CAMBRIDGE
International Education

Cambridge IGCSE™

MATHEMATICS **0580/42**

Paper 4 (Extended) **February/March 2024**

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 February/March 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **11** 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 descriptions 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.

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.

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	Answer	Marks	Partial Marks
1(a)	8.24 cao	**2**	**M1** for $3\times1.04+4\times1.28$
1(b)(i)	32	**2**	**M1** for $\frac{8}{11+8+6}[\times100]$ oe
1(b)(ii)	360	**2**	**M1** for $\frac{1500}{11+8+6}\times k$ where k = 1 , 11, 8 or 6
1(b)(iii)	270	**1**	**FT** 0.75 × *their* 360
1(b)(iv)	1.25 cao	**2**	**M1** for $x\times\left(1-\frac{8}{100}\right)=1.15$ oe or better
1(c)	140 nfww	**3**	**M2** for $\frac{620 \text{ to } 640}{5-0.5}$ or $\frac{620+10}{4 \text{ to } 5}$ oe or **M1** for 620 +10 oe or 620 – 10 oe or 5 + 0.5 oe or 5 – 0.5 oe seen
2(a)	$y+\text{angle } BCD=180$ oe AND angles on a straight line AND $x+\text{angle } BCD=180$ oe AND opposite angles of a cyclic quadrilateral are supplementary OR angles in opposite segments are supplementary leading to $x = y$ with no errors	**B2**	**B1** for angles on a straight line OR opposite angles of a cyclic quadrilateral are supplementary OR angles in opposite segments are supplementary

Question	Answer	Marks	Partial Marks
2(b)	Allow any two statements from: CXD is common angle or angle AXB = angle CXD $x = y$ or angle BAX = angle DCX angle ABX = angle CDX	**M1**	
	States all three equal pairs of angles OR 2/all angles equal so triangles similar	**A1**	
2(c)(i)	6 nfww	**3**	**B2** for $BX = 18$ nfww or **M2** for $\frac{24}{12} = \frac{BC+12}{9}$ oe or **M1** for $\frac{24}{12} = \frac{BX}{9}$ oe If 0 scored, **SC1** for answer 18
2(c)(ii)	4	**1**	
3(a)(i)	5	**1**	
3(a)(ii)	16.8	**3**	**M1** for 15 × 4 + 16 [× 1] + 17 × 2 + 18 [× 1] [+ 19 × 0] + 20 × 2 oe **M1** dep on previous M1 for *their* $\Sigma fx \div 10$
3(a)(iii)	16.5	**1**	
3(a)(iv)	15	**1**	
3(b)	21	**3**	**M2** for 8×17.5 and 7×17 oe or **M1** for 7×17 or 8×17.5 oe seen
3(c)	5 correct blocks, with correct widths, heights 0.8cm, 1.8cm 7cm, 4cm, 1cm	**4**	**B3** for 4 correct blocks or **B2** for 3 correct blocks or **B1** for 2 correct blocks If 0 scored **SC1** for correct frequency densities (0.4 0.9 3.5 2 0.5) soi
4(a)(i)	432	**2**	**M1** for 12 × 12 × 9 ÷ 3 oe

Question	Answer	Marks	Partial Marks
4(a)(ii)	404 or 403.5 to 403.7	**5**	**M4** for $12^2+4\times\frac{1}{2}\times12\times\sqrt{6^2+9^2}$ oe or **M3** for $\frac{1}{2}\times12\times\sqrt{6^2+9^2}$ oe or **M2** for explicit method to find height of triangular face e.g. $\sqrt{6^2+9^2}$ oe or **M1** for implicit method to find height of triangular face or for 6^2+9^2 oe seen or **B1** for slant height of triangle *FC* $\sqrt{153}$ or $3\sqrt{17}$ or 12.4 or 12.36 to 12.37 soi
4(b)	4.4[0] or 4.398 to 4.399… nfww	**4**	**M3** for $\sqrt{\frac{304}{(2+3)\times\pi}}$ oe or **M2** for $\frac{4\pi r^2}{2}+\pi r\times3r=304$ oe or **M1** for $\frac{4\pi r^2}{2}$ oe seen or $\pi r\times3r$ oe seen
5(a)(i)	$(x-4)(x+3)$ final answer	**2**	**M1** for $(x+a)(x+b)$ where $ab=-12$ or $a+b=-1$ or for $x(x+3)-4(x+3)$ or $x(x-4)+3(x-4)$
5(a)(ii)	$\frac{x+4}{x+3}$ final answer	**2**	**M1** for $(x-4)(x+4)$ seen
5(b)	$3x^2-14x+8$ or $(x-4)(3x-2)$ final answer	**3**	**M2** for $((2x-3)-(x+1))((2x-3)+(x+1))$ or $(4x^2-6x-6x+9)-(x^2+x+x+1)$ or better or correct answer seen or **M1** for $(x-4)(ax+b)$ or $(3x-2)(x+c)$ or $(4x^2-6x-6x+9)$ or $\pm(x^2+x+x+1)$ oe
5(c)	$\frac{x^2-3x-12}{(x+1)(x-3)}$ or $\frac{x^2-3x-12}{x^2-2x-3}$ final answer	**4**	**B1** for common denominator $(x+1)(x-3)$ oe isw **B1** for $(2x+4)(x-3)-x(x+1)$ or better seen **B1** for $2x^2-6x+4x-12$ or $-x^2-x$ seen

Question	Answer	Marks	Partial Marks
5(d)	$2x^3 - 15x^2 + 22x + 15$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified or for simplified four-term expression of correct form with 3 terms correct in final answer or **B1** for correct expansion of two brackets with at least 3 terms out of 4 correct
5(e)	$2x^2 - 3x - 77[=0]$ oe $\left(6x^2 - 9x - 231[=0]\right)$ or $18y^2 + 147y + 222[=0]$ oe $\left(6y^2 + 49y + 74[=0]\right)$	**M2**	**M1** for correct method to eliminate one variable e.g. $2(13+3y)^2 - 9y = 116$ or $2x^2 - 3(x-13) = 116$ oe
	$(2x+11)(x-7)$ [= 0] oe or $\dfrac{[--]3 \pm \sqrt{([-]3)^2 - 4\times 2\times -77}}{2\times 2}$ oe or $(6y+37)(3y+6)$ [= 0] or $\dfrac{-147 \pm \sqrt{147^2 - 4\times 18\times 222}}{2\times 18}$ oe	**M2**	**FT** *their* 3-term quadratic in x or y, correct factors, correct substitution into formula or for correctly completing square **M1** for a pair of factors giving 2 correct terms when expanded *their* quadratic or for e.g. $\sqrt{([-]3)^2 - 4\times 2\times -77}$ oe or $\dfrac{[--]3 \pm \sqrt{p}}{2\times 2}$ oe
	$x = 7$ and $y = -2$ $x = -5\frac{1}{2}$ oe and $y = -6\frac{1}{6}$ oe	**B2**	**B1** for both x-values or both y-values or for 1 correct pair
6(a)	15[.0] or 15.00 to 15.01	**3**	**M2** for $\dfrac{17.2}{\sin 68} \times \sin 54$ oe or **M1** for $\dfrac{\sin 54}{AC} = \dfrac{\sin 68}{17.2}$ oe
6(b)	15.7 or 15.65 to 15.66	**3**	**M2** for $\sqrt{their 15^2 + 12.8^2 - 2\times their 15 \times 12.8 \times \cos 68}$ OR **M1** for $their 15^2 + 12.8^2 - 2\times their 15\times 12.8\times \cos 68$ **A1** for 244.9 to 245.2

Question	Answer	Marks	Partial Marks
6(c)	13.9 or 13.90 to 13.92	3	**M2** for $\frac{x}{17.2} = \sin 54$ oe or $\frac{x}{their 15} = \sin 68$ oe or **M1** for distance required is the perpendicular from *A* to *BC* soi
7(a)(i)	$\begin{pmatrix} -12 \\ 15 \end{pmatrix}$	1	
7(a)(ii)(a)	$\begin{pmatrix} 12 \\ -10 \end{pmatrix}$	1	
7(a)(ii)(b)	15.6 or 15.62…	2	**M1dep** for $their 12^2 + (their [-]10)^2$ oe, dep *their* 12 ≠ 0 and *their* –10 ≠ 0
7(b)	$\frac{3}{8}\mathbf{a} + \frac{5}{8}\mathbf{b}$ final answer	3	**B2** for an unsimplified correct answer or $MS = \frac{5}{8}(\mathbf{b} - \mathbf{a})$ soi or $NS = \frac{3}{8}(-\mathbf{b} + \mathbf{a})$ soi or **B1** for correct route for $\overrightarrow{OS}$ or for *MN* = **b** – **a** or *NM* = **a** – **b**
8(a)	Ruled line with negative gradient and positive *y*-intercept	2	**B1** for ruled line with negative gradient or for ruled line with positive *y*-intercept or straight line with negative gradient and positive *y*-intercept
8(b)	Negative quadratic, with vertex at origin	2	**B1** for negative quadratic in other position or for sketch in 3rd and 4th quadrants only with single maximum at (0, 0) and no other turning point or for positive quadratic, with vertex at origin
8(c)(i)	$18x - 6x^2$ isw	B2	**B1** for one correct term $18x$ or $-6x^2$ seen
	setting *their* derivative = 0 or $\frac{dy}{dx} = 0$	M1	**Dep** on at least B1 earned or *their* derivative = $\pm 18x \pm 6x^2$
	(0, 10) and (3, 37)	B2	**B1** for $x = 0$ and $x = 3$ or for (0, 10) or (3, 37)

Question	Answer	Marks	Partial Marks
8(c)(ii)	(0, 10) minimum with correct reason AND (3, 37) maximum with correct reason	**3**	Reasons could be e.g. 1 A reasonable sketch of a negative cubic 2 Correct use of 2nd derivative = –12(0) + 18 = 18, 18 > 0, so (0, 10) is a minimum oe. 2nd derivative = –12(3) + 18 = –18, –18 < 0 so (3, 37) is a maximum oe. 3 Evaluates correctly values of *y* on both sides of both correct stationary points 4 Finds gradient on each side of both correct stationary points. **B2** for 1 correct with correct reason for that stationary point or for **both** *x*-values correct and reasonable sketch of a negative cubic, or for correct substitution and evaluation of **both** of *their* *x*-values into *their* second derivative or substitution and evaluation for one *x*-value on both sides of **both** of *their* stationary points to find the gradients soi or **M1** for showing [2nd derivative =] $-12x + 18$ or correct FT *their* 2^{nd} derivative or substitution and evaluation shown for one *x*-value on both sides of **one** of *their* stationary points to find the gradients soi or for sketch of any negative cubic.
9(a)(i)	5	**3**	**M2** for $\frac{(12800-8000)\times 100}{8000\times 12}$ or **M1** for $[12800-8000=]\frac{8000\times 12\times r}{100}$ or 400 seen If 0 scored, **SC1** for answer 13.3 or 13.33…
9(a)(ii)	4[.0] or 3.99…	**3**	**M2** for $\sqrt[12]{\frac{12800}{8000}}$ or **M1** for $12800 = 8000\times k^{12}$ for any k

Question	Answer	Marks	Partial Marks
9(b)	9 nfww	**3**	**M2** for 260 000 × $\left(1+\frac{1.8}{100}\right)^8$ oe evaluated to 4 sf or better or 260 000 × $\left(1+\frac{1.8}{100}\right)^9$ oe evaluated to 2 sf or better or **M1** for [300 000 =] 260 000 × $\left(1+\frac{1.8}{100}\right)^n$ oe soi (Accept any inequality sign in [300 000 =])
10(a)	−2.5 −1.25 5.5	**3**	**B1** for each
10(b)	Correct graph	**4**	**B3FT** for 8 or 9 correct points or **B2FT** for 6 or 7 correct points or **B1FT** for 4 or 5 correct points
10(c)	y = 2 drawn	**M1**	
	−2.75 to –2.65 –1.1 to −1.05 0.75 to 0.85	**A2**	**A1** for 1 solution
10(d)	–2.5 5.5	**2**	**B1** for each
11(a)(i)	−3.5 oe	**2**	**M1** for $g\left(\frac{1}{2}\right)$ seen or $3\left(\frac{1}{x}\right)-5$ or better
11(a)(ii)	$\frac{x+5}{3}$ oe final answer	**2**	**M1** for correct first step $y+5=3x$, $\frac{y}{3}=x-\frac{5}{3}$ or $x=3y-5$
11(b)	$3x-11$ final answer	**2**	**M1** for $3(x-2)-5$
11(c)(i)	5	**2**	**M1** for $\frac{1}{3x-5}[=0.1]$
11(c)(ii)	4 nfww	**2**	**M1** for $2^x-(3\times7-5)[=0]$ or better

Question	Answer	Marks	Partial Marks
12(a)	88.9 or 88.92 to 88.93…	**4**	**M3** for $2\times12+\frac{360-50}{360}\times2\times\pi\times12$ oe or **M2** for $\frac{(360-50)}{360}\times2\times\pi\times12$ oe isw or **M1** for $\frac{50}{360}\times2\times\pi\times12$ oe isw
12(b)	9.01 or 9.009 to 9.010…	**3**	**M2** for $\frac{(360-50)}{360}\times\pi\times12^2\times h=3510$ or **M1** for $\frac{k}{360}\times\pi\times12^2\times h$ oe seen with k = 50 or 360 – 50