Cambridge IGCSE™

MATHEMATICS	**1521/42**
Paper 4 (Extended)	**May/June 2021**
MARK SCHEME	
Maximum Mark: 130	

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
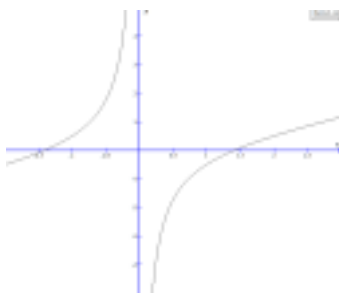

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

	Maths-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, 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 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 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.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answers	Marks	Partial Marks
1(a)(i)	9.25 cao	2	**B1** for 4 or for 9.25 seen
1(a)(ii)	$24 + 3 \times (8 - 3) + 6 \times 8 + 37 = 124$	3	with no errors seen **M1** for $24 + 3 \times (8 - 3)$ seen **M1** for 6×8 seen If 0 scored, **SC1** for 48 and 39 seen
1(a)(iii)	7	2	**M1** for $800 \div 124$ oe
1(b)	138	2	**M1** for $345 \div (5 + 4 + 6)$ oe
1(c)	120	2	**M1** for $350 + 5$ oe or $240 - 5$ oe seen
2(a)	28[.0…]	3	**M2** for $[\sin =] \dfrac{15 \times \sin 104}{31}$ oe or **M1** for $\dfrac{\sin[MCB]}{15} = \dfrac{\sin 104}{31}$ oe
2(b)	20.5 or 20.45[…]	4	**B1** for $[ABM =]$ 76 **M2** for $\sqrt{15^2 + 18^2 - 2 \times 15 \times 18 \times \cos(180 - 104)}$ OR **M1** for $15^2 + 18^2 - 2 \times 15 \times 18 \times \cos(180 - 104)$ oe **A1** for 418 or 418.3 to 418.4
2(c)	304 or 303.68 to 303.8	3	**M2** for $\frac{1}{2} \times 15 \times 18 \times \sin 76 + \frac{1}{2} \times 15 \times 31 \times \sin(180 - 104 - their28)$ oe or **M1** for $\frac{1}{2} \times 15 \times 18 \times \sin 76$ oe or $\frac{1}{2} \times 15 \times 31 \times \sin(180 - 104 - their28)$ oe
3(a)(i)	$(3, -2)$	2	**B1** for each

Question	Answers	Marks	Partial Marks
3(a)(ii)	14.4 or 14.42…	3	**M2** for $(7--1)^2+(-8-4)^2$ oe or **M1** for $7--1$ oe or $-8-4$ oe seen or for $-1-7$ oe or $4--8$ oe seen
3(a)(iii)	$y=\dfrac{2}{3}x-2$ oe final answer	4	**M1** for gradient of $AB=\dfrac{4--8}{-1-7}$ oe **M1** for perp gradient $=-\dfrac{1}{their\ (-\dfrac{12}{8})}$ **M1** for (9, 4) substituted into $y=(their\ m)x+c$ oe soi
3(b)	$-\dfrac{3}{4}s+\dfrac{7}{4}t$ oe	3	**M2** for $\overrightarrow{PX}=\dfrac{7}{4}(t-s)$ oe or $\overrightarrow{QX}=\dfrac{3}{4}(t-s)$ oe or **M1** for $PQ=t-s$ oe or for a correct route for OX or for $QX=\dfrac{3}{4}$ *their PQ* or for $PX=\dfrac{7}{4}$ *their PQ*
4(a)	0.5 4.9 – 4.9 – 0.5	3	**B2** for 3 correct or **B1** for 2 correct
4(b)	Correct curve 	5	**B3FT** for 9 or 10 points correctly plotted or **B2FT** for 7 or 8 points correctly plotted or **B1FT** for 5 or 6 points correctly plotted **B1** for one branch on each side of the *y*-axis and **not touching** the *y*-axis OR **SC4** for correct curve with branches joined
4(c)	0.24 to 0.35	1	
4(d)(i)	Correct ruled line	2	**M1** for line with negative gradient through origin or for a line with negative gradient with one correctly plotted point that lies on the correct line ± 1mm
4(d)(ii)	– 0.7 to – 0.65 0.65 to 0.7	2	**B1** for each
4(d)(iii)	$[y=]-\dfrac{5x}{3}$ oe final answer	2	**M1** for $y+\dfrac{5}{3}x=0$ or $3y=-5x$ oe

Question	Answers	Marks	Partial Marks
4(d)(iv)	13 with algebra used	3	**M1** for $\frac{x}{2} - \frac{1}{x} = their$ **(d)(iii)** or better **M1** for *their* fractions cleared $\qquad 3x^2 - 6 = -10x^2$ or better or for collecting terms correctly $\frac{10x + 3x}{6} = \frac{1}{x}$ FT *their* **(d)(iii)**
5(a)(i)	0.625 oe	1	
5(a)(ii)	240	3	**M2** for ½(54 + 42) × 5 oe or **M1** for one relevant area
5(b)	6 nfww	4	**M3** for ½ (35 + 45) × v = *their* 240 oe or better or **M2** for ½ (35 + 45) × v oe or **M1** for one relevant area
6(a)(i)	2820 or 2817 or 2818	2	**M1** for $25000 \times \left(1 - \frac{18}{100}\right)^{11}$ oe
6(a)(ii)	17	2	**M1** for 2 trials evaluated where $n > 11$ or for answer 16[.2…] or for 856.5 to 857 seen If 0 scored, **SC1** for 17 seen with answer 6
6(b)	19.54 cao	3	**M1** for 469 ÷ 0.9046 or 538 × 0.9046 **A1** for 19.5 or 19.53….
6(c)	325	3	**M2** for $273 \div \left(1 - \frac{16}{100}\right)$ oe or **M1** for (100 – 16) [%] oe associated with 273 seen
7(a)(i)	5.12 or 5.118 to 5.119 nfww	4	**M1** for 0.5, 2, 4, 6.5, 9 soi **M1** for Σfm with m's in intervals including boundaries **M1** (dep on 2nd **M1**) for *their* Σfm ÷ 800
7(a)(ii)	Correct histogram	3	**B1** for each correct block If 0 scored, **SC1** for two of the correct frequency densities soi 83, 97, 69
7(b)(i)(a)	4	1	
7(b)(i)(b)	3.2[0]	2	**B1** for 5.6 or 2.4 seen
7(b)(i)(c)	6	2	**B1** for 54 written

Question	Answers	Marks	Partial Marks
7(b)(ii)(a)	16 27 9 3	**2**	**B1** for 2 or 3 correct
7(b)(ii)(b)	$\dfrac{2}{45}$ oe nfww	**3**	**M2** for $\dfrac{their(9+3)}{55} \times \dfrac{their(9+3)-1}{54}$ oe or **M1** for $\dfrac{their(9+3)}{55}$ oe or $\dfrac{their(9+3)-1}{54}$ oe seen If 0 scored, **SC1** for $\left(\dfrac{their(9+3)}{60} \times \dfrac{their(9+3-1)}{59} \right)$ oe
8(a)(i)	angle between radius and tangent	**1**	
8(a)(ii)	30	**1**	
8(b)	8.66[0…]	**3**	**M2** for $5 \div \tan(\ their\ \textbf{(a)(ii)})$ oe or $\sqrt{10^2 - 5^2}$ or **M1** for $\dfrac{5}{AM} = \tan(their\textbf{(a)(ii)})$ oe or $AM^2 + 5^2 = 10^2$
8(c)	17.1 or 17.11 to 17.12…	**4**	**M3** for $(6 \times \frac{1}{2} \times their\ \textbf{(b)} \times 5 - \pi \times 5^2) \div 3$ oe or $their\ \textbf{(b)} \times 5 - \dfrac{120}{360} \times \pi \times 5^2$ oe or **M2** for $6 \times \frac{1}{2} \times their\ \textbf{(b)} \times 5 - \pi \times 5^2$ oe or $\dfrac{120}{360} \times \pi \times 5^2$ or $2 \times \frac{1}{2} \times their\ \textbf{(b)} \times 5$ oe isw or $\frac{1}{2} \times (their\ OA)^2 \times \sin 120$ oe isw or **M1** for $\left[\dfrac{k}{360} \times \right] \pi \times 5^2$ isw or $\frac{1}{2} \times their\ \textbf{(b)} \times 5$ oe isw or $\frac{1}{2} \times (2 \times their\ \textbf{(b)})^2 \times \sin 60$ oe isw
8(d)	27.8 or 27.79[...]	**3**	**M2** for $2 \times their\ \textbf{(b)} + \dfrac{120}{360} \times 2\pi \times 5$ oe or **M1** for $\dfrac{120}{360} \times 2\pi \times 5$ oe isw or $2 \times their\ \textbf{(b)} + \dfrac{k}{360} \times 2\pi \times 5$ oe
9(a)(i)	*BXC* oe	**1**	
	[Vertically] opposite [angles]	**1**	

Question	Answers	Marks	Partial Marks
9(a)(ii)	*XBC* oe	1	
	[Angles in the] same segment oe	1	
9(a)(iii)	Similar	1	
9(a)(iv)	6.9	2	**M1** for $\dfrac{4.6}{CX}=\dfrac{1.6}{2.4}$ oe
9(a)(v)	3.2	2	**M1** for $\left(\dfrac{1.6}{2.4}\right)^2$ or $\left(\dfrac{2.4}{1.6}\right)^2$ or $\left(\dfrac{their\ 6.9}{4.6}\right)^2$ or $\left(\dfrac{4.6}{their\ 6.9}\right)^2$ or $\sqrt{\dfrac{7.2}{x}}=\dfrac{2.4}{1.6}$ oe
9(b)	16	3	**M2** for $12\times\sqrt[3]{\dfrac{448}{189}}$ oe or **M1** for $\sqrt[3]{\dfrac{448}{189}}$ or $\sqrt[3]{\dfrac{189}{448}}$ or $\left(\dfrac{h}{12}\right)^3=\dfrac{448}{189}$ oe
10(a)	$3 \times 12 \times 4$	**M1**	
	$\times 60 \times 60$ oe [= 518 400]	**M1**	
10(b)	650	4	**M3** for $\dfrac{5\times12\times18\times3600-518\,400}{518\,400}\times100$ oe or **M2** for $\dfrac{5\times12\times18\times3600}{518\,400}\times100$ oe or $\dfrac{5\times12\times18\times3600-518\,400}{518\,400}$ oe or **M1** for $5 \times 12 \times 18$ [$\times 3600$] or better seen
10(c)	6.42 or 6.422 to 6.423	4	**B3** for answer 642 or 642.2 to 642.3 OR **M3** for $\dfrac{1}{100}\sqrt{\dfrac{518\,400}{0.4\times\pi}}$ oe or **M2** for [$r^2 =$] $\dfrac{\text{figs }5184}{\text{figs }4\times\pi}$ oe or **M1** for figs $4 \times \pi\, r^2$ = figs 5184 oe If 0 scored, **SC2** for answer 2.2[0…] or **SC1** for answer 220[. …]

Question	Answers	Marks	Partial Marks
11(a)	(0, 0) (3, 20.25) oe (6, 0)	6	**M2** for $x^3 - 9x^2 + 18x$ isw or **M1** for two correct of $x^3, -9x^2$ and $+18x$ seen isw **M1** for *their* derivative $= 0$ or $\dfrac{dy}{dx} = 0$ **B2** for [$x =$]0, 3, 6 or for (3, 20.25) and (6, 0) or **M1dep** for $x(x-3)(x-6)$ oe FT *their* $ax^3 + bx^2 + cx$ [$= 0$] dep on at least M1M1
11(b)	(0, 0) minimum with correct reasoning (3, 20.25) oe maximum with correct reasoning (6, 0) minimum with correct reasoning	4	**B3** for 2 correct with correct reasoning or **B2** for 1 correct with correct reasoning or **B2FT** for correct evaluation with correct 2nd derivative for all three of *their* different x values or **M1** for showing [2nd derivative =] $3x^2 - 18x + 18$ or evaluates correctly values of y on both sides of one correct stationary point or gradients for one value on either side of one correct stationary point or reasonable sketch If 0 scored, **SC1** for all correct with no reasoning