## **Model Solutions & Marking Notes**

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

Q1	Model Solution – 15 Marks	Marking Notes
	4	Scale 15D (0, 4, 8, 12, 15)
	1	Accept correct answer without work
	2	Low Partial Credit
	0	<ul> <li>1 part correct</li> <li>Draws an axis of symmetry</li> <li>Some relevant statement about axial symmetry</li> </ul>
		Mid Partial Credit  ■ 2 parts correct
		<ul> <li>High Partial Credit</li> <li>3 parts correct</li> <li>Draws correct axes of symmetry for first three parts</li> </ul>

Q2	Model Solution – 45 Marks	Marking Notes
(a), (b)	(a) Length × Breadth = $50 \times 25$ = $1250 \text{ m}^2$ (b) $2 \times (\text{Length} + \text{Breadth})$ = $2 \times (50 + 25)$	Scale 15D (0, 4, 8, 12, 15)  Low Partial Credit  • Formula for area or perimeter  • One calculation relevant to either part  • Finds perimeter in (a)  • Finds area in (b)  Mid Partial Credit
	$= 2 \times 75 = 150 \text{ m}$	<ul> <li>(a) correct</li> <li>Finds perimeter in (a) and area in (b)</li> <li>Work of merit in (a) and (b)</li> </ul>
		<ul> <li>High Partial Credit</li> <li>(a) correct, and work of merit in (b)</li> <li>(b) correct</li> </ul>
		<ul> <li>Full Credit −1</li> <li>Apply a * for no or incorrect units, the first time it occurs</li> </ul>
(c)	Method 1:	Scale 15D (0, 4, 8, 12, 15)
	$(20 \times 25) + \left(\frac{1}{2} \times 20 \times 25\right)$	Accept correct answer with no units
	= 500 + 250	Low Partial Credit
	$= 750 \mathrm{m}^2$	Some work of merit, for example:      Solitation and a solation and a solati
	OR  Method 2:	Splits into rectangle(s) and triangle, or correct relevant formula
	Total rectangle: $25 \times 50 = 1250$	Mid Partial Credit
	Unshaded: $(10 \times 25) + \left(\frac{1}{2} \times 20 \times 25\right)$	Finds one relevant area
	= 250 + 250 = 500	High Partial Credit
	Answer: $1250 - 500 = 750 \text{ m}^2$	<ul> <li>Finds two relevant areas</li> <li>60 × 25 = 1500</li> </ul>
	OR	Full Credit –1
	Method 3:	Apply a * if the area of the unshaded
	Extend rectangle by 10 m at the RHS. Then answer = $\frac{1}{2} \times 60 \times 25 = 750 \text{ m}^2$	region $EBCF$ is found, with supporting work.

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Q2	Model Solution – 45 Marks	Marking Notes
(d) (i), (ii)	(i) $c^2 = a^2 + b^2$ $\Rightarrow c^2 = 20^2 + 25^2$ $\Rightarrow c^2 = 400 + 625$ $\Rightarrow c^2 = 1025$ $\Rightarrow c = \sqrt{1025} = 32 \text{ m [nearest m]}$ (ii) $40 + 25 + 20 + 32$ = 117  m	Scale 15D (0, 4, 8, 12, 15)  Low Partial Credit  Work of merit in (i), for example: Theorem of Pythagoras stated correctly, or indicates 20 <sup>2</sup> or 25 <sup>2</sup> Work of merit in (ii), for example: Adds two relevant numbers
		Mid Partial Credit  • $c^2 = 20^2 + 25^2$ • (ii) correct  • Work of merit in both (i) and (ii)
		<ul> <li>High Partial Credit</li> <li>(i) correct</li> <li>(ii) correct and work of merit in (i)</li> </ul>
		<ul> <li>Full Credit -1</li> <li>Apply a * for incorrect or no rounding.</li> <li>Apply a * for no or incorrect units, if a * was not applied for these in (a) or (b).</li> </ul>

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Q3	Model Solution – 40 Marks	Marking Notes
(a)	$l \times b \times h$ $= 3 \times 3 \times 5$ $= 45 \text{ cm}^3$	Scale 5C (0, 2, 3, 5) Accept correct answer without work.  Low Partial Credit  Correct formula Finds area of one or more surfaces  High Partial Credit  3 × 3 × 5  Full Credit -1 Apply a * for no or incorrect units
(b)	or any other valid net.	Scale 20D (0, 5, 10, 15, 20)  Low Partial Credit  1 correct face, anywhere on grid Sketch of net of any cuboid with at least 5 correct faces  Mid Partial Credit Correct net of cube with sides of 3 cm 4 correct faces anywhere on grid 2 or 3 correct faces in correct positions relative to the given face  High Partial Credit 4 correct faces in correct positions Correct net with excess faces  Full Credit -1 Apply a * to a correct net without using the given face.

Q3	Model Solution – 40 Marks	Marking Notes
(c)	$\pi r^2 h$ = $(\pi)(1.2)^2(4)$ = $18 \text{ cm}^3$ [nearest cm <sup>3</sup> ]	Scale 15D (0, 4, 8, 12, 15)  Accept correct answer with no units  Consider solution as requiring 4 steps:  Step 1: Correct formula  Step 2: Substitution of $r$ and $h$ into formula  Step 3: Calculates $r^2$ Step 4: Evaluates answer  Low Partial Credit  • 1 step correct  • Product of 2 relevant numbers  • Uses $2\pi$ rh formula and substitutes for $r$ and $h$ • Uses $A = \pi r^2$ and substitutes  correctly for $r$
		$\begin{tabular}{ll} \it Mid Partial Credit \\ & 2 steps correct \\ & Uses 2\pi rh formula and finishes \\ & correctly \\ & A = 1.44\pi \\ \it High Partial Credit \\ & 3 steps correct \\ & Uses A = \pi r^2 and finishes correctly. \it Full Credit -1 \\ & Apply a * for incorrect rounding \\ \end{tabular}$

Q4	Model Solu	ution – 30	Marks		Marking Notes
(a)(i)	Grey	Blac	:k V	Vhite	Scale 5C (0, 2, 3, 5)
	90°	120	)° 1	150°	Accept correct answer without unit (degrees)
					A tolerance of 3° applies
					Low Partial Credit  ■ 1 angle correct
					• 3 angles sum to 360°
					<ul><li>High Partial Credit</li><li>2 angles correct</li></ul>
					<ul> <li>1 angle measured correctly and all</li> <li>3 angles summing to 360°</li> </ul>
(a)(ii)	$\frac{90}{360}$	< 60 = <del>-</del>	$\frac{1}{1} \times 60 =$	= 15 times	Scale 5C (0, 2, 3, 5)
	300	•	r		Accept correct answer without work.
					<ul><li>Low Partial Credit</li><li>Some work of merit, e.g. indicates</li></ul>
					360°
					High Partial Credit
					• One correct relevant calculation, for example $\frac{360}{90} = 4$
					Full credit -1
					Estimates for either White or Black
(b)(i)	В	1/2	50%	0.5	Scale 10D (0, 3, 5, 8, 10)
		2	40%	0.4	Accept percentage without % sign (i.e. 50)
	С	<u>2</u> 5	40%	0.4	<ul><li>Low Partial Credit</li><li>Work of merit in 1 part</li></ul>
	D	$\frac{1}{50}$	2%	0.02	Mid Partial Credit
					2 parts correct
					High Partial Credit  ■ 3 parts correct
					Full Credit –1
					<ul> <li>Apply a * if the fraction is not given in its simplest form</li> </ul>

Q4	Model	Solut	ion –	30 Ma	rks			Marking Notes
(b)(ii)	D I • 0	0.1	0.2	0.3	C ● 0·4	B ● 0·5	0.6	Scale 10D (0, 3, 5, 8, 10)  Low Partial Credit  1 correct  Mid Partial Credit 2 correct  High Partial Credit 3 correct Points marked correctly but not labelled.

Q5	М	odel S	olutio	on – 3	35 Ma	rks			Marking Notes
(a)(i)		4	7	9	9				Scale 10D (0, 3, 5, 8, 10) Accept diagram with unordered entries.
		5	0	6	7	8			Accept the key without units.
		6	5	7	8	9	9	9	Consider solution as comprising 16 entries: 15 entries on the diagram, plus the key.
		7	5	9					Low Partial Credit  • 1 correct entry
			K	ey:	5	6 =	56	[kg]	<ul> <li>Mid partial Credit</li> <li>6 correct entries</li> <li>All entries correct but rewrites the stem for each number</li> </ul>
									High Partial Credit  • 11 correct entries
									<ul> <li>Full Credit −1</li> <li>Apply a * if just 1 entry in the diagram is omitted or incorrect. (If the key is missing, award at most High Partial Credit.)</li> </ul>

Q5	Model Solution – 35 Marks	Marking Notes
(a)(ii), (iii)	(ii) Median = $\frac{15+1}{2}$ = 8 th entry $\Rightarrow$ Median = 65 kg (iii) $79 - 47 = 32$ kg	Scale 10C (0, 4, 7, 10) Accept correct answer without work  Low Partial Credit  Shows understanding of median, for example: mentions "8th" or "middle"  Shows understanding of range, for example: highlights max or min values  Finds mean or mode correctly
		<ul> <li>High Partial Credit</li> <li>(ii) or (iii) correct</li> <li>Work of merit in both (ii) and (iii) (as covered under LPC above)</li> <li>Full Credit -1</li> <li>Apply a * if range given from "47 to 79 "</li> </ul>
(b)(i)	$\frac{927}{15} = \frac{309}{5} \text{ kg or } 61.8 \text{ kg}$	Scale 5B (0, 2, 5) Accept correct answer without work  Partial Credit  Divides 927 by incorrect value  Attempts to add original values
(b)(ii), (iii)	(ii) $\frac{309}{5} - 1 = \frac{304}{5}$ kg or $61.8 - 1 = 60.8$ kg  OR $\frac{46+48+48+49+\dots+74+78}{15}$ $= \frac{912}{15}$ $= \frac{304}{5}$ kg or $60.8$ kg  OR $60.8 \times 15 = 912$ kg  OR $46+48+48+49+\dots+74+78$ $= 912$ kg $= 912$ kg	Scale 10C (0, 4, 7, 10)  Acept correct answers without work  Low Partial Credit  • Work of merit, for example: Subtracts 1 from any of the original weights, or shows understanding of mean  High Partial Credit  • (ii) or (iii) correct

Q6	Model Solution – 20 Marks	Marking Notes		
(a)	Any relevant question giving numerical data  (i) 8, B 16, B 32, B	Scale 5A (0, 5)  Full Credit -1  • Apply a * if the question is not about apps or social media  Scale 15D (0, 4, 8, 12, 15)		
(ii)	8, W 16, W 32, W 8, S 16, S 32, S  (ii) 3 × 3 × 2 = 18 options  OR  Lists all of the possibilities and counts them to get 18	Accept correct answer without work  Low Partial Credit  1 correct entry in (i)  3 entries in (i) with one aspect correct (memory size or colour)  Work of merit in (ii)  Mid Partial Credit  3 correct entries in (i)  All 7 entries in (i) with one aspect correct  3 correct possibilities listed in (ii)  High Partial Credit  (i) or (ii) correct  Full Credit -1  Apply a * if just 1 entry in (i) is omitted or incorrect.  Apply a * if all possibilities are listed but not counted incorrectly.		

Q7	Model Solution – 15 Marks	Marking Notes
(a)(i), (ii)	Either A and either O, as below.  O/A  A/O	Scale 5B (0, 2, 5)  Partial Credit  1 letter correct 1 or 2 letters correct but with 1 or 2 incorrect
(b)	$ \angle f  = 45^{\circ}$ $ \angle g  = 25^{\circ}$ $ \angle h  = 45 + 25 = 70^{\circ}$ OR $ \angle h  = 180 - (180 - (45 + 25))$ = 180 - (110) $= 70^{\circ}$	Scale 10C (0, 4, 7, 10)  Low Partial Credit  • f or g correct  • Work of merit towards h, for example: some relevant calculation, or indicates 180°  High Partial Credit  • h correct  • f and g correct  • f or g correct, and work of merit towards h

Q8	Model Solution – 30 Marks	Marking Notes
(a)	Answer: Isosceles  Reason: 2 of the angles are the same  OR  The 3 angles aren't equal, but the 3 angles aren't all different  or any other valid reason	Scale 5B (0, 2, 5)  Partial Credit  Answer correct  Shows understanding of one given type of triangle.  Incorrect answer but correct reason.
(b)	$ \angle O $ = 180 - (2 × 55) = 180 - 110 = 70°	Scale 10C (0, 4, 7, 10)  Accept correct answer without work  Accept correct answer without units (degrees)  Low Partial Credit  Work of merit, for example: Some relevant calculation, or indicates 180°  High Partial Credit  Some relevant calculation involving 180°
(c)	"Triangles that have the same size angles"  OR  "Triangles whose sides are in proportion"  or any other valid explanation	Scale 5B (0, 2, 5)  Partial Credit  Work of merit e.g. the two triangles are isosceles.
(d)	$ BC  = 2 \times 1.3 = 2.6 \text{ m}$ $OR$ $\frac{ BC }{1.3} = \frac{2}{1}$ $\therefore  BC  = 2 \times 1.3 = 2.6 \text{ m}$	Scale 10C (0, 4, 7, 10)  Accept correct answer without work  Low Partial Credit  Some work of merit, for example: indicates 2 or $\frac{1}{2}$ High Partial Credit  Equates relevant ratios

Q9	Model Solution – 40 Marks	Marking Notes
(a)(i)	B = (3,1) $H = (8,5)$	Scale 5C (0, 2, 3, 5)  Low Partial Credit  1 ordinate correct  High Partial Credit  B or H correct  Correct co-ordinates but reversed  Full Credit -1  Apply a * if B and H are swapped, but otherwise correct
(a) (ii), (iii)	<ul> <li>(ii) B joined to H with a line segment</li> <li>(iii) Perpendicular bisector of [BH] constructed on diagram, with construction lines shown</li> </ul>	Scale 15D (0, 4, 8, 12, 15)  Low Partial Credit  (ii) correct  Work of merit in (iii), for example: arc drawn with centre at B or H  Mid Partial Credit  (ii) correct and work of merit in (iii)  Significant work of merit in (iii), for example: Arcs drawn with centres at both B and H, or perpendicular bisector drawn, with no construction lines  High Partial Credit  (ii) correct and significant work of merit in (iii)  (iii) correct

Q9	Model Solution – 40 Marks	Marking Notes
(a)	(a)(iv)	Scale 15D (0, 4, 8, 12, 15)
(iv),	$\left(\frac{3+8}{2}, \frac{1+5}{2}\right)$	Accept correct answer without units in (b).
(b)		In (a)(iv), accept correct answer without
	$=\left(\frac{11}{2},\frac{6}{2}\right)$	work.
	$=(5\frac{1}{2},3)$	In (a)(iv) accept a tolerance of $\pm 0.2$
	2	In (b), correct answer without work is considered substantial work ( <b>not</b> correct).
	(b) /(2 0) <sup>2</sup> + /( 4) <sup>2</sup>	Low Partial Credit
	$\sqrt{(3-8)^2 + (6-4)^2}$ $= \sqrt{(-5)^2 + (2)^2}$	Work of merit in one part, for
	$=\sqrt{(-3)^2+(2)^2}$ = $\sqrt{25+4}$	example: Correct formula; or rise or run
	$=\sqrt{29}$ cm	identified; or distance measured from
	<b>V</b> 25 cm	diagram (allow a tolerance of $\pm 0.2$ )
		Mid Partial Credit
		Work of merit relevant to <b>both</b> parts
		Substantial work in 1 part, for
		example: In (a)(iv): correctly fills in formula, or
		one co-ordinate correct, or co-
		ordinates reversed but otherwise
		correct;
		In (b): correctly fills in formula, or
		fills formula incorrectly but finishes correctly, or correct answer without
		work.
		High Partial Credit
		• 1 part correct
		Substantial work in 1 part and work
		of merit in the other part.
(c)	$180 \div 4 = 45 \text{ km}$	Scale 5B (0, 2, 5)
		Accept correct answer without work.
		Accept correct answer without units.
		Partial Credit
		• $\frac{180}{4}$ or $180 \div 4$ or $\frac{4}{180}$
		4 180

Mathematics

Ordinary Level

Q10	Model Solution – 15 Marks	Marking Notes
(a)	Answer: $(0,8)$ Justification: $(0,8)$ : $y = 3x + 8$ $8 = 3(0) + 8$ $8 = 8$ True	Scale 5C (0, 2, 3, 5)  Low Partial Credit  Answer correct  Substitution of any given values into equation  High Partial Credit
	OR  States Line cuts y-axis at (0,8)  or any other valid justification, for example: diagram, or shows that the other 2 points are not on the line	<ul> <li>Correct answer and some correct substitution into equation</li> <li>Coordinates reversed with justification</li> <li>Correct justification with incorrect box ticked</li> </ul>
(b)	Method 1: 2x + 7 = 5x - 11 $2x - 5x = -11 - 7$ $-3x = -18$ $x = 6$ $y = 2(6) + 7$ $y = 12 + 7$ $y = 19$ Point = (6, 19) OR Method 2: -y = -2x - 7 $-y = 5x - 11$ $0 = 3x - 18$ $18 = 3x$ $6 = x$ $y = 2(6) + 7$ $y = 12 + 7$ $y = 19$ Point = (6, 19)	Scale 10D (0, 3, 5, 8, 10)  Accept correct answer without work.  Low Partial Credit  • Sets up equation in Method 1  • Matches co-efficient of x or multiplies one of the given equations by -1 in Method 2.  • Any correct transposition  Mid Partial Credit  • Correct transpositions in Method 1  • Eliminates one variable in Method 2  High Partial Credit  • Solves for one variable

(a), (b), (c)  (b) $\sin 65^\circ$ = $0.906$ = $0.99$ [1 D.P]  (c) $\frac{x}{3} = 0.9$ Scale 15D (0, 4, 8, 12, 15)  Accept correct answer without units in (c)  Low Partial Credit  • Work of merit in any part , for example: uses $x$ or $3$ in making fraction  • Labels 1 side of triangle correctly  • States correct relevant trigonometric ratio	Q11	Model Solution – 15 Marks	Marking Notes
$\Rightarrow x = 3 \times 0.9 = 2.7 \text{ units}$ $Mid Partial Credit$ • 1 part correct • Work of merit in 2 parts $High Partial Credit$ • 2 parts correct $Full Credit 1$ • Apply a * for calculator in the incorrect mode • Apply a * in (b) for incorrect or no rounding.	(a), (b),	(a) $\frac{x}{3}$ (b) $\sin 65^{\circ} = 0.906 \dots = 0.9 [1 D.P]$ (c) $\frac{x}{3} = 0.9$	Scale 15D (0, 4, 8, 12, 15)  Accept correct answer without units in (c)  Low Partial Credit  • Work of merit in any part , for example:     uses x or 3 in making fraction  • Labels 1 side of triangle correctly  • States correct relevant trigonometric ratio  Mid Partial Credit  • 1 part correct  • Work of merit in 2 parts  High Partial Credit  • 2 parts correct  Full Credit 1  • Apply a * for calculator in the incorrect mode