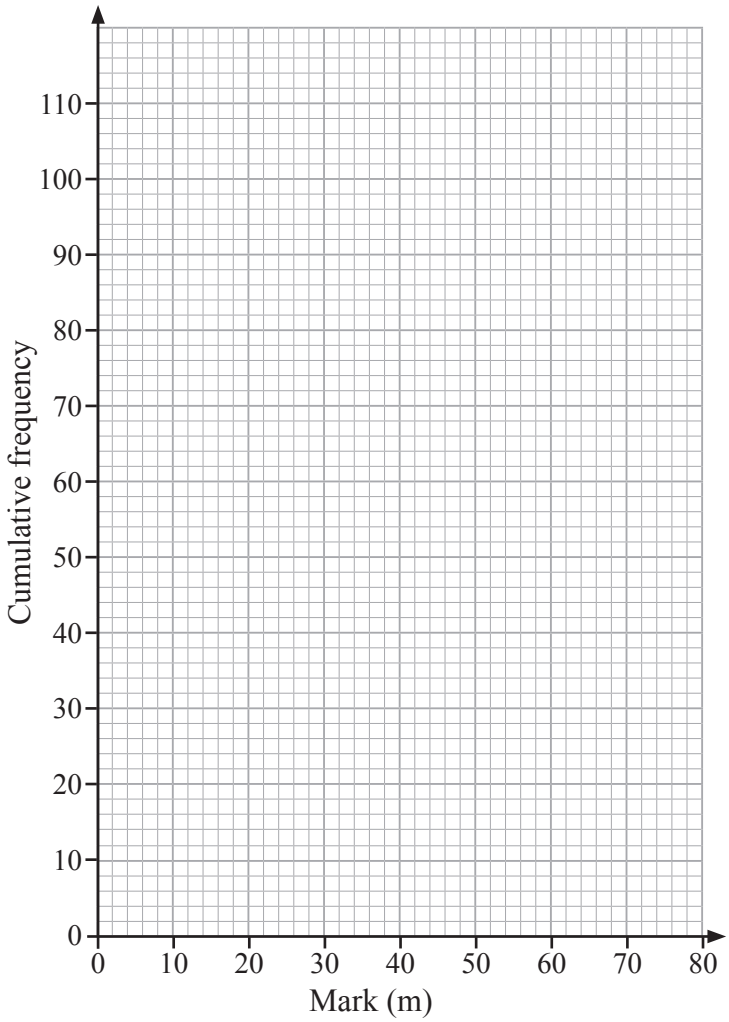
(Questions continue overleaf)

23 **(a)** The marks in an examination are recorded. Complete the cumulative frequency column in the table below. [1]

Mark (m)	Frequency	Cumulative Frequency
$0 < m \leqslant 10$	4	
$10 < m \leqslant 20$	6	
$20 < m \leqslant 30$	16	
$30 < m \leqslant 40$	24	
$40 < m \leqslant 50$	30	
$50 < m \leqslant 60$	16	
$60 < m \leqslant 70$	12	
$70 < m \leqslant 80$	4	

(b) On the axes provided draw a cumulative frequency graph.



[2]

(c) Use the cumulative frequency graph to estimate

(i) the median,

Answer _____ [1]

(ii) the interquartile range.

Answer _____ [2]

(d) The pass mark is 36

Use the cumulative frequency graph to estimate the percentage of the candidates who pass.

Answer _____ % [2]

24 A special offer shampoo bottle contains 20% extra.

It contains 900 ml of shampoo.

How much shampoo was in the original bottle?

Answer _____ ml [3]

25 A full jar of coffee weighs 670 g. An empty coffee jar weighs 450 g.

Both are measured to the nearest 5 g.

Calculate the maximum weight of coffee in the jar.

Answer _____ g [3]

26 Solve the simultaneous equations

$$3x - y = 7 \text{ and } 5x - 2y = 10$$

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ $y =$ _____ [3]

27 **(a)** Factorise $p^2 - 64$

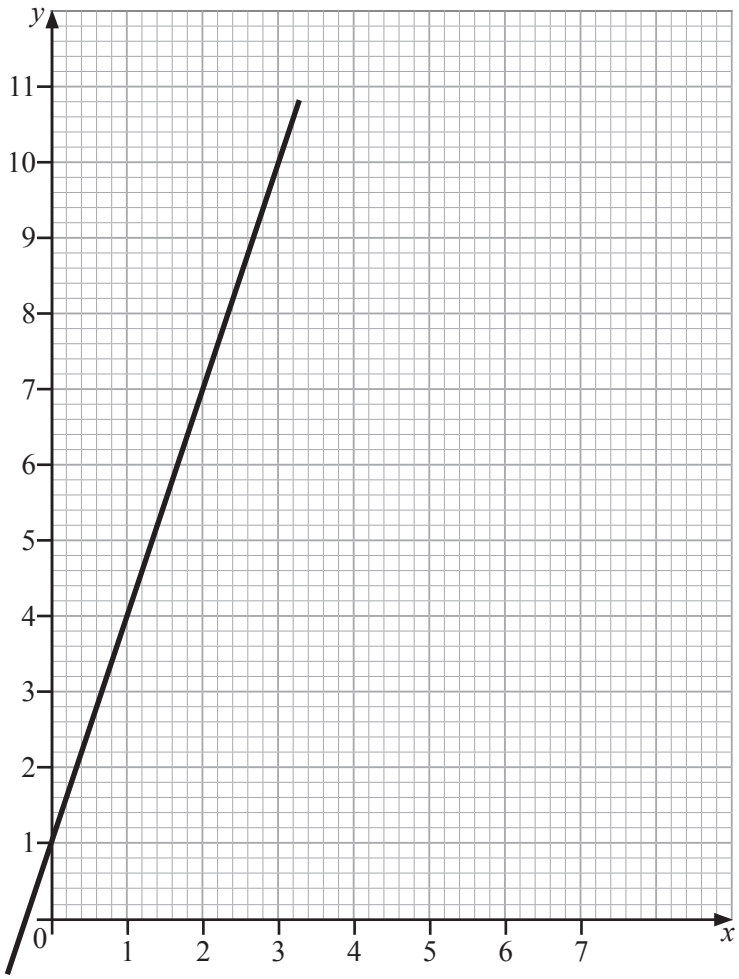
Answer _____ [1]

(b) Simplify $\dfrac{4x^3h}{12x^2h^3}$

Answer _____ [2]

[Turn over

28



(a) Find the gradient of the line shown.

Answer _____ [1]

(b) Hence write down the equation of the line in the form $y = mx + c$

Answer _____ [1]

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