Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2022**

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.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **13** printed pages.

© UCLES 2022

PUBLISHED

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).

© UCLES 2022

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.

© UCLES 2022

PUBLISHED

ABBREVIATIONS IN MARK SCHEME

Abbreviation	Meaning
M	Method marks - for a correct method applied to appropriate numbers.
A	Accuracy marks – depend on M marks. Hence M0 A1 is not possible.
B	Independent of method marks – for a correct final answer, a partially correct answer or a correct intermediate stage.
SC	Marks given in special cases only when indicated in mark scheme.
FT	Work can be followed through after an error.
isw	Ignore subsequent working (after correct answer obtained)
cao	Correct answer only
nfww	Not from wrong working
oe	Or equivalent
soi	Seen or implied
eeo	Each error or omission
dep	Dependent on the previous mark(s)

© UCLES 2022

Question	Answer	Marks	Partial Marks
1(a)(i)	1 | 7 7 8 8 9 9 2 | 1 1 1 1 2 3 3 4 5	**2**	**B1** for one row correctly ordered or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission
1(a)(ii)	21	**1**	
1(a)(iii)	23	**1**	
1(a)(iv)	48	**2**	**M1** for $\frac{2}{15}[\times 360]$ or $\frac{360}{15}[\times 2]$
1(b)(i)	120	**1**	
1(b)(ii)	130	**1**	
1(b)(iii)	60	**1**	
1(c)(i)	93.4	**4**	**M1** for mid-values soi **M1** for Σfx **M1 dep on second M** for $\Sigma fx \div 200$
1(c)(ii)	19	**2**	**M1** for $\frac{86}{50}$ or $\frac{114}{60}$

Question	Answer	Marks	Partial Marks
2(a)	42	**2**	**M1** for $12 \div 2$ or better
2(b)(i)	5.72	**2**	**M1** for $\frac{100-12}{100} \times 6.50$ oe or **B1** for 0.88 oe
2(b)(ii)	12.5[0]	**2**	**M1** for $\frac{100-12}{100} \times x = 11$ or better oe

Question	Answer	Marks	Partial Marks
2(c)	4	**2**	**M1** for $\frac{100+2.5}{100}\times[...]=\frac{100+6.6}{100}$ oe
2(d)(i)	72.3 or 72.31...	**2**	**M1** for $80\times\left(\frac{100-2}{100}\right)^5$ oe
2(d)(ii)	4 nfww	**3**	**B2** for answer 9 nfww or **M2** for correct trials with values giving either side of 67 or **M1** for $80\times\left(\frac{100-2}{100}\right)^n=67$ or $their(i)\times\left(\frac{100-2}{100}\right)^k=67$ or an evaluated trial with $n \geqslant 6$ or $k \geqslant 1$

Question	Answer	Marks	Partial Marks
3(a)(i)	6	**3**	**B2** for $4x + 6 = 30$ or better or **M1** for $x + x + 7 + 2x - 1$ [= 30]
3(a)(ii)	21	**3**	**M2** for (555 – *their* $x \times 15$ – *their* $(x + 7) \times 18) \div$ *their* $(2x - 1)$ or **M1** for *their* $x \times 15$ or *their* $(x + 7) \times 18$
3(b)(i)	8	**2**	**M1** for isolating the term in w or correctly removing all fractions e.g. $\frac{3w}{16}=1+\frac{1}{2}$ or better or 3w – 16 = 8
3(b)(ii)	–3	**2**	**M1** for $2^{-y}=8$ or $2^{y}=\frac{1}{8}$ or $2^{-y}=their\,w$ or better

Question	Answer	Marks	Partial Marks
3(c)(i)	$[p =] \frac{1}{2}$ oe $[q =] 1$	**2**	**B1** for each If zero scored, **SC1** for 2 values satisfying one of the original equations
3(c)(ii)	$[u =]$ 30 and 150 $[v =]$ 0 and 360	**4**	**B1** for each OR **SC1** for $\sin u$ = *their p* and $\cos v$ = *their q* **SC1** if their two different angles for u sum to 180 or if their different two angles for v sum to 360

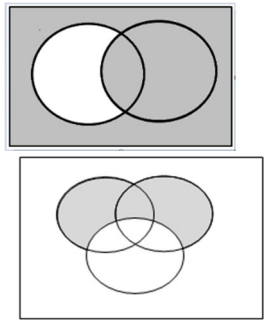
Question	Answer	Marks	Partial Marks
4(a)(i)	3	**1**	
4(a)(ii)	7	**1**	**FT** *their* (i) 3×*their* (i) –2
4(b)	$\frac{x+2}{3}$ oe final answer	**2**	**M1** for $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$ or $x = 3y - 2$
4(c)	25	**2**	**M1** for $\frac{1}{x} = 5^{-2}$ oe
4(d)	$\frac{2x^2 - x - 1}{x}$ final answer	**2**	**M1** for $2x - 1 - \frac{1}{x}$
4(e)	2.98×10^{17} or $2.980... \times 10^{17}$	**1**	
4(f)	625	**2**	**M1** for x = j(4)

Question	Answer	Marks	Partial Marks
5(a)(i)(a)	$\frac{(8-2)\times 180}{8\times 2}$ oe	**M2**	**M1** for $\frac{(8-2)\times 180}{8}$ or $\frac{360}{8}$ or $\frac{(2\times 8-4)\times 90}{8}$
5(a)(i)(b)	174 or 173.8....	**4**	**M3** for $\frac{1}{2}\times 6\times OM$ oe or $\frac{1}{2}\times (OA)^2\times \sin 45$ oe or $\frac{1}{2}\times 6\times OA\times sin67.5$ oe where OA and OM are as in the **M2** or **M2** for $OM = 3\times \tan 67.5$ oe or for $OA = \left(\frac{3}{cos67.5}\right)$ or $\frac{6\times sin67.5}{sin45}$ oe or **M1** for $\frac{OM}{3} = \tan 67.5$ oe or for $\frac{3}{OA} = cos67.5$ oe or for $\frac{sin45}{6} = \frac{sin67.5}{OA}$ oe
5(a)(ii)	193 or 193.0 to 193.1	**3**	**M2** for $\pi\times\left(\frac{3}{cos67.5}\right)^2$ oe or **M1** for $\frac{3}{r} = cos67.5$ or $\frac{sin45}{6} = \frac{sin67.5}{r}$

Question	Answer	Marks	Partial Marks
5(b)(i)	1.27 or 1.272 to 1.273	**2**	**M1** for $\left[\frac{1}{2}\times\right]\pi\times0.45^2\times4$ or $\frac{1}{2}\times\pi\times0.45^2[\times4]$
5(b)(ii)	742 or 743	**6**	**M5** for a method leading to the volume of water e.g. $4\times\{2\times\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ $-\frac{1}{2}\times0.45^2\times\sin\left(2invcos\left(\frac{0.15}{0.45}\right)\right)\}$ oe **OR** **M2** $[2\times]\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or $[2\times]\frac{90-invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or **M1** for use of $\frac{\theta}{360}\times\pi\times0.45^2$ oe **M2** for $\frac{1}{2}\times0.45^2\times\sin\left(2invcos\left(\frac{0.15}{0.45}\right)\right)$ oe or $\frac{1}{2}\times0.15\times0.45\times\sin\left(invcos\left(\frac{0.15}{0.45}\right)\right)[\times2]$ oe

Question	Answer	Marks	Partial Marks
5(b)(ii)			**or M1 for use of** $\frac{1}{2}\times 0.45^2$ **× sinθ oe** **or** $[2\times]\frac{1}{2}\times 0.15\times 0.45\times \sin\beta$ **oe** **If 0 scored,** **SC1 for *inv*cos** $\left(\frac{0.15}{0.45}\right)$ **or *inv*sin** $\left(\frac{0.15}{0.45}\right)$ **or** $\sqrt{0.45^2-0.15^2}$ **soi**
6(a)(i)	–3	**1**	
6(a)(ii)	–1 1.55 to 1.6 4.4 to 4.45	**3**	**B1** for each
6(a)(iii)	–8	**1**	
6(a)(iv)	Ruled line through origin intersecting curve once	**2**	**B1** for ruled line through origin
6(b)(i)	18	**3**	**B2** for $6x - 12$ or **B1** for $6x$ or -12
6(b)(ii)	(2, –5)	**2**	**B1** for each. If 0 scored, **M1** for *their* $6x - 12 = 0$ or states $\frac{dy}{dx} = 0$
6(c)	[p =] 7 [q =] 3	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
7(a)	39.6 or 39.57....	**4**	**M2** for [cos =] $\frac{14^2+12^2-9^2}{2\times14\times12}$ or **M1** for $9^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \times \cos ACD$ **A1** for 0.7708... or 0.771 or $\frac{37}{48}$ oe
7(b)	$\frac{14\sin 25}{\sin 123}$	**M2**	**M1** for $\frac{\sin 123}{14} = \frac{\sin 25}{BC}$ oe
	7.054…	**A1**	
7(c)	3.74 or 3.735 to 3.739	**3**	**M2** for $7.05 \times \sin 32$ or **M1** for recognition that the line from B is perpendicular to AC
7(d)	11.8 or 11.83 to 11.85	**4**	**M1** for $32 + \textit{their}(a)$ soi **M2** for $12^2 + 7.05^2 - 2\times12\times7.05\times\cos(\textit{their}(a)+32)$ or **M1** for $\cos(\textit{their}(a)+32) = \frac{12^2+7.05^2-BD^2}{2\times12\times7.05}$
7(e)	309.6 or 309.57...	**2**	**FT** 270 + *their(a)* **M1** for 270 + *their(a)* oe

Question	Answer	Marks	Partial Marks
8(a)(i)	$A \cap B$	**1**	
8(a)(ii)		**2**	**B1** for each
8(b)(i)	$\frac{9}{11}$	**1**	
8(b)(ii)	$\frac{36}{121}$ oe	**3**	**M2** for $2 \times \frac{2}{11} \times \frac{9}{11}$ oe or **M1** for $\frac{2}{11} \times \frac{9}{11}$ oe If 0 scored **SC1** for $\frac{36}{110}$
8(c)(i)	3, 5, 28, 14 correctly placed	**2**	**B1** for 28 in the intersection
8(c)(ii)	$\frac{28}{50}$ oe	**1**	**FT** *their* 28 where *their* $28 < 50$
8(c)(iii)	$\frac{123}{175}$ oe	**2**	**M1** for $\frac{42}{50} \times \frac{41}{49}$
8(c)(iv)	$\frac{63}{88}$ oe	**2**	FT *their* 28 **M1** for $\frac{their28}{33} \times \frac{their28-1}{32}$

© UCLES 2022

Question	Answer	Marks	Partial Marks
9(a)	$x^2 - x - 30[= 0]$	**B3**	**M1** for $(2x+1)(x-1) - x^2 = 29$ oe **B1** for $(2x+1)(x-1) = 2x^2 - 2x + x - 1$ oe soi
	$(x-6)(x+5)$ oe	**M1**	or correct factors for *their* 3 term quadratic equation or for correct substitution into quadratic formula or correctly completing the square for *their* 3 term quadratic equation
	$x = 6$ cao	**B1**	
	12 or 2 × *their x* evaluated or $k = 2x$ stated	**B1 FT**	
9(b)(i)	$(y+1)^3 - y^3 = 5$ oe	**M1**	
	$(y+1)^3 = y^3 + 3y^2 + 3y + 1$ soi	**B2**	**B1** for $(y+1)^2 = y^2 + y + y + 1$ oe soi
	Completion to $3y^2 + 3y - 4 = 0$	**A1**	With no errors or omissions
9(b)(ii)	$\frac{-3 \pm \sqrt{3^2 - 4(3)(-4)}}{2 \times 3}$	**B2**	or **B1** for $\sqrt{3^2 - 4(3)(-4)}$ or for $\frac{-3+\sqrt{...}}{2\times 3}$ or $\frac{-3-\sqrt{...}}{2\times 3}$
	0.44	**B2**	**B1** for 0.758 or 0.7583...

© UCLES 2022