CAMBRIDGE
International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2026**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

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General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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Mathematics-specific marking principles

1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.

3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.

4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).

5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.

6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
^	More information required
A0	Accuracy mark awarded zero
A1	Accuracy mark awarded one
A2	Accuracy mark awarded two
A3	Accuracy mark awarded three
B0	Independent mark awarded zero
B1	Independent mark awarded one
B2	Independent mark awarded two
B3	Independent mark awarded three
BOD	Benefit of the doubt

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Annotation	Meaning
C	Communication mark
✗	Incorrect
FT	Follow through
Highlighter	Highlight a key point in the working
ISW	Ignore subsequent work
M0	Method mark awarded zero
M1	Method mark awarded one
M2	Method mark awarded two
M3	Method mark awarded three
MR	Misread
O	Omission
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
Pre	Premature rounding/approximation
SC	Special case
SEEN	Indicates that work/page has been seen
TE	Transcription error

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Annotation	**Meaning**
✓	Correct
XP	Correct answer from incorrect working

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

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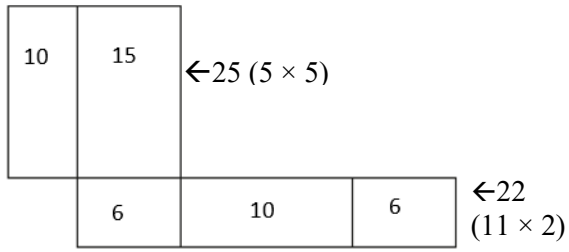
Question	Answer	Marks	Partial Marks	Guidance
1(a)	Point (6.2, 162) plotted correctly	**1**		Horizontally 6.15 < point < 6.25 Vertically 160 < point < 164
1(b)	Positive	**1**		Ignore embellishments, e.g. strong, etc. Condone +ve but not + alone.
1(c)	Ruled line of best fit drawn	**1**		Line of best fit must pass between (4.35, 116) and (4.35, 134) and between (6.5, 158) and (6.5, 176). Condone very good freehand.
1(d)	Reading at 140 from *their* straight line with positive gradient	**1**	Strict FT *their* straight line with positive gradient	Tolerance strictly less than ±1 square which means *lobf value* –0.05 < answer < *lobf value* + 0.05, e.g. do not allow an answer of 5.1 if *their* reading should be 5.05 which is a misinterpretation of the scale.
2(a)	47	**3**	**SC2** for answer 62 OR **B1** for 2, 3 and 5 or 2, 5 and 11 **M1** for [2 ×] 2 × 3 + [2 ×] 2 × 5 + 3 × 5 oe FT *their* values for 2, 3, and 5 written on diagram	Note: B1 is independent of positioning on diagram. B1 and products may be implied by correct areas/combined areas and none incorrect e.g. 
2(b)	30	**2**	FT *their* whole number values for 2, 3, and 5 written on diagram or **M1** for 2 × 3 × 5	2-mark FT for whole number sides if correctly evaluated or M1 FT if not whole numbers or not correctly evaluated. Note: if two sides that should be the same length are labelled different lengths the FT is not possible.

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Question	Answer	Marks	Partial Marks	Guidance
3	$\frac{3}{10}$ cao	**2**	**B1** for $\frac{10}{3}$ or answer 0.3 or **M1** for $\frac{3}{their10}$ oe	$\frac{10}{3}$ implied by answer $-\frac{3}{10}$ Note: do not allow M1 for $-\frac{3}{their10}$.
4	$\frac{7}{12}$ oe	**2**	**M1** for $\frac{1}{6}\times\frac{7}{2}$ or $\frac{7}{42}\div\frac{12}{42}$	Allow equivalent fractions. Allow decimal equivalent correct to 3sf or better, e.g. 0.583.
5(a)(i)	Image at (–6, 7), (–4, 7), (–4, 5), (–5, 5)	**2**	**B1** for translation by $\begin{pmatrix}-2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$	Condone good freehand, mark intention, ignore any labels and ignore other shapes drawn. For B1, shapes must fit on grid.
5(a)(ii)	Image at (0, –2), (2, –2), (2, –4), (0, –3)	**2**	**B1** for three correct vertices If 0 scored, **SC1** for reflection in $y = -x$	Condone good freehand, mark intention, ignore any labels and ignore other shapes drawn. SC1 at (0, 2), (0, 3), (–2, 4), (–2, 2)
5(b)	Rotation 90 anticlockwise oe (3, 3)	**3**	**B1** for each	Do not allow turn, shift, spin, rot. If more than one transformation award 0 marks. Treat extra properties as choice. Allow 270 clockwise, [+]90, –270. Allow acw, counter-clockwise. Condone 3, 3 and 'origin 3, 3'. Do not allow centre as a column vector but do not treat as an additional transformation.

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Question	Answer	Marks	Partial Marks	Guidance
6(a)	86	**2**	**M1** for $5 \times \sqrt{18}^2 - 2^2$ or **B1** for 18 or 90 or –4	
6(b)	[c =] [±]$\sqrt{\frac{E+d^2}{5}}$ oe final answer	**3**	**M1** for isolating the term in c **M1** for division by 5 **M1** for square rooting Mark third M1 on the final answer Maximum 2 marks if answer incorrect	e.g. $E + d^2 = 5c^2$, $-5c^2 = -E - d^2$ e.g. $\frac{E+d^2}{5} = c^2$, $c^2 = \frac{-E-d^2}{-5}$ $\sqrt{\frac{E+d^2}{5}} = c$. For this M1, c^2 must become c. Mark on completion of move. M marks can be awarded in any order, e.g. $\frac{E}{5} = c^2 + \frac{d^2}{5}$ then $\frac{E}{5} - \frac{d^2}{5} = c^2$ then $\sqrt{\frac{E}{5} - \frac{d^2}{5}} = c$ Note: the root symbol in the final answer should extend across the full fraction, minimally beyond the plus sign and below the fraction line.
7	$2x(3w - 2y)$ final answer	**2**	**B1** for $2(3wx - 2xy)$ or $x(6w - 4y)$ or $2x(3w - 2y)$ seen then spoilt	Condone omission of final bracket. Allow equivalent factorised expressions with all signs reversed for 2 marks or part marks, e.g. 2 marks for $-2x(-3w + 2y)$.
8	[cos 45 =] $\frac{1}{\sqrt{2}}$ [tan 60 =] $\sqrt{3}$	**2**	**B1** for one correct value	Condone equivalents, e.g. $\frac{\sqrt{2}}{2}$ for cos 45, $\frac{\sqrt{3}}{1}$ for tan 60. isw conversion of correct answer to a decimal but 0 marks for decimals alone.

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Question	Answer	Marks	Partial Marks	Guidance
9(a)	$3 \times 3 \times 7$ or $3^2 \times 7$[1]	**2**	**B1** for 3, 3, 7 or **M1** for correct factor tree/diagram/list/table	Allow B1 for the inclusion of 1 with correct factors.
9(b)	126	**2**	**B1** for $126k$ as final answer, where k is an integer or **M1** for [42 =] $2 \times 3 \times 7$ or for $2 \times 3 \times 3 \times 7$ oe	B1 evaluated e.g. 252, 378, 504, 630, 756, 882, 1008, 1134, 1260, 1386, 1512, 1638, 1764, 1890, 2016, 2142, 2268 etc. For M mark allow inclusion of 1 but do not allow 2×21. Allow prime factors of 42 not as a product, e.g. in a factor tree/diagram/list/table When combining the prime factors, allow 21 for 3×7 and allow picking out of correct combined tables/diagrams for M1, e.g. 63 42 | 3 21 14 | 7 3 2 63 | 42 | 21 3 2
9(c)	$21a^2c^2$	**2**	**B1** for answers ka^2c^2 or $21a^mc^n$ or 3, 7, a^2, c^2 or for $21a^2c^2$ seen then spoilt	k can be any value or numerical product. m and n can be any values e.g. B1 for 21 alone. Also allow answer 21, a^2, c^2 for B1.

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Question	Answer	Marks	Partial Marks	Guidance
10	$\frac{11}{15}$ cao	**3**	**B2** for $\frac{66}{90}$ oe or **M1** for $73.\dot{3} - 7.\dot{3}$ oe	oe e.g. $\frac{726}{990}$, $\frac{22}{30}$ Fraction must not contain decimals for B2. oe e.g. 7.33… – 0.73… M1 implied by $\frac{6.6}{9}$, $\frac{72.6}{99}$, $90x = 66$
11	9	**2**	**M1** for $\frac{360}{180-140}$ or for $\frac{180(n-2)}{n} = 140$ oe	
12(a)	Four ruled solid straight lines	**5**	**B1** for $x = 8$ **B1** for $y = 2$ **B1** for $x + y = 8$ **B2** for $2y - x = 4$ or **B1** for a diagonal line passing through (0, 2) or (8, 6) or a line with gradient $\frac{1}{2}$	In question 12 withhold 1 mark on first occurrence of dashed line. This should be when you first see it in part (a). Condone very good freehand, mark intention. Lines can be any length. Be careful not to credit the same line twice.

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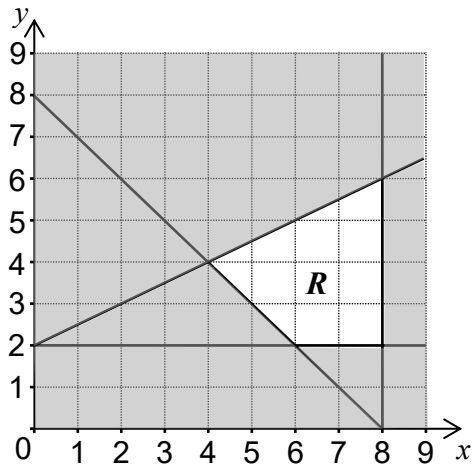
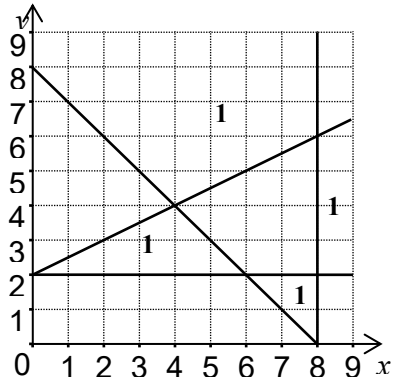
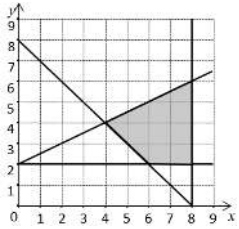
Question	Answer	Marks	Partial Marks	Guidance
12(b)	Correct region identified  	**2**	**B1** for a region satisfying three of the correct inequalities  or **SC1** for 	Allow unambiguous identification of the correct region. Note: use the B1 diagram only if all four lines are correct. If any lines are incorrect, use the guidance below. Allow maximum of one incorrect line drawn or one line omitted for B1. i.e. three of these must be correct • left of $x = 8$ • above $y = 2$ • right of $x + y = 8$ • below $2y - x = 4$ Mark *R* first, if no *R* mark **unshaded** region. If *their R* (or unshaded region) spans more than one region, apply the choice rule and mark the worst. Allow unambiguous indication of shading, e.g. a little shading just to one side of the lines. The SC is only if there is no *R* and the shading is in the region shown only.
13	6π cao	**2**	**M1** for $\frac{90}{360} \times 2\pi \times 12$ oe	Allow 3.14 or better or $\frac{22}{7}$ for π for M1. M1 implied by 18.8[4] to 18.9

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Question	Answer	Marks	Partial Marks	Guidance
14(a)	–2 1 6	**2**	**B1** for one correct value in the correct position OR **SC1** for answer –3 –2 1	Numbers must be in the correct order.
14(b)	$4 \times 3^{n-1}$ oe final answer	**2**	**B1** for [$c \times$] 3^{an+k} oe, $a > 0$	For 2 marks (or 1 if spoilt) equivalents include $12 \times 3^{n-2}$, $3^n + 3^{n-1}$, $4 \times \frac{3^n}{3}$. Allow $\frac{16}{3}n^3 - 24n^2 + \frac{128}{3}n - 20$. Allow other variables for n. Condone e.g. $n = 4 \times 3^{n-1}$.
15	$\angle EAD = 55$	**B3**	**B2** for $\angle ABD = 55$ or **B1** for $\angle BAD = 105$ or $\angle BAF = 20$ OR **M2** for 180 – (180 – 75) – 20 oe	Angles may be seen on diagram for B1 or B2. oe e.g. 180 – (105 + 20), 75 – 20
	Opposite angles of a cyclic quadrilateral sum to 180 **and** Alternate segment theorem **and** no reason linked with inappropriate working	**B2**	**B1** for opposite angles of a cyclic quadrilateral sum to 180 **or** Alternate segment theorem	Allow supplementary and equal/add to for sum to. Allow angles in opposite segments sum to 180. Do not allow just 'alternate segment', alternative segment theorem, AST, alt segment theorem, alternate angles, opposite segment theorem.

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Question	Answer	Marks	Partial Marks	Guidance
16	5	**2**	**M1** for [r^3 =] $500 \div \frac{4}{3}\pi$ oe or [r^3 =]$500 \div \left(\frac{4}{3}\times 3\right)$ oe	oe e.g. [r^3 =] $\frac{500\times 3}{4\times\pi}$, $\frac{500}{\frac{4}{3}\times\pi}$, $\frac{500\times 3}{4\times 3}$, $\frac{500}{4}$, 125, $\frac{500}{1.33\times\pi}$ Allow use of 3.14, $\frac{22}{7}$ etc for π for M1. $\sqrt[3]{125}$ scores M1. Do not allow ± 5 for 2 marks.
17(a)	$-2+5\sqrt{7}$ cao	**2**	**B1** for $12 + 8\sqrt{7} - 3\sqrt{7} - 2 \times 7$ or better, with at least three terms correct	–2 and $5\sqrt{7}$ each count as two correct terms. Ignore extra incorrect terms for B1.
17(b)	$\frac{3+\sqrt{5}}{2}$ cao	**3**	**B2** for $\frac{6+2\sqrt{5}}{4}$ oe OR **M1** for $\frac{2}{3-\sqrt{5}}\times\frac{3+\sqrt{5}}{3+\sqrt{5}}$ oe **M1** for $9 + 3\sqrt{5} - 3\sqrt{5} - 5$ or better	Allow correct simplified equivalent for 3 marks, e.g. $\frac{\sqrt{5}}{2}+\frac{3}{2}$, $\frac{-3-\sqrt{5}}{-2}$, $1.5 + 0.5\sqrt{5}$. oe e.g. $\frac{2\left(3+\sqrt{5}\right)}{4}$, $\frac{-6-2\sqrt{5}}{-4}$ for B2 oe e.g. $\frac{2}{3-\sqrt{5}}\times\frac{-3-\sqrt{5}}{-3-\sqrt{5}}$ then M1 for $-9 + 3\sqrt{5} - 3\sqrt{5} + 5$ If fraction line missing in $\frac{3+\sqrt{5}}{3+\sqrt{5}}$ then brackets are required, e.g. $\frac{2}{3-\sqrt{5}}\ \begin{matrix}\times(3+\sqrt{5})\\ \times(3+\sqrt{5})\end{matrix}$

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Question	Answer	Marks	Partial Marks	Guidance
18(a)	$\frac{29}{100}$ oe	3	**M2** for $\left(\frac{2}{10}\times\frac{2}{10}\right)+\left(\frac{5}{10}\times\frac{5}{10}\right)$ oe or **M1** for one correct product seen If 0 scored, **SC1** for answer $\frac{11}{45}$ oe	Allow fraction, percentage and decimal equivalents. M1 may be implied by $\frac{4}{100}$ or $\frac{25}{100}$. oe e.g. $\frac{22}{90}$ In **(a)** and **(b)**: • Do not allow ratio e.g. 29:100, 29 to 100. • Ignore incorrect cancelling or conversion to an acceptable form following a correct answer. • Withhold 1 mark for the first instance of words e.g. 29 in 100 or 29 out of 100.
18(b)	$\frac{1}{6}$ oe	3	**M2** for $\left(\frac{2}{10}\times\frac{5}{9}\times\frac{4}{8}\right)\times k$ oe where $k = 1, 2$ or 3 or **M1** for $\left(\frac{a}{10}\times\frac{b}{9}\times\frac{c}{8}\right)$ seen where each fraction is a probability $\neq 0$ If 0 scored, **SC1** for answer $\frac{3}{20}$ oe	Allow fraction, percentage and decimal equivalents (3sf or better 0.167 or $0.1\dot{6}$). oe for 3 marks e.g. $\frac{120}{720}$, $\frac{12}{72}$, $\frac{3}{18}$, $\frac{4}{24}$ oe e.g. $\frac{1}{5}\times\frac{5}{9}\times\frac{1}{2}$, $\frac{5}{10}\times\frac{2}{9}\times\frac{4}{8}$ M2 implied by $\frac{40}{720}$, $\frac{1}{18}$, $\frac{80}{720}$

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Question	Answer	Marks	Partial Marks	Guidance
19	$3x^3 + 7x^2 - 22x - 8$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified or simplified four-term expression of correct form with three terms correct. or **B1** for one pair of brackets expanded with at least three terms out of four correct	e.g. $3x^3 - 6x^2 + 12x^2 - 24x + x^2 - 2x + 4x - 8$, or $3x^3 + 13x^2 + 4x - 6x^2 - 26x - 8$ Award B2 for correct answer seen then spoilt. $3x^2 + 12x + x + 4$ or $x^2 - 2x + 4x - 8$ or $3x^2 - 6x + x - 2$ $+ 13x$, $- 5x$ and $+ 2x$ count as two terms correct If in a longer train of terms only allow if 4 out of 4 correct consecutive terms are given (or 3 out of 3 if terms in x are simplified).
20	5	**3**	**M2** for $h = \sqrt[3]{\frac{27}{216}} \times 10$ oe or $\frac{10}{h} = 2$ oe or **M1** for $\sqrt[3]{\frac{27}{216}}$ or $\sqrt[3]{\frac{216}{27}}$ oe or better or for $\left(\frac{10}{h}\right)^3 = \frac{216}{27}$ or $\left(\frac{h}{10}\right)^3 = \frac{27}{216}$ oe or better	oe e.g. $\frac{3}{6} \times 10$, $10 \div \sqrt[3]{\frac{216}{27}}$, $\frac{10}{\sqrt[3]{8}}$, $10 \div \sqrt[3]{8}$ $\sqrt[3]{1000 \times \frac{27}{216}}$, $\sqrt[3]{\frac{1000}{8}}$, $\sqrt[3]{125}$ e.g. M1 for [L]SF = $\frac{1}{2}$ or 2 but not just $\frac{1}{2}$ or 2 alone

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Question	Answer	Marks	Partial Marks	Guidance
21(a)	$(x + 4)^2 – 23$ final answer	**2**	**B1** for $(x + 4)^2$ seen	Allow $(x + 4)^2 + – 23$ for 2 marks.
21(b)	(–4, –23)	**1**	FT *their* (a) if in the correct form	
22(a)(i)	$\frac{1}{5}(\mathbf{c} - \mathbf{a})$ or $\frac{1}{5}\mathbf{c} - \frac{1}{5}\mathbf{a}$	**2**	**M1** for $\overrightarrow{AC} = \mathbf{c} - \mathbf{a}$ or $\overrightarrow{CA} = \mathbf{a} - \mathbf{c}$ or for $\frac{1}{5}\overrightarrow{AC}$ or $\overrightarrow{AO} + \overrightarrow{OC} + \frac{4}{5}\overrightarrow{CA}$	Allow e.g. $AO + OC$ or AC for $\overrightarrow{AC}$ This is for a correct route for $\overrightarrow{AP}$, dealing correctly with the ratio; condone a mix of notation, e.g. $-\mathbf{a} + \mathbf{c} + \frac{4}{5}CA$
22(a)(ii)	$\frac{1}{5}(4\mathbf{a} + \mathbf{c})$ or $\frac{4}{5}\mathbf{a} + \frac{1}{5}\mathbf{c}$	**1**	FT *their* **(a)(i)** + **a** simplified	*Their* **(a)(i)** must be in terms of **a** and/or **c** for this mark.

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Question	Answer	Marks	Partial Marks	Guidance
22(b)	For showing any two of $\overrightarrow{OQ}$, $\overrightarrow{OP}$ and $\overrightarrow{PQ}$ share a common factor, e.g. $\overrightarrow{OP} = \frac{1}{5}(4\mathbf{a} + \mathbf{c})$ **and** $\overrightarrow{OQ} = \frac{1}{4}(4\mathbf{a} + \mathbf{c})$	**B1**		Other pairs with common factors are acceptable, e.g. $\overrightarrow{PQ} = \frac{1}{5}(\mathbf{a} + \frac{1}{4}\mathbf{c})$ and $\overrightarrow{OP} = \frac{4}{5}\left(\mathbf{a} + \frac{1}{4}\mathbf{c}\right)$ $\overrightarrow{OQ} = \frac{1}{4}(4\mathbf{a} + \mathbf{c})$ and $\overrightarrow{PQ} = \frac{1}{20}(4\mathbf{a} + \mathbf{c})$ If factorisation not shown, allow two correct vectors in terms of **a** and **c** from $\overrightarrow{OP} = \frac{4}{5}\mathbf{a} + \frac{1}{5}\mathbf{c}$, $\overrightarrow{OQ} = \mathbf{a} + \frac{1}{4}\mathbf{c}$ $\overrightarrow{PQ} = \frac{1}{5}\mathbf{a} + \frac{1}{20}\mathbf{c}$ (which don't have to be simplified), followed by a correct relationship, e.g. $\overrightarrow{OQ} = \frac{5}{4}\overrightarrow{OP}$, $4\overrightarrow{OQ} = 5\overrightarrow{OP}$, $\overrightarrow{OQ} : \overrightarrow{OP} = 5 : 4$, $\frac{\overrightarrow{OQ}}{\overrightarrow{OP}} = \frac{5}{4}$ $\overrightarrow{PQ} = \frac{1}{4}\overrightarrow{OP}$, $4\overrightarrow{PQ} = \overrightarrow{OP}$, $\overrightarrow{PQ} : \overrightarrow{OP} = 1 : 4$, $\frac{\overrightarrow{PQ}}{\overrightarrow{OP}} = \frac{1}{4}$ $\overrightarrow{OQ} = 5\overrightarrow{PQ}$, $\frac{1}{5}\overrightarrow{OQ} = \overrightarrow{PQ}$, $\overrightarrow{OQ} : \overrightarrow{PQ} = 5 : 1$, $\frac{\overrightarrow{OQ}}{\overrightarrow{PQ}} = 5$ Allow without vector arrows for both B1 marks in **22(b)**.
22(b)	A correct conclusion e.g. $\overrightarrow{OQ}$ is a multiple of/is parallel to $\overrightarrow{OP}$ and they have a common point *O*, so collinear oe	**B1**		e.g. with common point *P* if $\overrightarrow{OP}$ and $\overrightarrow{PQ}$ used, or with common point *Q* if $\overrightarrow{OQ}$ and $\overrightarrow{PQ}$ used.

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Question	Answer	Marks	Partial Marks	Guidance
23(a)	–3	**3**	**B2** for $4x - 11$ isw or **B1** for $4x - k$ or $kx - 11$ or $4x - 11 + 12$ isw	Condone answer $-3x$ for B2 Do not allow answer $y = -3$ for 3 marks. Condone poor notation for derivative e.g. B2 for $y = 4x - 11$, $0 = 4x - 11$, $2 = 4x - 11$, similarly for B1
23(b)	$y = \frac{1}{3}x - \frac{8}{3}$ or $3y - x + 8 = 0$ oe	**4**	**B3** for $\frac{1}{3}x - \frac{8}{3}$ or $(y - -2) = \frac{1}{3}(x - 2)$ oe OR **B1** for $y = -2$ **M1** for gradient $= \frac{1}{3}$ or $-\frac{1}{their\,(a)}$ **M1** for substituting (2, – 2) or (2, *their* –2) into $y = (their\ m)x + c$ oe	For 4 marks, like terms must be collected. Allow equivalent fractions or exact decimals, e.g. $-2\frac{2}{3}$ or $-2.\dot{6}$, –2.6r for $-\frac{8}{3}$ but not rounded decimals such as 2.67, 0.333… oe e.g. B3 for $y = \frac{1}{3}x + -\frac{8}{3}$ Award B3 for $y = 0.333x - 2.67$. B1 may be implied by (2, –2) or $-2 = (their\ m)x + c$. This mark must be scored in part **(b)** workspace. If *their* (a) is kx, condone M1 for gradient $= -\frac{1}{their\ k}$. *their* –2 should be the result of evaluating $2(2)^2 - 11 \times 2 + 12$ ← this working may be seen in part **(a)**. oe e.g. $(y - (their\ -2)) = their\ m(x - 2)$, $their\ m = \frac{y - (their - 2)}{x - 2}$, *their m* cannot be *their* **(a)**

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Question	Answer	Marks	Partial Marks	Guidance
24	$\frac{3}{4}$ oe	**3**	**B2** for $2x + 1 = 2(2 - x)$ oe or **M1** for $49^{\frac{1}{2}(2x+1)}$ or for $7^{2(2-x)}$ or better or for equating *their* powers with a common base	oe e.g. $\frac{1}{2}(2x + 1) = 2 - x$ Allow $(7^2)^{2-x}$
25	(0.5, 5) and (3, –5)	**5**	**M2** for $2x^2 - 7x + 3$[= 0] oe three terms or **M1** for $7 - 4x = 4 + 3x - 2x^2$ oe or better **M1FT** for correct method to solve *their* three-term quadratic, e.g. factors, formula, completing the square $(2x - 1)(x - 3)$ [= 0] $\frac{-(-7)\pm\sqrt{(-7)^2-4\times2\times3}}{2\times2}$ oe **B1** for one correct pair of coordinates or two correct x-values or two correct y-values If B0 scored and at least 2 method marks awarded, **SC1** for correct substitution of both of *their* x-values into $y = 7 - 4x$ or $y = 4 + 3x - 2x^2$	Allow equivalent fractions for 0.5 e.g. $\frac{2}{4}$ $-2x^2 + 7x - 3$, allow in the form $2x^2 - 7x = -3$ if next step is completing the square. *their* three-term quadratic cannot be $4 + 3x - 2x^2$ for this M1 mark Condone partial factorisation, e.g. $2x(x - 3) - [1](x - 3)$, if followed by correct values of x. $2x - 1 = 0$ oe **and** $x - 3 = 0$ oe imply M1. oe e.g. $\frac{7\pm\sqrt{49-24}}{4}$, $\frac{7\pm\sqrt{25}}{4}$, $\frac{7\pm5}{4}$ Working must be shown for SC1 If eliminating x: **M2** for $y^2 - 25$ [= 0] oe two terms or **M1** for $y = 4 + 3\left(\frac{7-y}{4}\right) - 2\left(\frac{7-y}{4}\right)^2$ **M1** for correct method to solve *their* quadratic, e.g. factors, formula, completing the square B1 and SC1 equivalent steps to main scheme.

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