



Cambridge IGCSE™

CAMBRIDGE INTERNATIONAL MATHEMATICS

0607/21

Paper 2 (Extended)

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MARK SCHEME

Maximum Mark: 75

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.

This document consists of **16** printed pages.

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.

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.

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
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Accuracy mark awarded two
	Accuracy mark awarded three
	Independent mark awarded zero
	Independent mark awarded one
	Independent mark awarded two
	Independent mark awarded three
	Benefit of the doubt

Annotation	Meaning
	Communication mark
	Incorrect
	Follow through
Highlighter	Highlight a key point in the working
	Ignore subsequent work
	Method mark awarded zero
	Method mark awarded one
	Method mark awarded two
	Method mark awarded three
	Misread
	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.
	Premature rounding/approximation
	Special case
	Indicates that work/page has been seen

Annotation	Meaning
	Transcription error
	Correct
	Correct answer from incorrect working

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

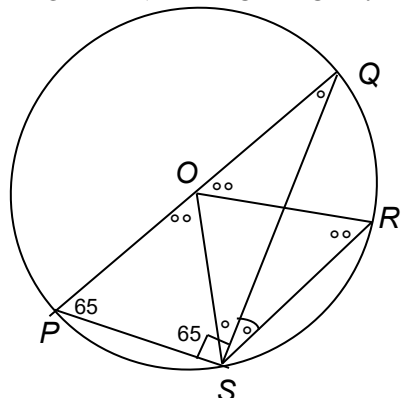
awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfwf	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks	Guidance															
1	$4\frac{3}{7}$ cao	1																	
2	$\frac{30}{100}$ oe final answer	1		e.g. $\frac{3}{10}$, $\frac{6}{20}$, $\frac{15}{50}$															
3	14	1		Allow ± 14 or -14															
4	5	2	M1 for $4 = 2W - 3 \times 2$ or better or $W = \frac{H + 3X}{2}$																
5	$\begin{pmatrix} 4 \\ 0 \end{pmatrix}$	2	B1 for answer $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 0 \end{pmatrix}$ or M1 for $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ seen If 0 scored SC1 for $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$	Do not allow fraction lines in vectors for the B1 or M1 mark. e.g. M1 for $\begin{pmatrix} 3+1 \\ -2+2 \end{pmatrix}$															
6	144	2	M1 for $\frac{360}{10}$ soi or $\frac{(10-2) \times 180}{10}$ oe	Alternative method $\frac{(2 \times 10 - 4) \times 90}{10}$															
7(a)(i)	<table border="1"> <tr> <td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr> <td>H</td><td>H1</td><td>H2</td><td>H3</td><td>H4</td></tr> <tr> <td>T</td><td>T1</td><td>T2</td><td>T3</td><td>T4</td></tr> </table>		1	2	3	4	H	H1	H2	H3	H4	T	T1	T2	T3	T4	1		
	1	2	3	4															
H	H1	H2	H3	H4															
T	T1	T2	T3	T4															

Question	Answer	Marks	Partial Marks	Guidance
7(a)(ii)	$\frac{2}{8}$ oe	2	M1 for working that would lead to $\frac{2}{8}$ oe or for $\frac{k}{8}$ or $\frac{2}{n}$ as final answer or $\frac{k}{8}$ or $\frac{2}{n}$ seen and then cancelled down to give their final answer k is a positive integer $1 \leq k \leq 7$, $k \neq 2$ n is a positive integer $3 \leq n \leq 14$, $n \neq 8$	In all parts ISW attempts to cancel or change form after correct answer seen. Only accept fraction, percentage and decimal equivalents (3 sf or better). Do not accept ratio, e.g. not 2 to 8.
7(b)	$\frac{64}{125}$ oe	2	M1 for $\left(1 - \frac{1}{5}\right)^3$ oe	0.512 or 51.2% scores 2 marks
7(c)	$\frac{18}{42}$ oe	3	M2 for $\frac{4}{7} \times \frac{3}{6} + \frac{3}{7} \times \frac{2}{6}$ oe or M1 for $\frac{4}{7} \times \frac{3}{6}$ or $\frac{3}{7} \times \frac{2}{6}$ or better OR M2 for $1 - \left(\frac{4}{7} \times \frac{3}{6} + \frac{3}{7} \times \frac{4}{6}\right)$ oe or M1 for $\frac{4}{7} \times \frac{3}{6}$ or $\frac{3}{7} \times \frac{4}{6}$ or better If 0 scored SC1 for answer $\frac{25}{49}$	M1 accept either part multiplied by something else or as part of a longer product Accept $\frac{12}{42}$ or $\frac{6}{42}$ for M1 M1 possibly implied by $\frac{2}{7}$ or $\frac{1}{7}$

Question	Answer	Marks	Partial Marks	Guidance
8	[gradient] $\frac{1}{4}$ oe [y – intercept] 3	3	B2 for one correct or M1 for rearrangement to $4y = x + 12$ or better If 0 scored, SC1 for gradient $\frac{x}{4}$ or for y-intercept (0, 3)	e.g. 0.25
9	$8 - 2x - x^2$ final answer	2	B1 for $8 - 4x + 2x - x^2$ with at least three terms correct	$-2x$ is two terms
10(a)	$\frac{11}{2}$ or 5.5	3	M1 for correct first step e.g. $10n - 15 = 40$ or $2n - 3 = 8$ M1FT for a correct second step e.g. $10n = 40 + 15$ or $2n = 8 + 3$	$\frac{55}{10}$ then 5.5 on answer line scores 3 5.5 then $\frac{55}{10}$ on answer line scores 2 FT is from $ax + b = c$ to $ax = d$
10(b)	$x = 4$ $y = 2$	3	M1 for correct method to eliminate one variable A1 for $x = 4$ A1 for $y = 2$ If M0 or M1A0 scored, SC1 for two non-zero values satisfying one of the original equations	Allow one arithmetic error in elimination method. M1 for $11kx = 44k$ or $11my = 22m$ If using substitution method M1 , no errors allowed. e.g. M1 for $5(8 - 2y) - y = 18$ oe or $x + 2(5x - 18) = 8$ oe

Question	Answer	Marks	Partial Marks	Guidance
10(c)	$n > 9$ final answer	2	M1 for $17 + 10 < 5n - 2n$ oe or better	$9 < n$ scores 2 marks $n \geq 10$ scores 0 unless M1 seen. Allow for M1 $17 + 10 * 5n - 2n$ or $n * 9$ where * is $<$, $\leq$, $=$, $\geq$
11	$3\pi + 12$ or $3(\pi + 4)$ final answer	2	M1 for $\frac{1}{4} \times 2 \times \pi \times 6 [+k]$ oe	$3\pi + 12 = 15\pi$ scores M1 only k is a numerical value and does not contain π .
12	Translation $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$	2	B1 for each	More than one transformation scores 0. Extra properties count as choice. But allow translate and e.g. move, as this is ONE transformation. Do not accept a fraction line in the vector. Accept the vector in words e.g. 2 units to the right e.g. 2 parallel to the x -axis in the positive x -direction do not accept e.g. 2 units parallel to the x -axis (as no direction given) If vector is given as vector and in words, both must be correct.

Question	Answer	Marks	Partial Marks	Guidance
13(a)	103° opposite angles in a cyclic quadrilateral add to 180°	2	B1 for each	opposite angles in a cyclic quadrilateral add to 180° accept quad for quadrilateral accept cyclical for cyclic accept total, sum for add. accept supplementary for add to 180 allow unambiguous spelling e.g. siclic. do not accept ‘make together’ do not accept e.g. $A + C = 180$ unless with complete geometrical reason do not accept e.g. quadrilateral in a circle
13(b)	80	3	Considering diagram: B2 for angle of 80 correct at SOR seen on diagram or B2 for angle of 50 identified correctly for : POS, ROQ, OSR or ORS with no errors for these four angles. or B1 for any correct angle identified	1 dot 25° 2 dots 50° Possible angles are $PQS = 25$, $OSQ = 25$, $POS = 50$, $ROQ = 50$, $OSR = 50$, $ORS = 50$, $OSP = 65$, $OPS = 65$, $PSQ = 90$. (allow right angle symbol) 

Question	Answer	Marks	Partial Marks	Guidance
14	$\frac{1}{9}$	2	B1 for 9^{-1} or $\frac{1}{3^2}$ or 3^{-2} or $\frac{1}{27^{\frac{2}{3}}}$ or $729^{-\frac{1}{3}}$ or $\sqrt[3]{\frac{1}{729}}$ seen	ISW any decimal conversion
15(a)	2.04×10^4	1		ignore trailing zeros
15(b)	4.51×10^{16}	2	B1 for figs 451 or M1 for 42×10^{15} and 3.1×10^{15} or 4.2×10^{16} and 0.31×10^{16} soi	ignore trailing zeros
16	$7\sqrt{3}$ final answer	3	B2 for two of $5\sqrt{3}$, $4\sqrt{3}$, $2\sqrt{3}$ correct or B1 for one correct	Note $4\sqrt{3} - 2\sqrt{3} = 2\sqrt{3}$ scores B2
17	$8x^2y^4$ final answer	2	B1 for two correct terms kx^2y^4 or $8x^ky^4$ or $8x^2y^k$ in final answer	y^k may be written as eg y^2y^3 for B1 similar for k and x Note: $2^3x^2y^4$ scores B1
18	3	1		
19	4	2	M1 for $3^{12-n} = 3^{2n}$ or $3^{12} = 3^{2n+n}$ seen or implied	e.g. $12 = 3n$ or $12 - n = 2n$ Do not allow any misreads
20(a)	$4\sqrt{10}$ or $\sqrt{160}$ final answer	3	M2 for $(-4-8)^2 + (3-(-1))^2$ or $(8-(-4))^2 + (-1-3)^2$ oe soi by $(-12)^2 + 4^2$ or M1 for $(-1-3)$ or $(3-(-1))$ or $(8-(-4))$ or $(-4-8)$	Do NOT condone omission of brackets (unless recovered). 160 implies M2 144 implies M1 12 or -12 or 16 may imply M1 but not if from wrong working (recovery from poor brackets is not wrong working)

Question	Answer	Marks	Partial Marks	Guidance
20(b)	$y = 3x - 5$ final answer	5	B1 for (2, 1) soi M1 for gradient $= \frac{3 - -1}{-4 - 8}$ oe M1 for perpendicular gradient $= -\frac{1}{\text{their } (-\frac{1}{3})} = m$ M1 for correct substitution soi $(\text{their } 1) = (\text{their } m) \times (\text{their } 2) + c$ oe	Accept e.g. $\frac{12}{4}$ for 3 Allow 2, 1, $x = 2, y = 1, \frac{2}{1}$ for 2 $= -\frac{1}{3}$ Possibly implied by $m = 3$ $\text{their } -\frac{1}{3}$ is not <i>their</i> length from part (a) <i>their</i> midpoint is not $(-4, 3)$ or $(8, -1)$ <i>their</i> m is not gradient of AB

Question	Answer	Marks	Partial Marks	Guidance
21(a)	$\frac{-5x^2 + 17x + 2}{(x-3)(x+1)}$ or $\frac{-5x^2 + 17x + 2}{x^2 - 2x - 3}$ final answer	3	M1 for $2(x+1) - 5x(x-3)$ oe or better B1 for correct denominator ISW	$\frac{2(x+1) - 5x(x-3)}{(x+1)(x-3)}$ scores M1B1 $\frac{2(x+1)}{(x+1)(x-3)} - \frac{5x(x-3)}{(x+1)(x-3)}$ scores M1B1 $\frac{2(x+1)}{(x-3)} - \frac{5x(x-3)}{(x+1)}$ scores M1B0 $\frac{2x+2-5x^2-15x}{(x-3)(x+1)}$ scores M0B1 , if no previous correct working earlier $\frac{2}{x-3} \times x+1 - \frac{5x}{x+1} \times x-3$ scores 0 unless recovered $\frac{2}{x-3} \times (x+1) - \frac{5x}{x+1} \times (x-3)$ scores M1B0
21(b)	$\frac{2x+3}{x+4}$ final answer	4	B1 for $(2x-3)(2x+3)$ seen B2 for $(2x-3)(x+4)$ seen or M1 for $(2x+a)(x+b)$ where $ab = -12$ or $2b+a=5$	
22	120 and 240 cao	3	B2 for 120 or 240 or B1 for 60 or M1 for $\cos w = -\frac{1}{2}$ if 0 scored, SC1 for two angles with sum of 360	Do not allow 60 within a list or table unless clearly identified. not multiples of 90

Question	Answer	Marks	Partial Marks	Guidance
23	$(13x)^2 - (5x)^2$	M2	M1 for $(13x)^2 = (5x)^2 + h^2$	Attempt at Pythagoras Accept other letters for h If brackets are missing, can score M1, but does not score M2 unless recovered by further working. M2 for 12 as from 5,12,13 M2 for $169x^2 - 25x^2$ or for $144x^2$ or for $13^2 - 5^2$ or 144 M1 for $(13x)^2 + (5x)^2$ or for $13x^2 = 5x^2 + h^2$ or for $13x^2 + 5x^2$
	12x	A1		12x scores M2A1 as a known Pythagorean triple
	$\frac{1}{3}\pi \times (5x)^2 \times \text{their}(12x) = \frac{4}{3}\pi r^3$	M1	<i>their</i> 12x is dependent on scoring earlier at least M1	The two expressions must be seen in full and equated for the M1 mark. Accept $\frac{1}{3}\pi \times 25x^2 \times 12x = \frac{4}{3}\pi r^3$ Missing brackets can be recovered, but then A0 $100x^3$ without prior steps does not imply LHS. Could be done in stages.
	Correct work leading to $r^3 = 75x^3$	A1		Must be convinced, with at least one line of intermediate working, and no errors seen (after the first three marks) as answer given. Condone π as 3.14, 3.142 or $\frac{22}{7}$ for M1, but only scores A1 if correctly cancelled.