Candidate surname	Other names

Maths Planner

AQA

2024 Practice Paper

Mathematics

PAPER 3 (Calculator)

Higher Tier

Time 1 hour 30 minutes

Worked Written Solutions ✓

Total Marks

85

Q	Topic(s)	Marks
1	Types of Numbers	/ 3
2	Relate Ratio to Fraction & Percentage	/ 2
3	Laws of Indices	/ 7
4	Percentage Increase / Decrease	/ 2
5	Sequences	/ 2
6	Standard Form	/ 4
7	HCF	/ 3
8	Volume of 3D Shapes	/ 3
9	Bearings	/ 2
10	Product Rule for Counting	/ 2
11	Mass, Density & Volume	/ 4
12	Similar Volumes	/ 3
13	Speed with Bounds	/ 4

Q	Topic(s)	Marks
14	Cumulative Frequency Curves	/ 4
15	Probability Trees	/ 5
16	3D Trigonometry & Pythagoras	/ 4
17	Parallel & Perpendicular Lines	/ 4
18	Histograms	/ 3
19	Algebraic Venn Diagram / Probability	/ 4
20	Polygons / Non-right-angled Area	/ 3
21	Ratio Equations	/ 4
22	Complete the Square / Graph Transformations	/ 5
23	Sine & Cosine	/ 4
24	Functions	/ 4

Maths Planner

Marking Codes

Mark	What does it mean?
M1	**Method mark**. This mark is generally given for an appropriate method in the context of the question. *This mark is given for showing your working and may be awarded even if working is incorrect.*
A1	**Accuracy mark**. This mark is generally given for a correct answer following correct working.
B1	**Working mark**. This mark is usually given when working and the answer cannot easily be separated.
C1	**Communication mark.** This mark is given for explaining your answer or giving a conclusion in context supported by your working
P1	**Process Mark.** This mark is generally given for setting up an appropriate process to find a solution in the context of the question

Student Warning

The questions in this paper will not be in the exam

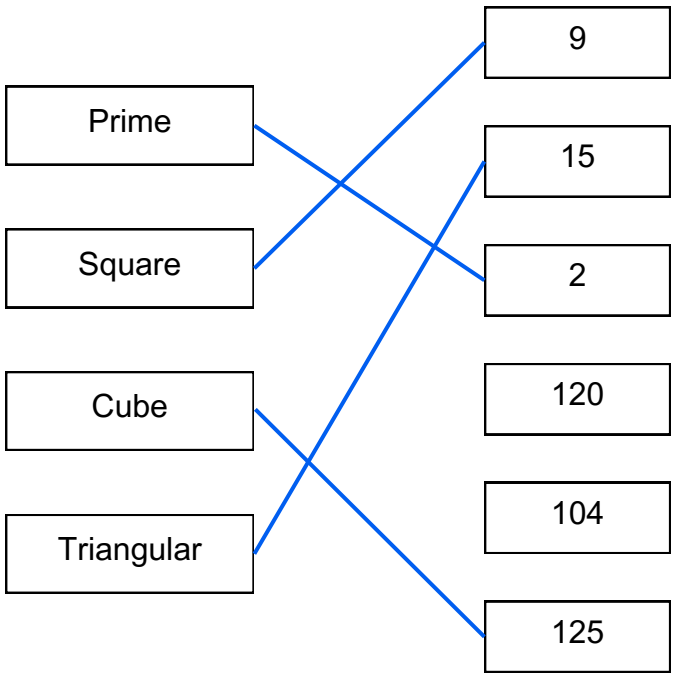
These topics are **not guaranteed** to show up in your Paper 3 exam. Please make sure to revise **all topic areas**, especially since topics covered in Paper 1 and Paper 2 can still come up.

These questions have been selected using analysis on previous official exam papers.

Answers all questions in the spaces provided.

Do not write outside the box

1 Match the numbers to the correct description. **[3 marks]**



✓ B1 (at least 2 correct)
✓ B2 (at least 3 correct)
✓ B3 (for all 4 correct)

2 In a classroom, the ratio of boys to girls is 3 : 5

In the same classroom,
the ratio of students who prefer science to those who prefer art is 7 : 3

2 (a) Write the fraction of students who are boys. **[1 mark]**

B : G Total
3 : 5 8

Answer $\frac{3}{8}$ ✓ B1

2 (b) Write the percentage of students who prefer art. **[1 mark]**

S : A total
7 : 3 10
x10 ↓ ↓ x10
70 : 30 100%

Answer 30 ✓ B1 %

Do not write outside the box

3 (a) Simplify $a^2 \times a \times a^{-5}$

[2 marks]

$a^n \times a^m = a^{n+m}$

$a^2 \times a^1 \times a^{-5} = a^{-2}$

Answer a^{-2} ✓ B1

3 (b) Simplify $\dfrac{(4wc^3)^3}{8wc}$

[3 marks]

$\dfrac{(4wc^3)^3}{8wc} = \dfrac{4^3w^3c^9}{8wc}$ ✓ M1

$(a^n)^m = a^{nm}$

✓ M1

$= \dfrac{64w^3c^9}{8w^1c^1} = 8w^2c^8$

$a^n \div a^m = a^{n-m}$

$64 \div 8 = 8$

Answer $8w^2c^8$ ✓ A1

3 (c) Write $32^{\frac{1}{2}}$ as a single power of 2.

[2 marks]

$2^5 = 32$

✓ M1

$\therefore (2^5)^{\frac{1}{2}} = 2^{\frac{5}{2}}$

$(a^n)^m = a^{nm}$

✓ A1 ✓ A1

Answer $2^{\frac{5}{2}}$ or $2^{2.5}$

Do not write outside the box

4 A number was increased by 8% followed by a decrease of 5%.
Work out the overall percentage change of the number.

[2 marks]

Multipliers $1 + \frac{8}{100} = 1.08$ $1 - \frac{5}{100} = 0.95$

$\therefore 1.08 \times 0.95 = 1.026$ ✓ M1

$1.026 \times 100 = 102.6$ $102.6 - 100 = 2.6\%$

Answer 2.6 ✓ A1 %

5 Here are the first five terms of a sequence.

-3 −8 −13 −18 −23 −28

+5 -5 -5 -5 -5

✓ M1

Work out an expression for the *n*th term of the sequence. **[2 marks]**

💡 What the sequence **increases/decreases** by goes in front of **n**

💡 Find the term **before** term 1 to know what goes **after n**

Answer -5n −3 ✓ A1

Do not write outside the box

6 (a) Write 5×10^{-5} as an ordinary number. **[1 mark]**

0.00005.0

0.00005

Answer 0.00005 ✓ B1

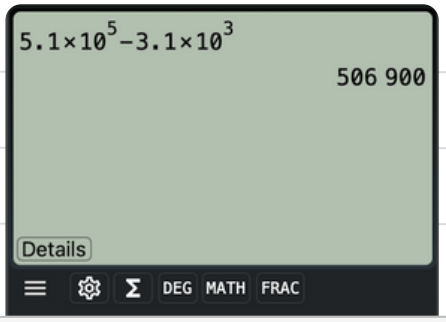
6 (b) Write 830×10^{6} in standard form. **[1 mark]**

830000000.

8.30000000

Answer 8.3×10^{8} ✓ B1

6 (c) Work out $5.1 \times 10^{5} - 3.1 \times 10^{3}$
Give your answer in standard form. **[2 marks]**



You can input into your calculator

506900 ✓ P1

5.06900

Answer 5.069×10^{5} ✓ A1

Do not write outside the box

7 $A = 2 \times 3^3 \times 5^2$ A = 2 x 3 x 3 x 3 x 5 x 5 = 1350

$B = 2^3 \times 3 \times 5$ B = 2 x 2 x 2 x 3 x 5

7 (a) Write down the number that A represents.

[1 mark]

Answer 1350 ✓ B1

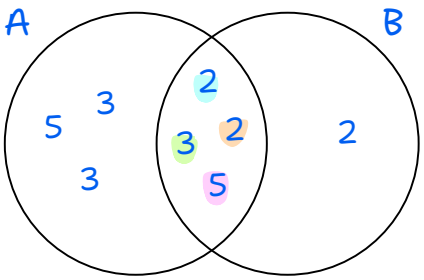
7 (b) Find the Highest Common Factor (HCF) of 2*A* and *B*.

[2 marks]

✓ M1

2A = 2 x 2 x 3 x ~~3~~ x ~~3~~ x 5 x ~~5~~

B = 2 x 2 x ~~2~~ x 3 x 5



HCF: Multiply all the numbers in the intercept

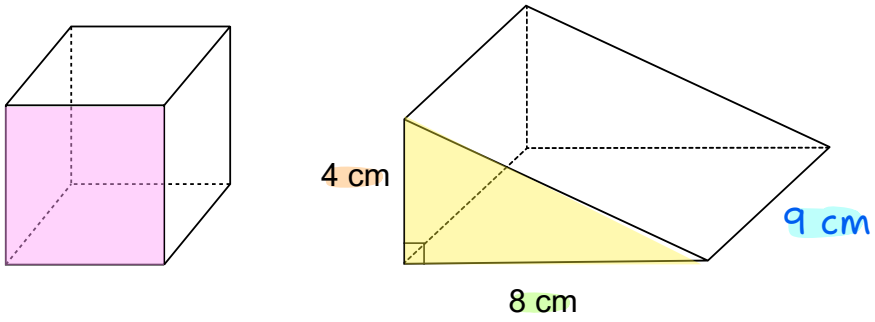
LCM: Multiply all the numbers in the union

∴ HCF = 2 x 2 x 5 x 3 = 60

Answer 60 ✓ A1

Do not write outside the box

8 Here is a cube and triangular prism.



The length of the triangular prism is a **single digit** odd number with 3 factors.

The volume of the cube is equal to the volume of the triangular prism.
Work out the side length of the cube.
Give your answer correct to 2 decimal places.

[3 marks]

💡 Volume = cross-section area x length

Triangular Prism:

Cross-section area = $\frac{b \times h}{2}$

$= \frac{8 \times 4}{2} = 16cm^2$ ✓ B1

$\therefore$ Volume = 16×9

$= 144cm^3$

$\therefore$ Volume of Cube = $144cm^3$ ✓ B1

Side length of Cube = $\sqrt[3]{144}$

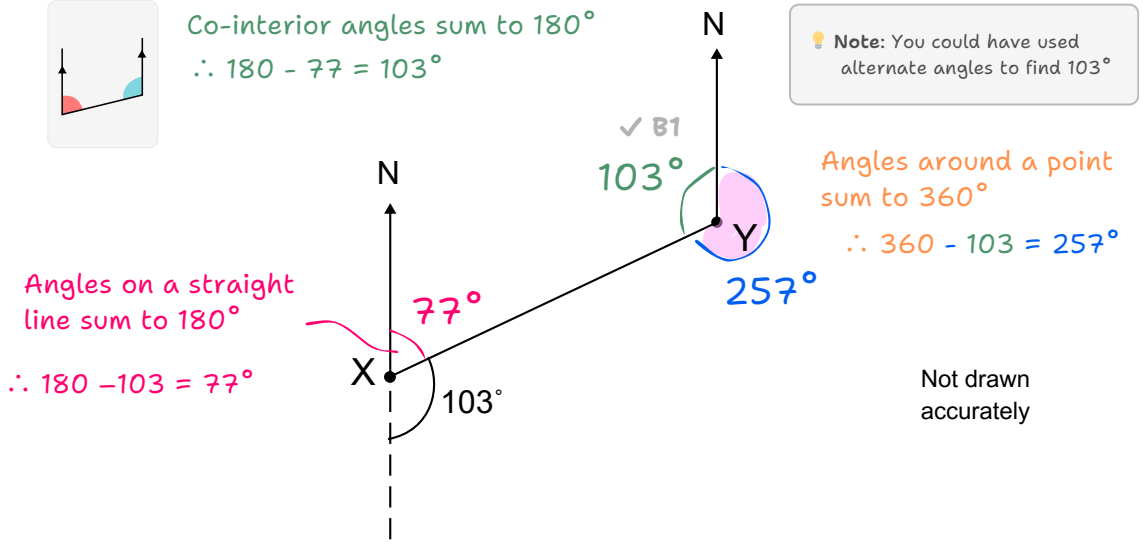
$= 5.241482788$ cm

Answer 5.24 ✓ A1

Do not write outside the box

9 The diagram below shows the positions of two lighthouses X and Y.

Co-interior angles sum to 180°
∴ 180 - 77 = 103°



Note: You could have used alternate angles to find 103°

Angles around a point sum to 360°
∴ 360 - 103 = 257°

Angles on a straight line sum to 180°
∴ 180 −103 = 77°

Not drawn accurately

Work out bearing of lighthouse X from lighthouse Y.

[2 marks]

- Measure from north line
- Measure clockwise
- Give answer in 3-digits

Answer 257 ✓ A1 °

10 Emma is organising a music playlist.
She wants to create a playlist with one song from each genre.

There are

5 pop songs 6 rock songs 4 jazz songs

Calculate the number of different ways Emma can choose one pop song, one rock song, and one jazz song for her playlist.

[2 marks]

Combinations = options x options x ...

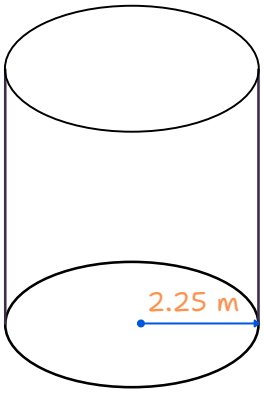
Combinations = 5 x 6 x 4 ✓ M1

= 120

Answer 120 ✓ A1

Do not write outside the box

11 The diagram shows a cylinder placed on a horizontal floor.



Not drawn accurately

R : H
1 : 4
2.25 : 9 ✓ B1

x 2.25 ↓ x 2.25

The radius and height of a cylinder are in the ratio 1:4.

The cylinder has a mass of 35kg. 35,000g

💡 1kg = 1000g

Work out the density of the cylinder, in grams per cubic metres.
Give your answer correct to 1 decimal place.

[4 marks]

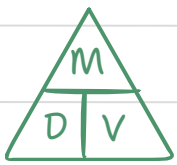
💡 Volume = cross-section area x height

Area = π x r²

∴ Cross-section Area = π x (2.25)² ✓ M1

= 15.904...m²

∴ Volume = 15.904... x 9 = 143.1388153m³



∴ Density = Mass / Volume

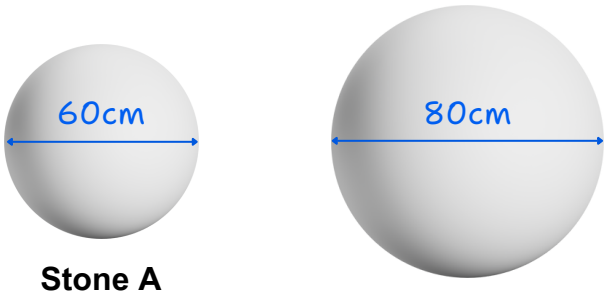
= 35,000 / 143.1388... ✓ M1

= 224.5178824

Answer 224.5 ✓ A1 g/m³

Do not write outside the box

12 Shown below are two strongman atlas lifting stones, they are not spheres.



Stone A **Stone B**

Stone **A** has a diameter 60 cm

Stone **B** has a diameter of 6702 cm³

Work out the volume of Stone **A**

Give your answer to the nearest integer.

[3 marks]

💡 VSF = LSF³

LSF = 80 ÷ 60 = $\frac{4}{3}$ ✓ M1

∴ VSF = $\left(\frac{4}{3}\right)^3$ = $\frac{64}{27}$ ✓ A1

∴ Volume of A = 6702 ÷ $\frac{64}{27}$

= 2827.40625

Answer = 2827 ✓ A1 cm³

Do not write outside the box

13 A car travels a distance of 150 km.
The distance is measured to the nearest 5 km.
The time taken for the journey is 2 hours, measured to the nearest 10 minutes.

Calculate the maximum average speed that car could have travelled.

[4 marks]

2 hours = 120 minutes

$S = \frac{D}{T}$

Distance: 145 LB 150 UB 155

147.5 152.5

✓ M1 (finding bounds)

Time: 110 LB 120 UB 130

115 125

$\frac{115}{60} = \frac{23}{12}$ hours

✓ P1

$S_{max} = \frac{D_{max}}{T_{min}} = 152.5 \div \frac{23}{12}$ ✓ M1 (correct bounds used)

$= 79.5652...$ km/h

Answer 80 ✓ A1 km/h

Do not write outside the box

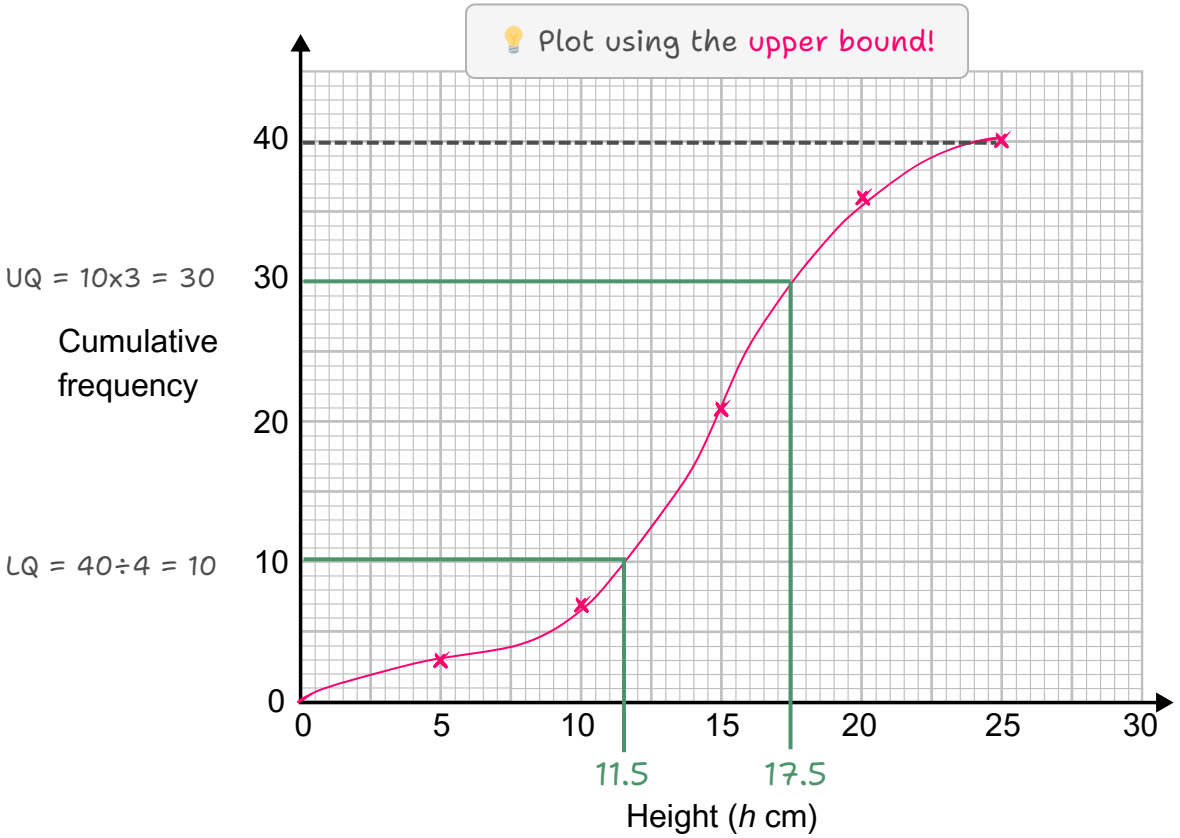
14 The cumulative frequency table gives information about the heights, in cm, of 40 plants.

Height (h cm)	Cumulative Frequency
$0 < h \leq 5$	3
$0 < h \leq 10$	7
$0 < h \leq 15$	21
$0 < h \leq 20$	36
$0 < h \leq 25$	40

✓ B1 (for correct points) ✓ B2 (for correct points and smooth curve)

14 (a) On the grid, draw a cumulative frequency graph for this information.

[2 marks]



14 (b) Use the graph to find an estimate for the interquartile range of the plants.

[2 marks]

IQR = UQ - LQ

✓ M1

∴ IQR = 17.5 - 11.5 = 6

Answer 6 ✓ A1 cm

Do not write outside the box

15 A tennis player is playing a game on Week 1 in a tournament and another game on Week 2.

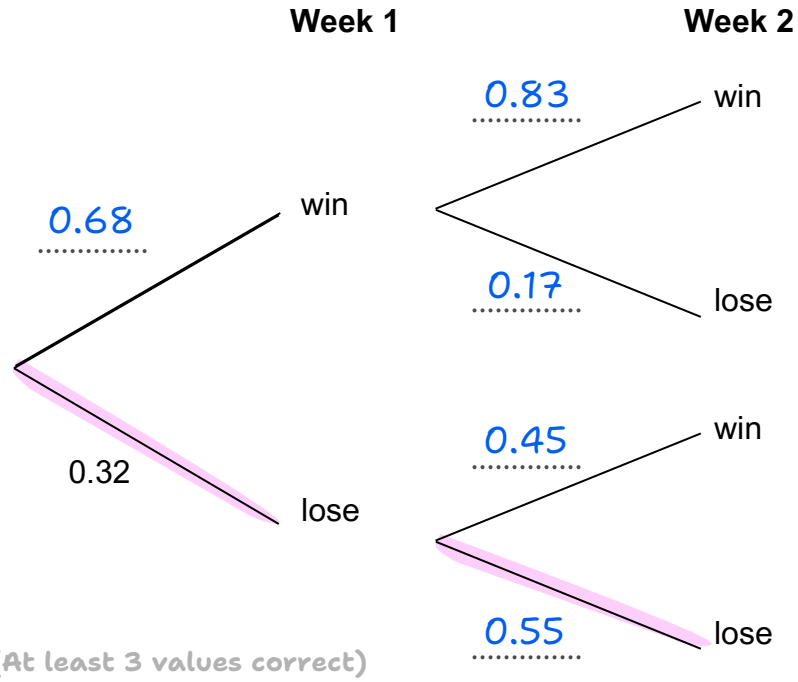
The probability that the player will lose on Week 1 is 0.32

If they win on Week 1, the probability that they will win on Week 2 is 0.83

If they lose on Week 1, the probability that they will win on Week 2 is 0.45

15 (a) Complete the probability tree diagram. **[2 marks]**

💡 Branches must add to 1



✓ A1 (At least 3 values correct)
✓ A2 (All 5 values correct)

15 (b) Estimate the probability that the player will win at least one match. **[3 marks]**

✓ P1 (to find P(lose) or 3 ways to win)

P(Win at least once) = 1 – P(Lose)

= 1 – (0.32 × 0.55)

✓ M1

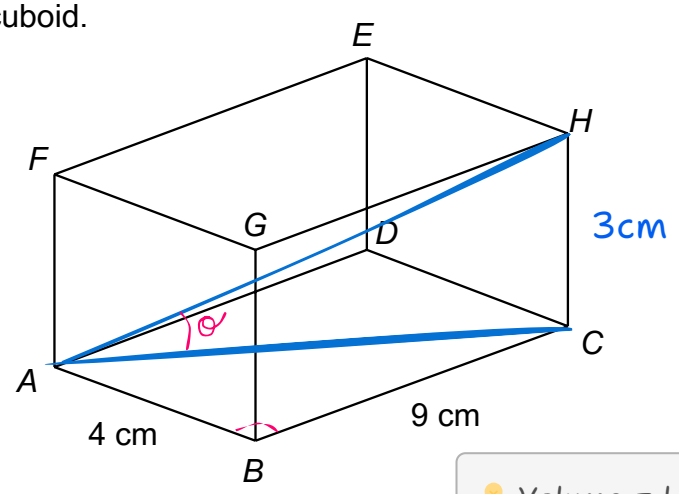
= 0.824

Answer 0.824 ✓ A1

Do not write outside the box

16 *ABCDEFGH* is a cuboid.

Not drawn accurately



Volume = l x w x h

The cuboid has a **volume** of 108 cm²

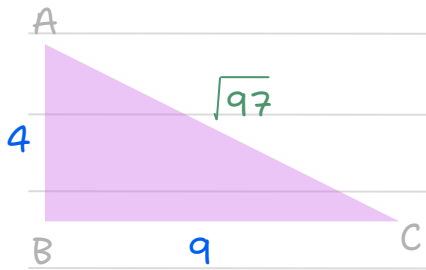
Work out the size of angle *CAH*.

Give your answer correct to 1 decimal place.

[4 marks]

$\therefore CH = 108 \div (4 \times 9)$ ✓ M1

$= 3$ cm

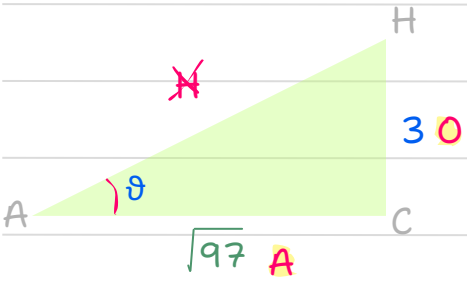


$AC^2 = AB^2 + BC^2$

$AC^2 = 4^2 + 9^2$ ✓ P1

$AC = \sqrt{4^2 + 9^2}$

$= \sqrt{97}$ $= (9.84885...)$



$\tan(\theta) = \frac{A}{H}$

$\tan(\theta) = \frac{3}{\sqrt{97}}$ ✓ P1

$\theta = \tan^{-1}\left(\frac{3}{\sqrt{97}}\right)$

$\theta = 16.9409...$

SOH CAH TOA

Answer 16.9 ✓ A1 °

Do not write outside the box

17 The straight line L_1 has the equation $y = -3x + 2$

The straight line L_2 is parallel to L_1 and passes through the point (-4, 8)

The straight line L_3 is perpendicular to to L_2 and passes through the point (1, 3)

The straight line L_2 and L_3 intercept at point A.

Work out the coordinates of point A.

[4 marks]

Parallel Lines have the same gradient!

∴ L_2 gradient = -3, and passes through (-4, 8)

Equation of Line: $y = mx + c$, where m = gradient and c = y-intercept

∴ $8 = -3(-4) + c$

$8 = 12 + c$

$c = -4$

∴ L_2: $y = -3x - 4$ ✓ A1

Perpendicular Gradient: $m_1 \times m_2 = -1$

∴ L_2 gradient = $\frac{1}{3}$, and passes through (1, 3)

Equation of Line: $y = mx + c$, where m = gradient and c = y-intercept

∴ $3 = \frac{1}{3} \times (1) + c$

$3 = \frac{1}{3} + c$

$c = \frac{8}{3}$

∴ L_3: $y = \frac{1}{3}x + \frac{8}{3}$ ✓ A1

To find intercept, solve L_2 and L_3 simultaneously

∴ $-3x - 4 = \frac{1}{3}x + \frac{8}{3}$ ✓ P1

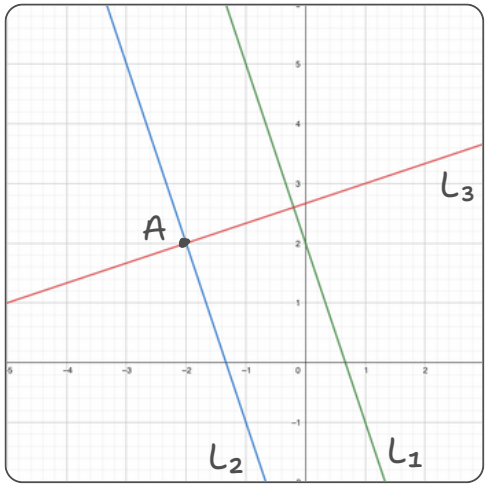
$-9x - 12 = x + 8$

$-20 = 10x$

$x = -2$

∴ $y = -3(-2) - 4$

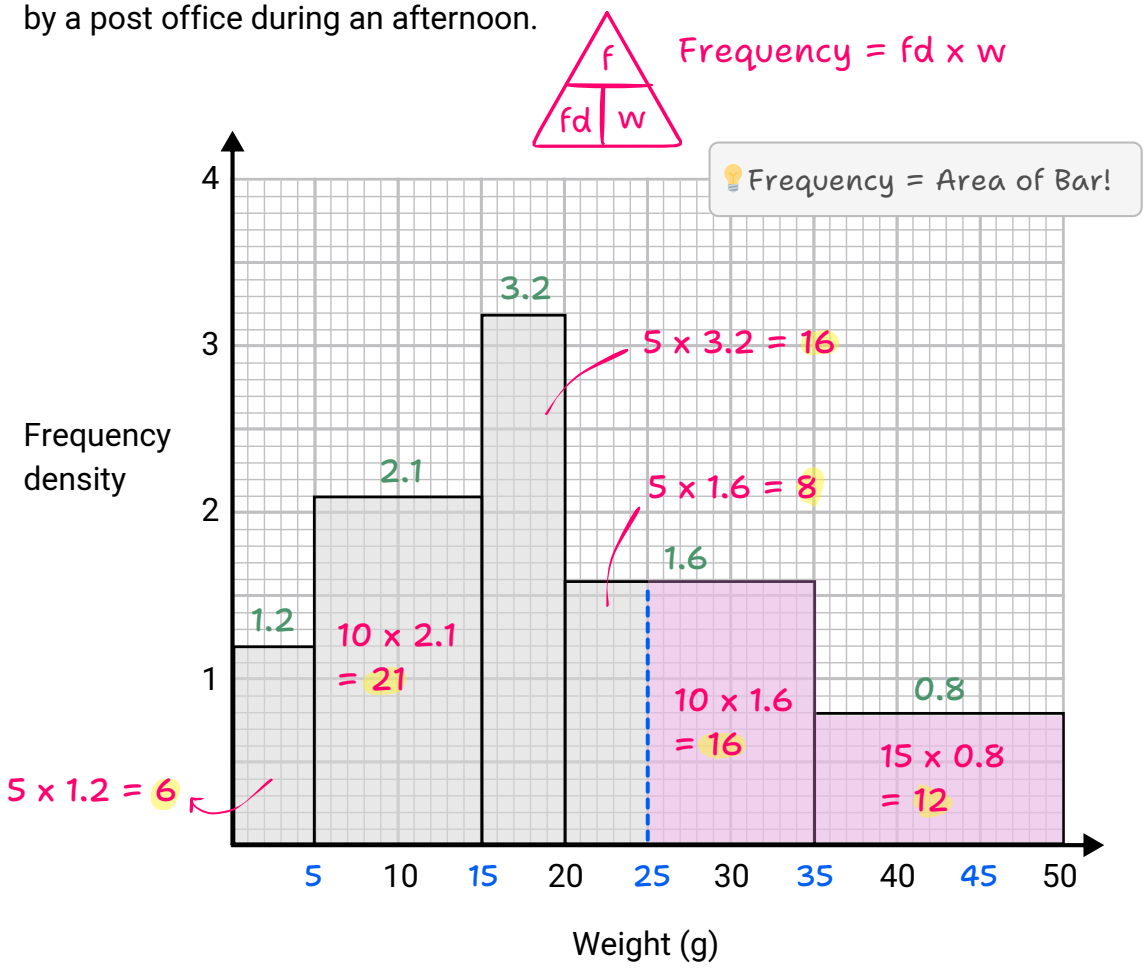
$y = 2$



Answer (-2, 2) ✓ A1

Do not write outside the box

18 The histogram shows information about the weights, in grams, of letters taken by a post office during an afternoon.



Work out the percentage of letters that weighed more than 25 grams.
Give your answer to the nearest percent.

[3 marks]

✓ P1

∴ Total No. of Letters = 6 + 21 + 16 + 8 + 16 + 12

= 79

∴ Total No. of Letters > 25g = 16 + 12

= 28 ✓ A1

∴ Percentage = $\frac{28}{79} \times 100$

= 35.44303797%

Answer 35 ✓ A1 %

Do not write outside the box

19 45 people were asked if they have travelled to Greece or Portugal.

12 people said they had visited both countries.

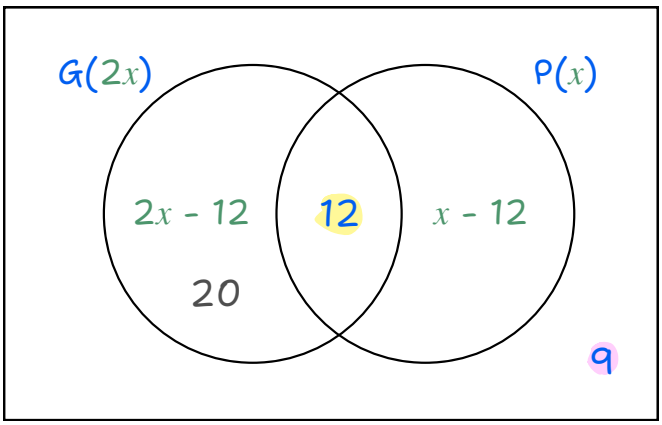
9 people had visited neither country.

Twice as many people had visited Greece than Portugal.

Two of these people were picked at random.
Work out the probability that they have both visited Greece.

[4 marks]

Let x be the number of people who travelled to Portugal



$\therefore 2x - 12 + 12 + x - 12 + 9 = 45$ ✓ P1 (setting up equation)

$3x - 3 = 45$

$3x = 48$

$x = 16$

💡"AND" multiply probabilities

💡This is conditional probability!

$\therefore$ Greece $= 2(16)$

$= 32$ ✓ A1

$\therefore P(G,G) = \frac{32}{45} \times \frac{31}{44}$ ✓ M1

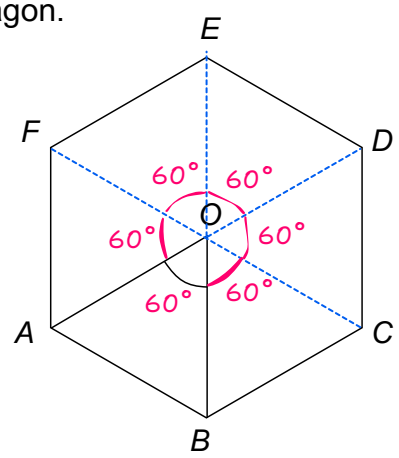
$= \frac{992}{1980}$

✓ A1 ✓ A1

Answer $\frac{992}{1980}$ or $\frac{248}{495}$

Do not write outside the box

20 Here is a regular hexagon.



Regular: Equal Sides

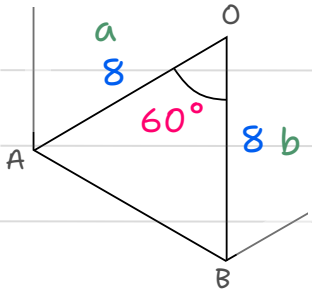
360÷6 = 60°

$OA = OB = 8$ cm

Work out the area of the hexagon.

Give your answer correct to 3 significant figures.

[3 marks]



Area = ½absinC

∴ AOB Area = ½x8x8xsin(60) ✓ M1

= 27.71281292

∴ Hexagon Area = 27.71... x 6 ✓ M1

= 166.2768775

Answer 166 ✓ A1 cm³

Do not write outside the box

21 Given $5a - 1 : a + 9 = 2a - 3 : a + 7$

Find possible values for *a*.

You can divide parts and equate!

[4 marks]

$\frac{5a-1}{a+9} = \frac{2a-3}{a+7}$ ✓ P1

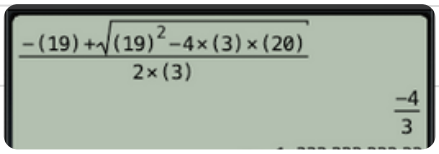
$(5a-1)(a+7) = (2a-3)(a+9)$

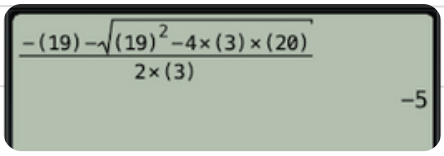
$5a^2 + 35a - a - 7 = 2a^2 + 18a - 3a - 27$ ✓ M1

$3a^2 + 19a + 20 = 0$

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

$x = \frac{-(19) \pm \sqrt{(19)^2-4\times(3)\times(20)}}{2\times(3)}$ ✓ M1 (Quad. Formula or Factorising)





$x^+ = -\frac{4}{3}$ $x^- = -5$

Answer $x = -5, \; x = -\frac{4}{3}$ ✓ A1 (both values)

Do not write outside the box

22 (a) $f(x) = x^2 + 5x + 8$

Complete the square!

Write $f(x)$ in the form $(x+p)^2 + q$ where p and q are integers. **[2 marks]**

$ax^2 + bx + c$

	$x^2 + 5x + 8$	Step 1: $b \div 2$
✓ B1 (for 2.5)	$(x + 2.5)^2 - (2.5)^2 + 8$	Step 2: subtract $(b \div 2)^2$
	$(x + 2.5)^2 + 1.75$	Step 3: simplify sum

Answer $(x + 2.5)^2 + 1.75$ ✓ A1

22 (b) Write down the coordinates for the turning point of the curve $-f(x-3)$

[3 marks]

f(x-3): Translation to the right by 3

-f(x): Reflection in the x-axis (y-values flip)

$(x+p)^2+q$: Turning Point $(-p, q)$

✓ A1

From part (a): $(x + 2.5)^2 + 1.75$ Turning Point $(-2.5, 1.75)$

f(x-3)	∴ -2.5 + 3 = 0.5 so, turning point is now (0.5, 1.75)
-f(x)	∴ 1.75 becomes -1.75 so, turning point is now (0.5, -1.75)

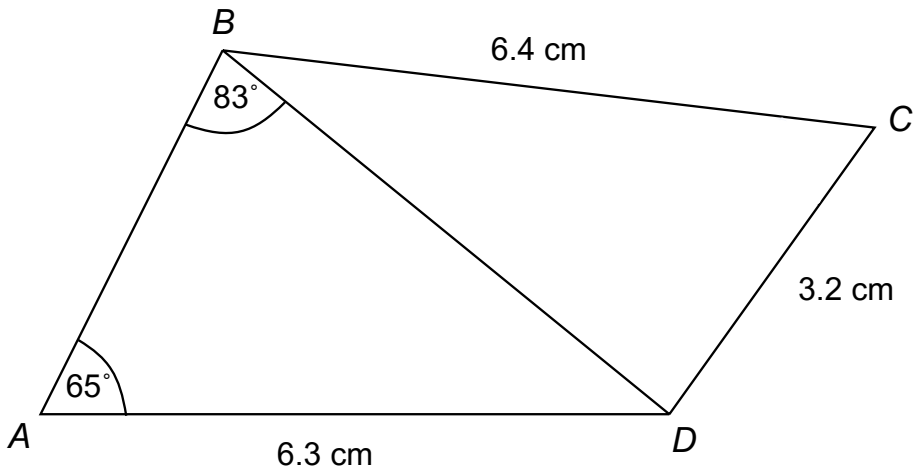
✓ A1 ✓ A1

Answer $(0.5, -1.75)$

Do not write outside the box

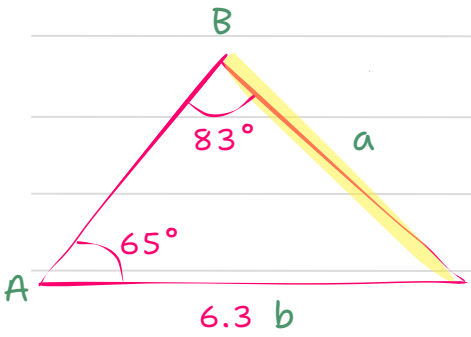
23 *ABCD* is a quadrilateral.

Not drawn accurately



Work out the size of angle *BCD*.
Give your answer correct to 2 significant figures.

[4 marks]

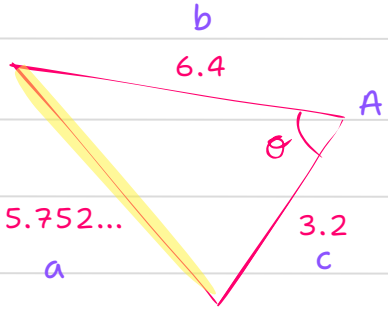


$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{\sin(65)} = \frac{6.3}{\sin(83)}$$ ✓ P1

$$a = \frac{6.3}{\sin(83)} \times \sin(65)$$

$a = 5.752618202$ ✓ A1



$$\cos A = \frac{b^2+c^2-a^2}{2bc}$$

$$\cos(\vartheta) = \frac{6.4^2+3.2^2-5.752...^2}{2\times(6.4)\times(3.2)}$$ ✓ P1

$\vartheta = \cos^{-1}(0.44207...)$

$\vartheta = 63.76366333$

Answer 64 ✓ A1 °

Do not write outside the box

24 f and g are functions such that,

$$f(x) = \frac{4}{\sqrt{x}} \qquad \text{and} \qquad g(x) = 4x + 1$$

Given $h(x) = fg(x)$

Work out the value of $h^{-1}(3)$

Give your answer in exact form. **[4 marks]**

f(g(x)) 💡 Substitute g(x) into f(x)

$f(4x+1) = \frac{4}{\sqrt{4x+1}} = h(x)$ ✓ M1

∴ Find $h^{-1}(x)$ 💡 To find the inverse function, rearrange to make x the subject!

Let $y = h(x)$

$y = \frac{4}{\sqrt{4x+1}}$ ✓ P1

$\times\sqrt{4x+1}$ ↓ ↓ $\times\sqrt{4x+1}$

$y\sqrt{4x+1} = 4$

$\div y$ ↓ ↓ $\div y$

$\sqrt{4x+1} = \frac{4}{y}$

$[]^2$ ↓ ↓ $[]^2$

$4x + 1 = \frac{16}{y^2}$

-1 ↓ ↓ -1

$4x = \frac{16}{y^2} - 1$

$\div 4$ ↓ ↓ $\div 4$

$x = \frac{4}{y^2} - \frac{1}{4}$

✓ A1 (or equivalent)

$\therefore h^{-1}(x) = \frac{4}{x^2} - \frac{1}{4}$

$h^{-1}(3) = \frac{4}{3^2} - \frac{1}{4}$

$= \frac{7}{36}$

Answer $\frac{7}{36}$ ✓ A1

END OF QUESTIONS