



General Certificate of Secondary Education
2016

Centre Number

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Candidate Number

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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.

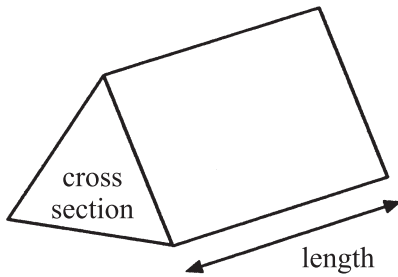
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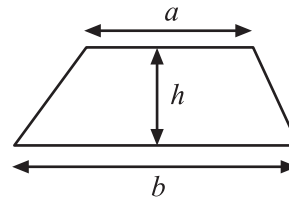
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Formula Sheet

Volume of prism = area of cross section \times length

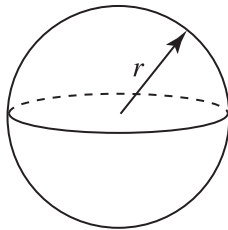


Area of trapezium = $\frac{1}{2}(a+b)h$



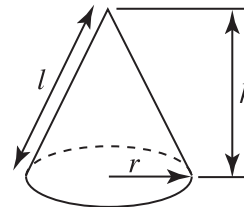
Volume of sphere = $\frac{4}{3}\pi r^3$

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

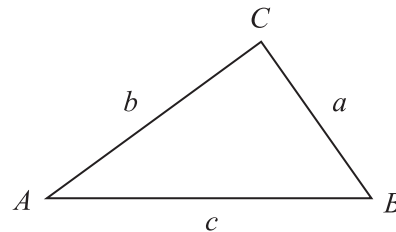


Volume of cone = $\frac{1}{3}\pi r^2 h$

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





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(Questions start overleaf)

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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]

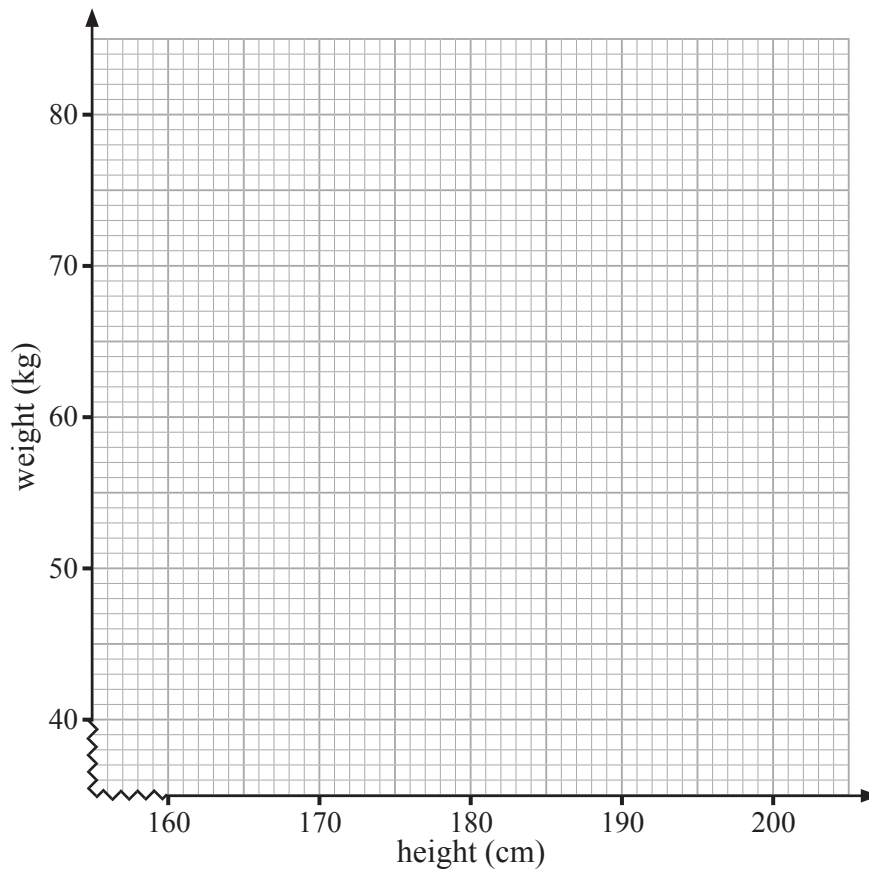


2 The heights and weights of 7 people are given.

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]

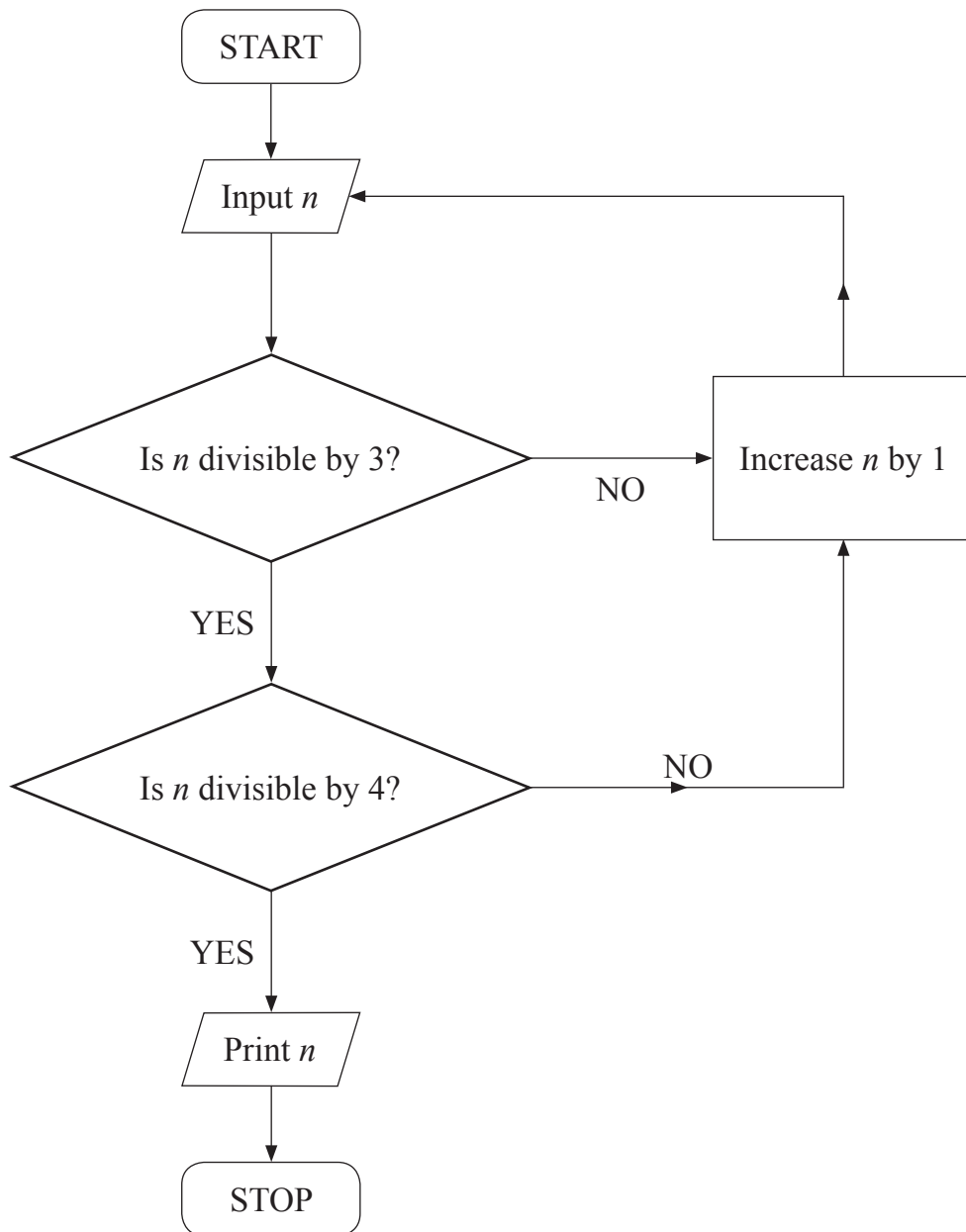
(c) Use your line of best fit to estimate the weight of a person whose height is 185 cm.

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.

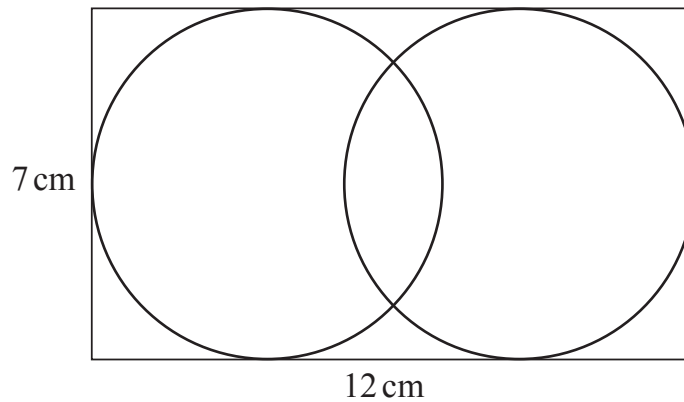


diagram
not drawn
accurately

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.

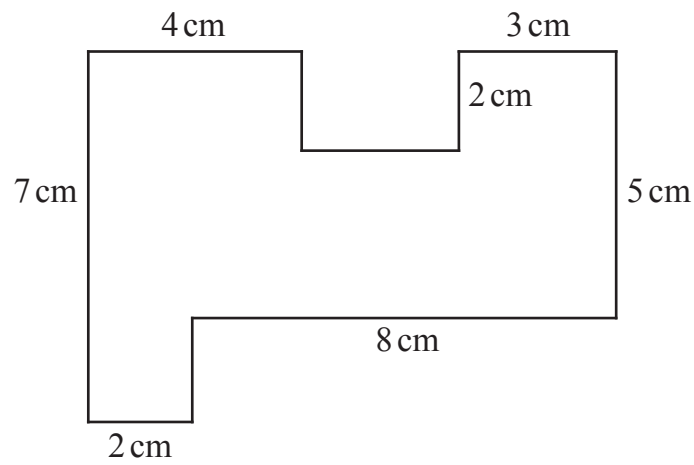
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[Turn over



6 Calculate the area of the shape shown below.

diagram not drawn to scale



Answer _____ cm² [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

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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]



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

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

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

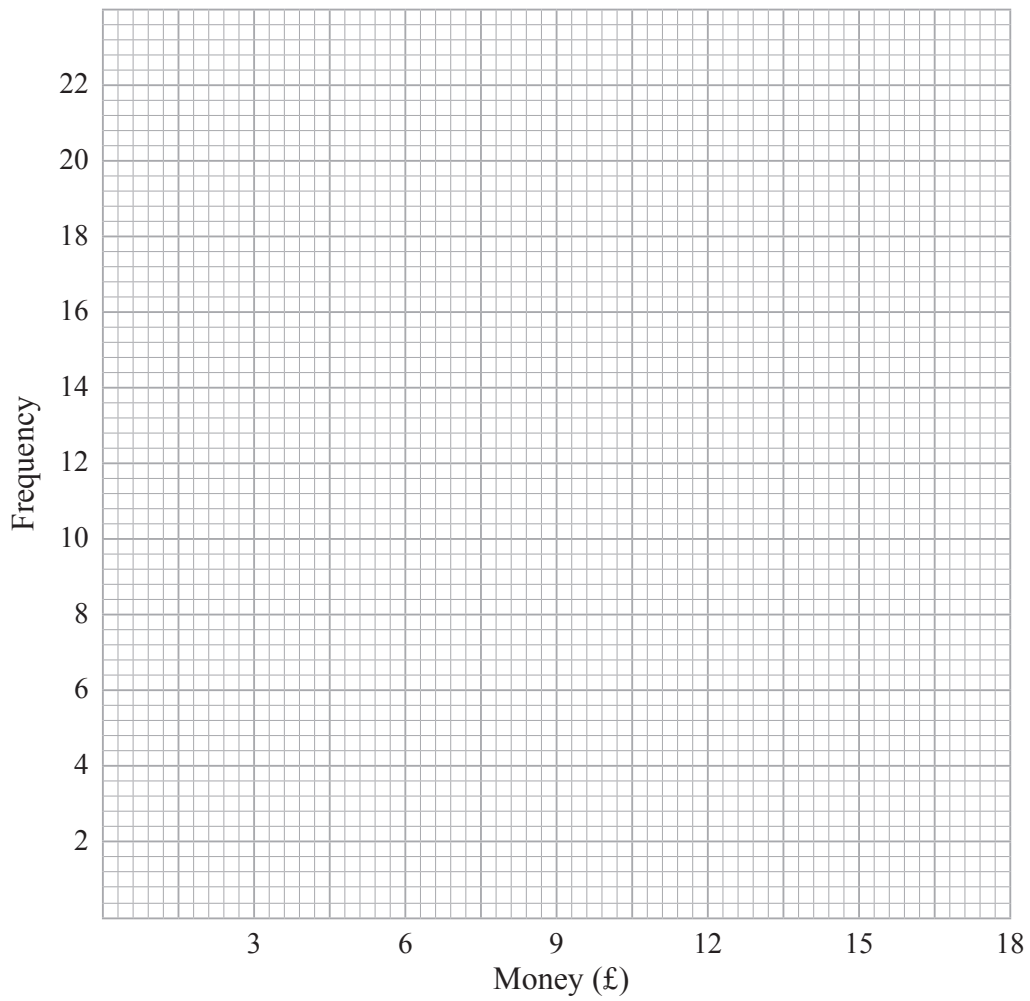
Answer £ _____ [4]

(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]

[Turn over



Quality of written communication will be assessed in this question.

15 Three regular polygons meet at point P as shown.

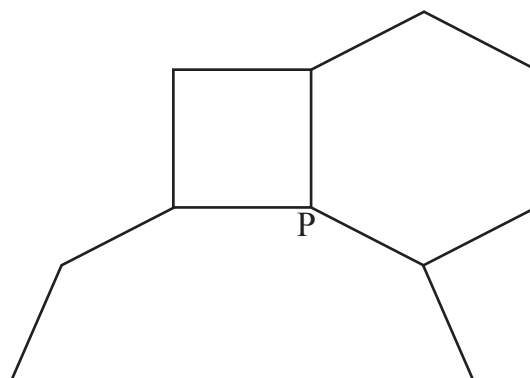


diagram not drawn accurately

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

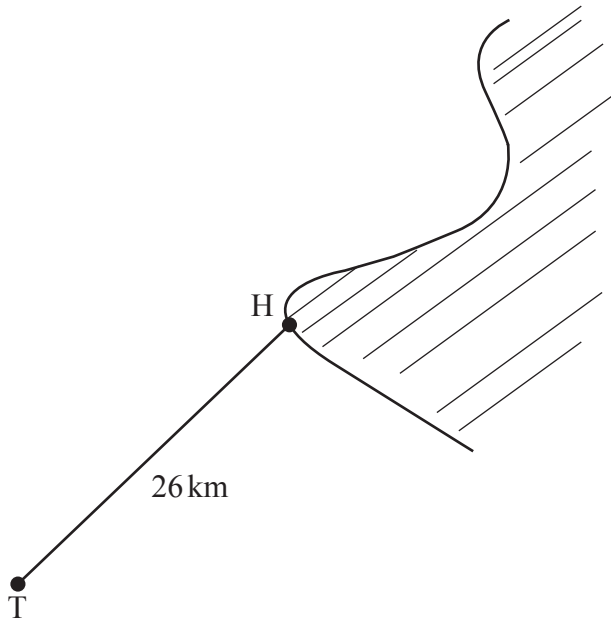
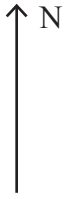


diagram not
drawn accurately

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

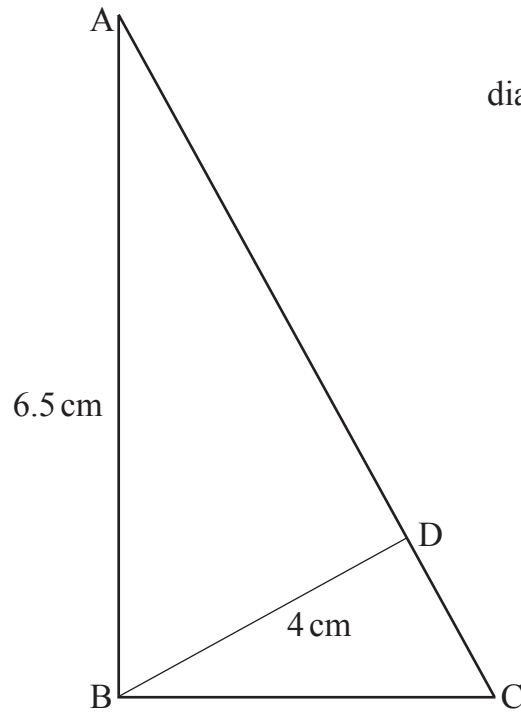


diagram not drawn accurately

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



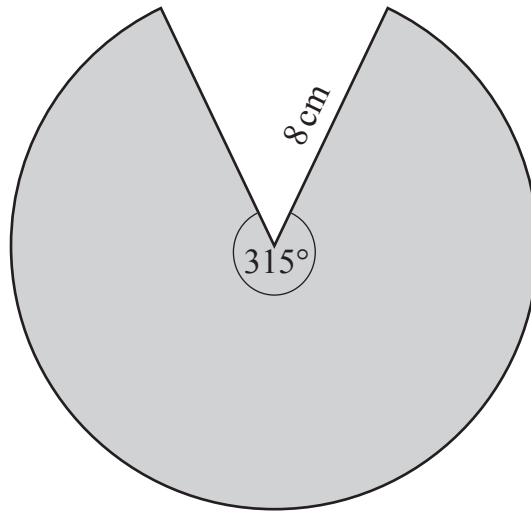


diagram not drawn accurately

Calculate the area of the shaded sector.

Answer _____ cm^2 [3]





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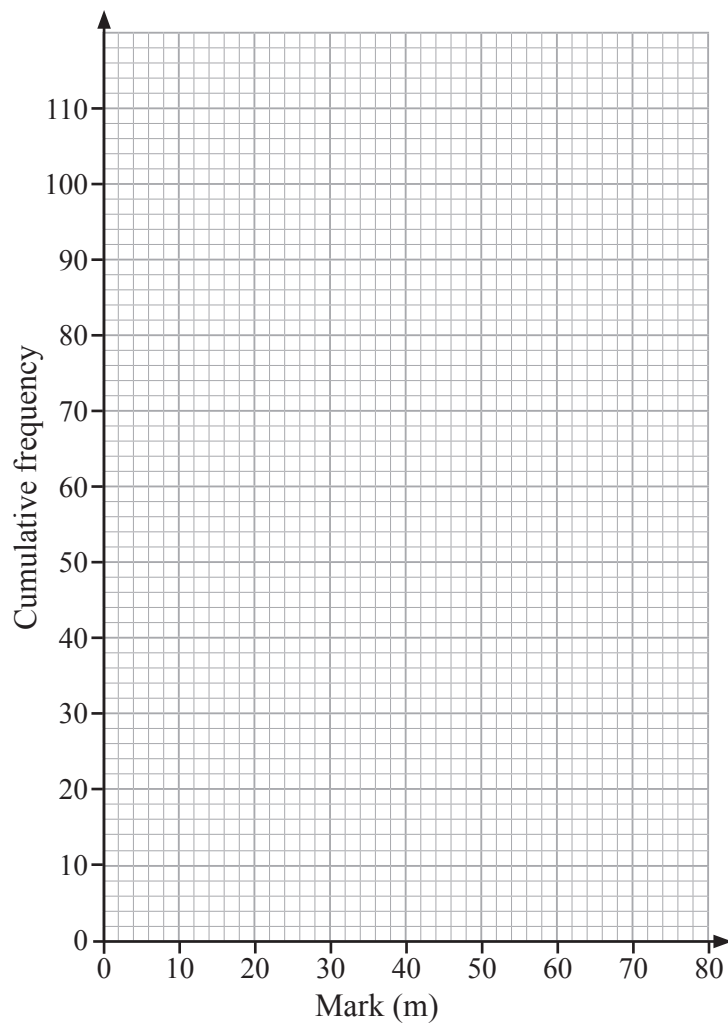
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- 23 (a) The marks in an examination are recorded. Complete the cumulative frequency column in the table below. [1]

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

[Turn over



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]

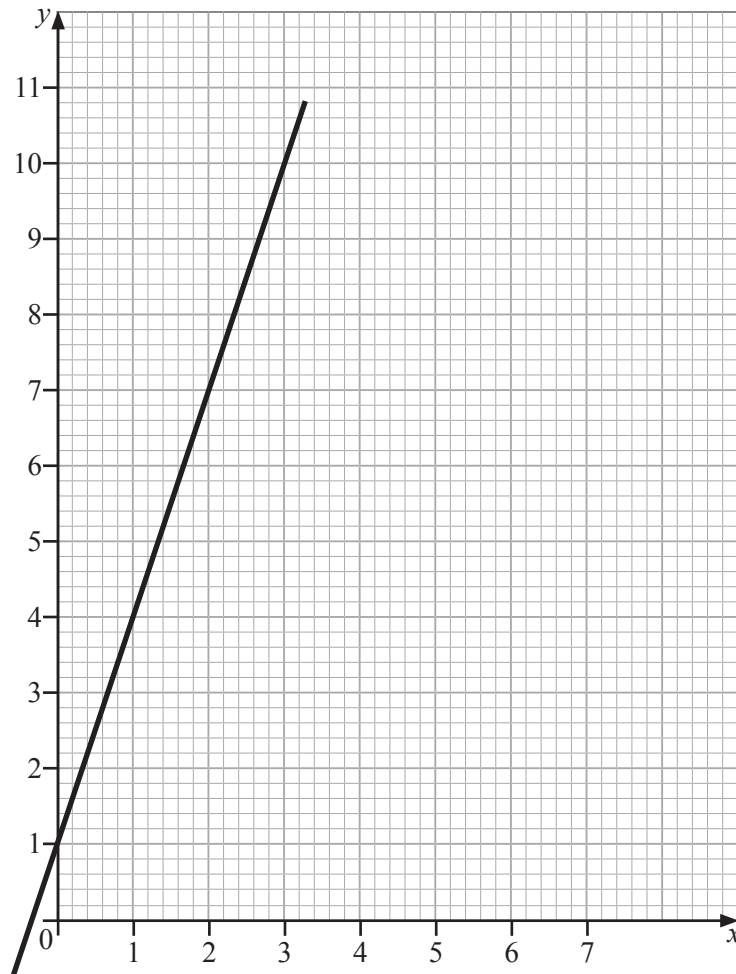
27 (a) Factorise $p^2 - 64$

Answer _____ [1]

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

Answer _____ [2]





(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	
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Total Marks	
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Examiner Number

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