IGCSE Mathematics 0580 Extended

Practice Paper B: ANSWERS and Worked Solutions

ANSWERS to Paper B (Non-Calculator) | 100 marks | Numrahedu.com | Free

How to use this PDF. Sit the paper first, in two hours, with no calculator. Only then read these solutions. Reading a worked answer feels like learning, but it is not the same as producing one.

Every answer has been verified by calculation, and where a result can be checked a second way, that check is shown.

Understanding the mark scheme

Code	Name	What earns it
M1	Method mark	A correct method, even if the arithmetic that follows is wrong. You cannot earn it if you write nothing down.
A1	Accuracy mark	A correct answer, usually depending on the method mark being earned first.
B1	Independent mark	A correct answer or statement on its own, with no method needed.

EXAM TIP

- Follow through applies. One slip early does not cost you the method marks that come after it.
- This is the non-calculator paper, so exact answers matter. Leaving $8\sqrt{2}$ as 11.3 or 4π as 12.6 can lose the accuracy mark.
- Name the rule for circle theorems and trigonometry. The reason carries a mark of its own.

Question 1 — 2 marks

Angles

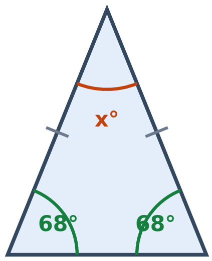
The diagram shows an isosceles triangle. Find the value of x. [2]

The two base angles are equal, and the angles in a triangle add to 180°.

$x + 68 + 68 = 180$

$x = 180 - 136 = \mathbf{44}$

Check: 44 + 68 + 68 = 180. Correct.



NOT TO SCALE

Mark scheme M1 for $x + 68 + 68 = 180$ or for $180 - 136$, A1 for 44

Question 2 3 marks

Stem and Leaf Diagram

The stem and leaf diagram shows the time, in minutes, that 15 people took to finish a puzzle. [3]
The key 1 | 2 represents 12 minutes. Find the mode, the range and the median.

Stem	Leaf
1	2 5 9
2	1 1 4 6 7 8
3	0 0 0 2 5
4	1

In order: 12, 15, 19, 21, 21, 24, 26, 27, 28, 30, 30, 30, 32, 35, 41

Mode = 30 minutes, because 30 appears three times, more often than any other value.

Range = 41 − 12 = 29 minutes

There are 15 values, so the median is the 8th. Counting along: 12, 15, 19, 21, 21, 24, 26, **27**

Median = 27 minutes

Check: The leaves are already in order in the diagram, so the 8th leaf counted from the top is the median. No re-sorting needed.

Mark scheme B1 for mode 30, B1 for range 29, B1 for median 27

Question 3 2 marks

Complete the Statements

(a) When $x =$ .... , $x - 4 = 9$ [1]

$x = 9 + 4 =$ **13**

Mark scheme B1 for 13

(b) When $8y = 56$, $100y = $ .... [1]

$8y = 56$, so $y = 7$

$100y = 100 \times 7 = \mathbf{700}$

Mark scheme B1 for 700

Question 4 3 marks

Shopping Bill

The table shows part of Ayesha's shopping bill. Find the cost of 1 kg of lentils. [3]

Item	Cost per kg	Mass in kg	Cost
Rice	$1.80	2.5	
Lentils		1.5	
Total			$9.75

Cost of rice = $1.80 \times 2.5 = \$4.50$

Cost of lentils = $9.75 - 4.50 = \$5.25$

Cost per kg = $\frac{5.25}{1.5} = \mathbf{\$3.50}$

Check: $3.50 \times 1.5 = 5.25$ and $5.25 + 4.50 = 9.75$. Correct.

Mark scheme M1 for $1.80 \times 2.5 = 4.50$, M1 for $9.75 -$ their 4.50, A1 for $3.50

Question 5 3 marks

Factorise Completely

(a) $24pq - 18p$ [2]

The highest common factor of $24pq$ and $18p$ is $6p$.

$= \mathbf{6p(4q - 3)}$

Check: $6p \times 4q = 24pq$ and $6p \times 3 = 18p$. Correct.

Mark scheme B1 for a partial factorisation such as $2p(12q - 9)$ or $6(4pq - 3p)$, B2 for $6p(4q - 3)$

(b) $t^2 - 81$ [1]

This is the difference of two squares, with $81 = 9^2$.

$= \mathbf{(t + 9)(t - 9)}$

Mark scheme B1 for $(t + 9)(t - 9)$

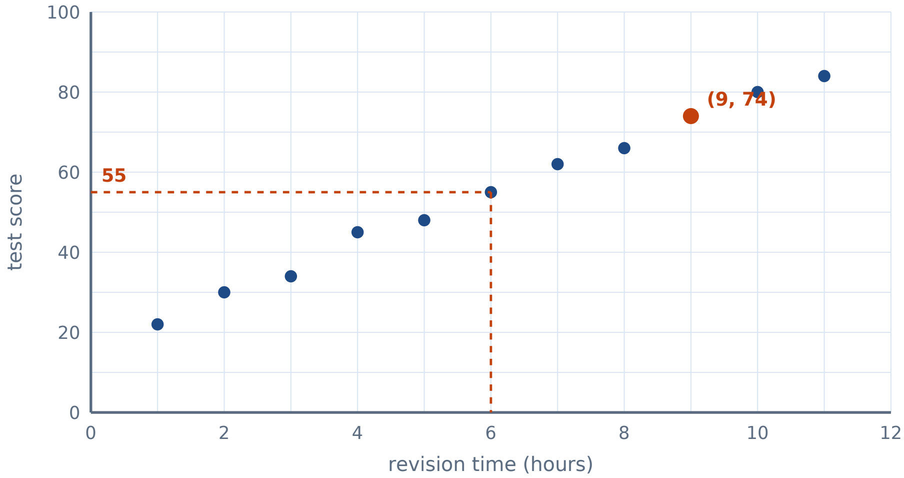
Question 6

3 marks

Scatter Diagram

(a) The scatter diagram shows the revision time and test score for 10 students. One student revised for 6 hours. Write down that student's test score. [1]

Reading up from 6 hours to the plotted point, then across: **55**



Mark scheme B1 for 55

(b) Another student revised for 9 hours and scored 74. Plot this on the diagram. [1]

The point (9, 74) is marked on the diagram above.

Mark scheme B1 for the point plotted correctly at (9, 74)

(c) Write down the type of correlation shown. [1]

Positive correlation. As revision time increases, the test score increases.

Mark scheme B1 for positive

Question 7

1 mark

Currency

The exchange rate is 1 US dollar = 280 rupees. Find the value of 2100 rupees in US dollars. [1]

Divide by the rate to go from rupees to dollars.

$\frac{2100}{280} = \mathbf{\$7.50}$

Check: $7.5 \times 280 = 2100$. Correct.

Mark scheme B1 for 7.50

Question 8 2 marks

Standard Form

Calculate $(6 \times 10^{-3}) \times (4 \times 10^{8})$. Give your answer in standard form. [2]

$= (6 \times 4) \times 10^{-3+8}$

$= 24 \times 10^{5}$

24 is not between 1 and 10, so adjust: $=$ $\mathbf{2.4 \times 10^{6}}$

Check: A very common error is to stop at 24×10^{5}. Standard form needs the front number between 1 and 10.

> **Mark scheme** M1 for 24×10^{5} or for adding the indices, A1 for 2.4×10^{6}

Question 9 2 marks

Highest Common Factor

Find the highest common factor of 84 and 126. [2]

$84 = 2^{2} \times 3 \times 7$

$126 = 2 \times 3^{2} \times 7$

Take each common prime to its lowest power: HCF $= 2 \times 3 \times 7 =$ **42**

Check: $84 \div 42 = 2$ and $126 \div 42 = 3$. Since 2 and 3 share no factor, 42 is the highest.

> **Mark scheme** M1 for both numbers written as products of primes, A1 for 42

Question 10 5 marks

Indices

(a) Simplify $m^{7} \times m^{3}$ [1]

Add the indices: $m^{7+3} = \mathbf{m^{10}}$

> **Mark scheme** B1 for m^{10}

(b) Simplify $12k^{8} \div 3k^{2}$ [2]

Divide the numbers and subtract the indices.

$= \frac{12}{3} k^{8-2} = \mathbf{4k^{6}}$

> **Mark scheme** B1 for $4k^{n}$ or for jk^{6}, B2 for $4k^{6}$

(c) Simplify $(16w^{12})^{\frac{3}{4}}$ [2]

Apply the power to each part.

$16^{\frac{3}{4}} = (\sqrt[4]{16})^3 = 2^3 = 8$

$(w^{12})^{\frac{3}{4}} = w^{12 \times \frac{3}{4}} = w^9$

$= \mathbf{8w^9}$

Check: Take the root before the power. $16^3 = 4096$ would be far harder by hand.

Mark scheme M1 for $16^{\frac{3}{4}} = 8$ or for w^9, A1 for $8w^9$

Question 11 3 marks

Inequality

Solve $5(x - 2) \leq 2x + 8$ and show your solution on the number line below. [3]

$5x - 10 \leq 2x + 8$

$5x - 2x \leq 8 + 10$

$3x \leq 18$

$\mathbf{x \leq 6}$

On the number line: a **closed** circle at 6, because 6 is included, with the arrow pointing left.

Check: $x = 6$ gives $5(4) = 20$ and $2(6) + 8 = 20$, so the two sides are equal at 6. That is why the circle is closed.

Mark scheme M1 for expanding to $5x - 10$, M1 for collecting to $3x \leq 18$, A1 for $x \leq 6$ with a correct closed circle and arrow

Question 12 3 marks

Recurring Decimal

Write 0.2777... , where the 7 recurs, as a fraction in its simplest form. Show all your working. [3]

Let $x = 0.2777...$

$10x = 2.777...$

$100x = 27.777...$

Subtracting: $100x - 10x = 27.777... - 2.777...$

$90x = 25$

$x = \frac{25}{90} = \mathbf{\frac{5}{18}}$ (dividing top and bottom by 5)

Check: $\frac{5}{18} = 0.2777...$ Correct. Multiply by 10 and 100 because one digit recurs and one digit does not.

Mark scheme M1 for a correct multiplication and subtraction, A1 for $\frac{25}{90}$, A1 for $\frac{5}{18}$

Question 13 3 marks

Exponential Decay

A car is worth \$12 000. Its value decreases by 25 percent each year. Find its value after 3 years. [3]

Multiplier $= 1 - \frac{25}{100} = 0.75 = \frac{3}{4}$

Value $= 12\,000 \times (\frac{3}{4})^3 = 12\,000 \times \frac{27}{64}$

$\frac{12\,000}{64} = 187.5$, and $187.5 \times 27 = 5062.5$

Value = **\$5062.50**

Check: Losing 25 percent three times is not losing 75 percent. 75 percent off would give \$3000, which is too low.

Mark scheme M1 for the multiplier 0.75, M1 for $12\,000 \times 0.75^3$, A1 for \$5062.50

Question 14 4 marks

Venn Diagrams

(a) The Venn diagram shows the number of elements in each region. There are 50 elements in the universal set. Find n(A ∩ B). [3]

Add every region and set the total to 50.

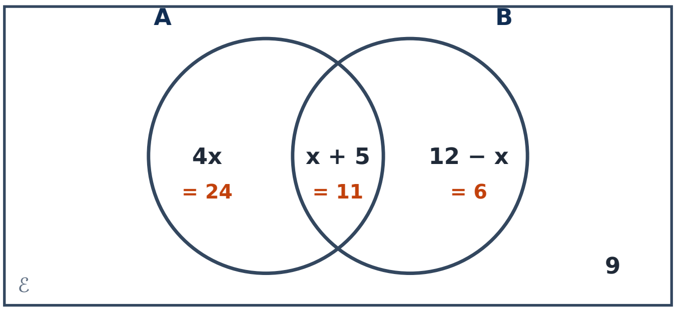
$4x + (x + 5) + (12 - x) + 9 = 50$

$4x + 26 = 50$

$4x = 24$, so $x = 6$

$n(A \cap B) = x + 5 =$ **11**

Check: The regions become 24, 11, 6 and 9, and 24 + 11 + 6 + 9 = 50. Correct.

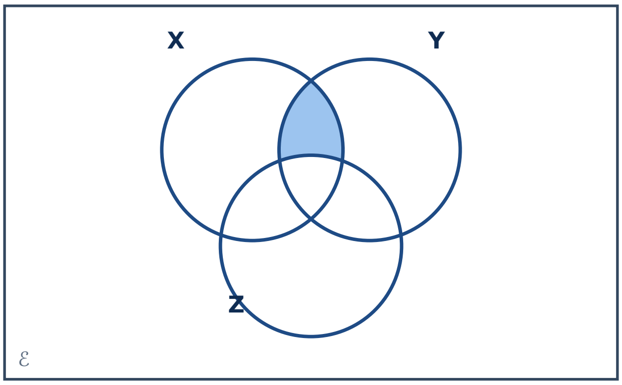


Mark scheme M1 for a correct equation in x, A1 for x = 6, A1 for 11

(b) On the diagram below, shade the region $X \cap Y \cap Z'$. [1]

This is the part inside both X and Y but **outside** Z, shaded above.

Check: The dash in Z' means not in Z, so the central region where all three overlap is left unshaded.



Mark scheme B1 for the correct region shaded

Question 15 5 marks

Region on a Grid

On the grid, draw and label the region R that satisfies all three of these inequalities. Shade the unwanted regions. $y < 5$, $x \geq 1$, $y \geq x + 1$ [5]

$y = 5$ is a **dashed** line, because $y < 5$ does not include the line itself.

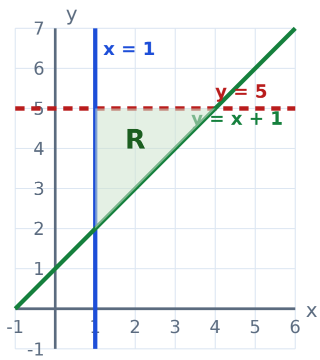
$x = 1$ is a **solid** line, because $x \geq 1$ includes it.

$y = x + 1$ is a **solid** line, because $y \geq x + 1$ includes it.

R is below $y = 5$, to the right of $x = 1$, and above $y = x + 1$.

R is the triangle with corners (1, 2), (1, 5) and (4, 5).

Check: Test the point (2, 4): $4 < 5$ yes, $2 \geq 1$ yes, $4 \geq 3$ yes. It lies inside R. Correct.



Mark scheme B1 for $y = 5$ dashed, B1 for $x = 1$ solid, B1 for $y = x + 1$ solid, B2 for R correct (B1 for a region satisfying two of the three)

Question 16 3 marks

Upper and Lower Bounds

A rectangle has length 12 cm and width 7.5 cm, each correct to 2 significant figures. Find the lower bound and the upper bound of the perimeter. [3]

12 to 2 significant figures: $11.5 \le \text{length} < 12.5$

7.5 to 2 significant figures: $7.45 \le \text{width} < 7.55$

Perimeter = 2(length + width)

Lower bound = 2(11.5 + 7.45) = 2 × 18.95 = **37.9 cm**

Upper bound = 2(12.5 + 7.55) = 2 × 20.05 = **40.1 cm**

Check: The two measurements are rounded to different place values. 12 is to the nearest whole number, so ±0.5, while 7.5 is to the nearest tenth, so ±0.05.

Mark scheme B1 for both sets of bounds seen, B1 for 37.9, B1 for 40.1

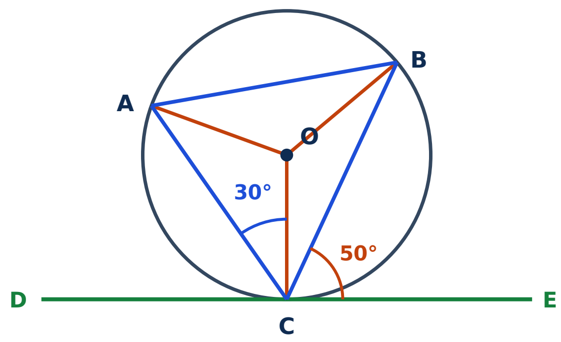
Question 17 4 marks

Circle Theorems

(a) A, B and C lie on a circle, centre O. DE is a tangent touching the circle at C. Angle BCE = 50° and angle ACO = 30°. Find angle OCB and give a reason. [2]

A tangent meets a radius at 90° at the point of contact, so angle OCE = 90°.

Angle OCB = 90 − 50 = **40°**



NOT TO SCALE

Mark scheme M1 for angle OCE = 90 with the reason that the tangent is perpendicular to the radius, A1 for 40°

(b) Find angle OBC and give a reason. [1]

OB and OC are both radii, so triangle OBC is isosceles.

Angle OBC = angle OCB = **40°**

Mark scheme B1 for 40° with the reason that the triangle is isosceles, two radii equal

(c) Find angle BAC and give a reason. [1]

By the alternate segment theorem, the angle between the tangent and the chord CB equals the angle in the alternate segment.

Angle BAC = angle BCE = **50°**

Check: Checking a second way: angle BOC = 180 − 40 − 40 = 100°, and the angle at the circumference is half the angle at the centre, so angle BAC = 50°. The two methods agree.

Mark scheme B1 for 50° with the alternate segment theorem named

Question 18 3 marks

Sine Rule

In triangle ABC, angle A = 45°, angle B = 60° and a = 8 cm. Find the exact length of b, giving your answer as a surd in its simplest form. [3]

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

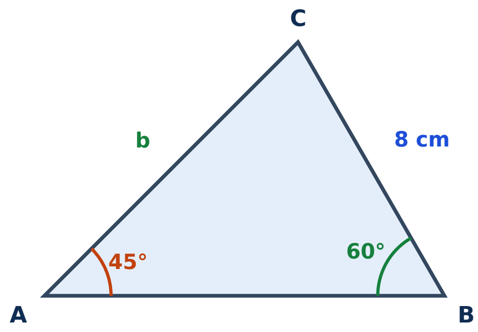
$$\frac{8}{\sin 45°} = \frac{b}{\sin 60°}$$

$$\sin 45° = \frac{\sqrt{2}}{2} \text{ and } \sin 60° = \frac{\sqrt{3}}{2}$$

$$b = \frac{8 \times \frac{\sqrt{3}}{2}}{\frac{\sqrt{2}}{2}} = \frac{8\sqrt{3}}{\sqrt{2}}$$

Rationalise: $\frac{8\sqrt{3}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{8\sqrt{6}}{2} = \mathbf{4\sqrt{6}\text{ cm}}$

Check: 4√6 is about 9.8, and B is the larger angle so b must be longer than a = 8. Correct.



NOT TO SCALE

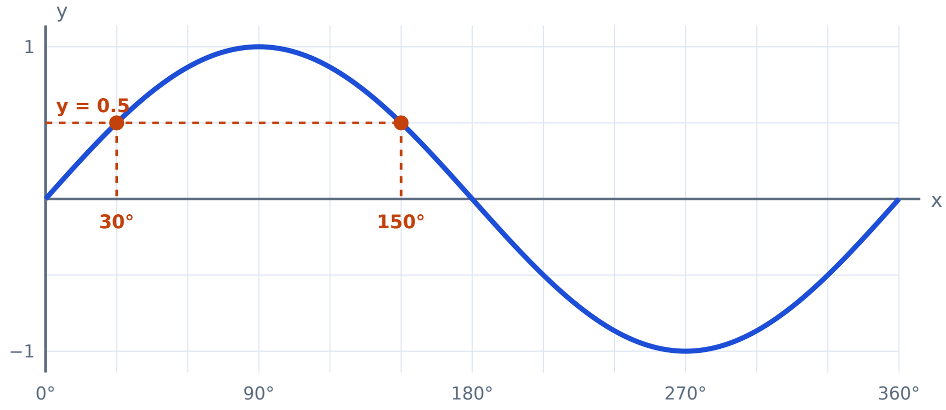
Mark scheme M1 for the sine rule correctly set up, M1 for using the exact values of sin 45° and sin 60°, A1 for 4√6

Question 19 4 marks

Trigonometric Graph

(a) On the grid, sketch the graph of y = sin x for 0° ≤ x ≤ 360°. [2]

The curve starts at (0, 0), rises to a maximum of 1 at 90°, returns to 0 at 180°, falls to a minimum of −1 at 270°, and comes back to 0 at 360°.



Mark scheme B1 for the correct wave shape, B1 for the correct maximum, minimum and intercepts

(b) Solve $\sin x = 0.5$ for $0° \le x \le 360°$. [2]

$\sin 30° = 0.5$, so one solution is $x = 30°$.

The sine curve is symmetrical about $x = 90°$, so the second solution is $180 - 30 = 150°$.

$x = 30°$ and $x = 150°$

Check: Both values lie where the curve is above the axis, which is where $\sin x$ is positive. A very common error is to give only 30°.

Mark scheme B1 for 30°, B1 for 150°

Question 20 6 marks

Algebraic Fractions

(a) Simplify $\frac{x^2 + x - 6}{x^2 + 6x + 9}$ [3]

Numerator: $x^2 + x - 6 = (x + 3)(x - 2)$

Denominator: $x^2 + 6x + 9 = (x + 3)^2$, a perfect square

$\frac{(x + 3)(x - 2)}{(x + 3)(x + 3)} = \mathbf{\frac{x - 2}{x + 3}}$

Check: At $x = 1$ the original is $\frac{-4}{16} = -0.25$ and the answer is $\frac{-1}{4} = -0.25$. Correct.

Mark scheme B1 for the numerator factorised, B1 for the denominator factorised, A1 for $\frac{x - 2}{x + 3}$

(b) Write $\frac{3}{x-2} + \frac{4}{x+1}$ as a single fraction in its simplest form. [3]

Common denominator = $(x - 2)(x + 1)$

$= \frac{3(x+1) + 4(x-2)}{(x-2)(x+1)}$

$= \frac{3x + 3 + 4x - 8}{(x-2)(x+1)}$

$= \mathbf{\frac{7x - 5}{(x-2)(x+1)}}$

Check: At $x = 3$: $\frac{3}{1} + \frac{4}{4} = 4$, and $\frac{16}{4} = 4$. Correct.

> **Mark scheme** M1 for a correct common denominator, M1 for expanding both brackets on the top, A1 for $\frac{7x-5}{(x-2)(x+1)}$

Question 21 4 marks

Three Dimensional Trigonometry

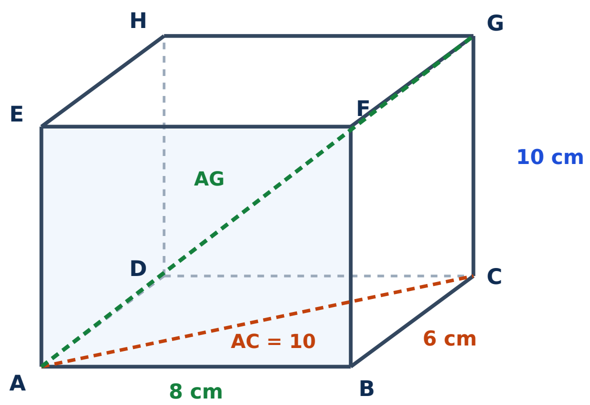
(a) ABCDEFGH is a cuboid with AB = 8 cm, BC = 6 cm and CG = 10 cm. Show that the diagonal AC of the base is 10 cm. [2]

AC is the diagonal of rectangle ABCD, so use Pythagoras on triangle ABC.

$AC^2 = 8^2 + 6^2 = 64 + 36 = 100$

$AC = \sqrt{100} =$ **10 cm**

Check: 6, 8, 10 is a 3, 4, 5 triangle doubled.



NOT TO SCALE

> **Mark scheme** M1 for $8^2 + 6^2$, A1 for 10 with the working shown

(b) Find the angle that the diagonal AG makes with the base ABCD. [2]

G is directly above C, so the angle is angle GAC in the right-angled triangle GAC.

The side opposite the angle is CG = 10, and the side adjacent is AC = 10.

$\tan(GAC) = \frac{10}{10} = 1$

Angle GAC = **45°**

Check: The opposite and adjacent sides are equal, so the triangle is isosceles and right-angled. 45° is exactly what we expect, with no calculator needed.

> **Mark scheme** M1 for $\tan = \frac{10}{\text{their AC}}$, A1 for 45°

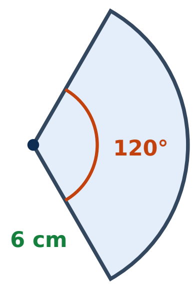
Question 22 4 marks

Sector of a Circle

(a) The sector has radius 6 cm and angle 120°. Find the arc length, giving your answer in terms of π. [2]

$\frac{120}{360} = \frac{1}{3}$

Arc $= \frac{1}{3} \times 2\pi \times 6 = \frac{1}{3} \times 12\pi =$ **4π cm**



NOT TO SCALE

Mark scheme M1 for $\frac{120}{360} \times 2\pi r$, A1 for 4π

(b) Find the area of the sector, giving your answer in terms of π. [2]

Area $= \frac{1}{3} \times \pi \times 6^2 = \frac{1}{3} \times 36\pi =$ **12π cm²**

Check: A third of the whole circle. The full circumference is 12π and the full area is 36π, so a third of each gives 4π and 12π.

Mark scheme M1 for $\frac{120}{360} \times \pi r^2$, A1 for 12π

Question 23 3 marks

Surds

(a) Simplify √48. [1]

48 = 16 × 3, and 16 is a square number.

√48 = √16 × √3 = **4√3**

Mark scheme B1 for 4√3

(b) Rationalise the denominator of $\frac{10}{\sqrt{5}}$. [2]

Multiply the top and the bottom by √5.

$\frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{10\sqrt{5}}{5} =$ **2√5**

Check: 2√5 is about 4.47, and $\frac{10}{2.236}$ is about 4.47. Correct.

Mark scheme M1 for multiplying top and bottom by √5, A1 for 2√5

Question 24 4 marks

Vectors

(a) $\mathbf{a} = (4, -1)$ and $\mathbf{b} = (-2, 3)$. Find $3\mathbf{a} - 2\mathbf{b}$. [2]

$3\mathbf{a} = (12, -3)$

$2\mathbf{b} = (-4, 6)$

$3\mathbf{a} - 2\mathbf{b} = (12 - (-4), -3 - 6) = \mathbf{(16, -9)}$

Check: Subtracting a negative adds: $12 - (-4) = 16$, not 8.

Mark scheme M1 for $3\mathbf{a}$ or $2\mathbf{b}$ correct, A1 for $(16, -9)$

(b) Find $|\mathbf{a} + \mathbf{b}|$, giving your answer as a surd in its simplest form. [2]

$\mathbf{a} + \mathbf{b} = (2, 2)$

$|\mathbf{a} + \mathbf{b}| = \sqrt{(2^2 + 2^2)} = \sqrt{8}$

$\sqrt{8} = \sqrt{4} \times \sqrt{2} = \mathbf{2\sqrt{2}}$

Mark scheme M1 for $\sqrt{(2^2 + 2^2)}$ or $\sqrt{8}$, A1 for $2\sqrt{2}$

Question 25 5 marks

Probability

(a) A bag contains 4 red counters and 5 blue counters. Two counters are taken at random without replacement. Find the probability that both are red. [2]

First counter red: $\frac{4}{9}$

Second counter red, with one red already gone: $\frac{3}{8}$

P(both red) $= \frac{4}{9} \times \frac{3}{8} = \frac{12}{72} = \mathbf{\frac{1}{6}}$

Check: Without replacement means both the top and the bottom of the second fraction drop by one.

Mark scheme M1 for $\frac{4}{9} \times \frac{3}{8}$, A1 for $\frac{1}{6}$

(b) Find the probability that the two counters are different colours. [3]

Two ways round: red then blue, or blue then red.

P(red then blue) $= \frac{4}{9} \times \frac{5}{8} = \frac{20}{72}$

P(blue then red) $= \frac{5}{9} \times \frac{4}{8} = \frac{20}{72}$

P(different) $= \frac{20}{72} + \frac{20}{72} = \frac{40}{72} = \mathbf{\frac{5}{9}}$

Check: P(both blue) $= \frac{5}{9} \times \frac{4}{8} = \frac{20}{72}$. Then $\frac{12}{72} + \frac{40}{72} + \frac{20}{72} = \frac{72}{72} = 1$. Correct.

Mark scheme M1 for one correct product, M1 for adding both orders, A1 for $\frac{5}{9}$

Question 26 3 marks

Simultaneous Equations

Solve the simultaneous equations $3x + 4y = 18$ and $2x - y = 1$. [3]

From the second equation, $y = 2x - 1$.

Substituting: $3x + 4(2x - 1) = 18$

$3x + 8x - 4 = 18$

$11x = 22$, so $x = 2$

$y = 2(2) - 1 = 3$

$x = 2$ and $y = 3$

Check: $3(2) + 4(3) = 18$ and $2(2) - 3 = 1$. Both correct.

Mark scheme M1 for a correct substitution or elimination, A1 for $x = 2$, A1 for $y = 3$

Question 27 4 marks

Quadratic Equations

(a) Solve $x^2 - 7x + 10 = 0$. [2]

Two numbers multiplying to 10 and adding to -7 are -2 and -5.

$(x - 2)(x - 5) = 0$

$x = 2$ or $x = 5$

Mark scheme M1 for $(x - 2)(x - 5)$, A1 for both roots

(b) Solve $3x^2 - 10x - 8 = 0$. [2]

Two numbers multiplying to $3 \times (-8) = -24$ and adding to -10 are -12 and 2.

$3x^2 - 12x + 2x - 8 = 3x(x - 4) + 2(x - 4) = (3x + 2)(x - 4)$

$x = 4$ or $x = -\frac{2}{3}$

Check: At $x = 4$: $48 - 40 - 8 = 0$. At $x = -\frac{2}{3}$: $\frac{4}{3} + \frac{20}{3} - 8 = 0$. Both correct.

Mark scheme M1 for $(3x + 2)(x - 4)$, A1 for both roots

Question 28 3 marks

Sequences

The first five terms of a sequence are 3, 8, 15, 24, 35. Find the nth term. [3]

First differences: 5, 7, 9, 11

Second differences: 2, 2, 2. The second difference is constant, so the sequence is quadratic.

The n^2 coefficient is $\frac{2}{2} = 1$, so start with n^2.

Subtract n^2 from each term: $3 - 1 = 2$, $8 - 4 = 4$, $15 - 9 = 6$, $24 - 16 = 8$

That leaves 2, 4, 6, 8, which is 2n.

nth term = $\mathbf{n^2 + 2n}$

Check: n = 5 gives 25 + 10 = 35. Correct.

> **Mark scheme** M1 for the second difference of 2 leading to n^2, M1 for subtracting n^2 and finding 2n, A1 for $n^2 + 2n$

Question 29 2 marks

Reverse Percentage

The price of a bicycle is reduced by 12 percent to $176. Find the original price. [2]

After the reduction the price is 88 percent of the original.

$0.88 \times \text{original} = 176$

Original $= \frac{176}{0.88} = \frac{17600}{88} =$ **$200**

Check: 200 × 0.88 = 176. Correct. Taking 12 percent off $176 gives $154.88, which is not the original price.

> **Mark scheme** M1 for recognising 176 as 88 percent, A1 for $200

Question 30 4 marks

Functions

(a) $f(x) = 3x - 2$ and $g(x) = x^2$. Find gf(2). [2]

gf(2) means do f first, then g.

$f(2) = 3(2) - 2 = 4$

$g(4) = 4^2 =$ **16**

Check: fg(2) would be different: g(2) = 4 then f(4) = 10. The order matters.

> **Mark scheme** M1 for f(2) = 4, A1 for 16

(b) Find $f^{-1}(x)$. [2]

Let $y = 3x - 2$

$y + 2 = 3x$, so $x = \frac{y + 2}{3}$

Swapping the letters: $f^{-1}(x) = \mathbf{\frac{x + 2}{3}}$

Check: $f(5) = 13$ and $f^{-1}(13) = \frac{15}{3} = 5$. Correct.

> **Mark scheme** M1 for a correct rearrangement, A1 for $\frac{x + 2}{3}$

Examiner advice

- Write the method down even when you are unsure. Method marks are given for a correct approach with a wrong answer, but never for a blank space.
- On a non-calculator paper, look for the exact route. Perfect squares, Pythagorean triples and the exact values of sin 30°, 45° and 60° are put there deliberately.
- Name the rule. For circle theorems the reason is worth a mark on its own.
- Check the answer is sensible. A probability above 1, a length longer than the hypotenuse, or a negative area all mean something has gone wrong.
- Watch the units, and read whether the question wants an exact answer or a rounded one.