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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 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.

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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.

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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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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

Question	Answer	Marks	Partial Marks
1(a)	54	**2**	**M1** for $\frac{48}{8}$
1(b)	142	**3**	**B2** for $2c = 278$ or better or **M1** for $c + 3 + c - 1 = 280$ OR **B2** for $2x = 276$ or better or **M1** for $c + 3 - (c - 1) = 4$
1(c)	8.02 or 8.024 to 8.025	**2**	**M1** for $\frac{1750-1620}{1620}$ [×100] or for $\frac{1750}{1620} \times 100$[−100]
1(d)	1580	**2**	**M1** for $[...] \times \frac{100+10}{100} = 1738$ oe or better
2(a)(i)	(1, 6)	**2**	**B1** for each
2(a)(ii)	$\begin{pmatrix} -4 \\ -2 \end{pmatrix}$	**1**	
2(a)(iii)	(15, 13)	**2**	**FT** *their* (a)(ii) **M1** for $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$ or $\begin{pmatrix} -12 \\ -6 \end{pmatrix}$ seen or for –1 + 16 and 5 + 8 seen
2(b)(i)	Image at (4, 1), (5, –1), (7, –1), (7, 1)	**2**	**B1** for rotation 180° but incorrect position
2(b)(ii)	Image at (1, 3), (–1, 3), (–1, 6), (1, 5)	**2**	**B1** for correct orientation but incorrect position or for drawing line $y = x + 2$

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Question	Answer	Marks	Partial Marks
2(b)(iii)	Enlargement [centre] (3, 3) [factor] $-\frac{1}{2}$	**3**	**B1** for each
3(a)	2.5	**3**	**M2** for $\frac{500\times r\times 14}{100}=675-500$ oe or **M1** for $\frac{500\times r\times 14}{100}$ or for 675 – 500
3(b)	108.18	**3**	**B2** for 508.18... or 508.2 or 508 or **M1** for $400\times\left(\frac{100+2.2}{100}\right)^{11}$ oe or better
3(c)	0.17[0] or 0.1700...	**3**	**M2** for either $\sqrt[(12\times 21)]{\frac{1074}{700}}$ or $\sqrt[252]{\frac{1074}{700}}$ or better or **M1** for 700 × [...]$^{(12\times 21}$ = 1074 oe If 0 scored **SC1** answer 2.06 or 2.059...
4(a)	250	**2**	**B1** for 6750 or **M1** for 7000 – 50 × 135 or for 7 – 50 × 0.135
4(b)	80	**2**	**M1** for 6 × 6 × 4 or for 4^3 oe OR **M1** for (6 × 6) – (4 × 4) oe
4(c)	118 or 117.7 to 117.8	**4**	**M3** for $\frac{1}{2}\times 4\times 4\times\sin 60$ × 20 × 0.85 oe OR **M1** for $\frac{1}{2}\times 4\times 4\times\sin 60$ or $\frac{1}{2}\times 4\times\sqrt{4^2-2^2}$ oe **M1** for 20 × *their* area of triangle **M1 dep** for 0.85 × *their* volume, dependent on previous M1 If 0 scored **SC1** for height = 3.46...

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Question	Answer	Marks	Partial Marks
4(d)(i)	$\pi\times\sqrt{24^2+10^2}\times10+\pi\times10^2$ or $\pi\times\left(\sqrt{24^2+10^2}\right)^2\times\frac{2\times\pi\times10}{2\times\pi\times26}+\pi\times10^2$	**M3**	**M2** for $\pi\times\sqrt{24^2+10^2}\times10$ or $\pi\times\left(\sqrt{24^2+10^2}\right)^2\times\frac{2\times\pi\times10}{2\times\pi\times26}$ or **M1** for 24^2+10^2 or $\pi\times10^2$
	1130.9 to 1131.1...	**A1**	Must see at least 5 sf
4(d)(ii)(a)	0.151 or 0.1511 to 0.1512...	**1**	
4(d)(ii)(b)	22	**2**	**B1** for figs 22[1…] or **M1** for $\frac{2.5\times100^2}{1131}$
5(a)	24	**2**	**M1** for $\frac{100\text{ or }0.1}{\text{time}}$ or **B1** for figs 24
5(b)	8.32 or 8.319 to 8.320	**3**	**M1** for $9.5\times\frac{45}{60}$ oe **M1** for $\frac{8.1}{7.5}$
5(c)	$\frac{18(p+q)}{5v}$ oe final answer	**3**	**M1** for $[k\times]\ \frac{(p+q)}{v}$ for some $k\neq0$ **M1** for $v\times\frac{1000}{3600}$ oe soi
6(a)	$\frac{16}{y}$ final answer	**2**	**M1** for $\frac{240u}{15uy}$ or better
6(b)	x^3+4x^2+x-6 final answer	**3**	**B2** for correct unsimplified expansion of three brackets or for simplified four-term expression of correct form with 3 terms correct in final answer or **B1** for correct expansion of two given brackets with at least 3 terms out of 4 correct

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Question	Answer	Marks	Partial Marks
6(c)	$\frac{-1\pm\sqrt{1^2-4(2)(-5)}}{2(2)}$	**M2**	**M1** for $\sqrt{1^2-4(2)(-5)}$ or better or for $\frac{-1+\sqrt{p}}{2(2)}$ or $\frac{-1-\sqrt{p}}{2(2)}$
	–1.85, 1.35	**A2**	**A1** for each or –1.851 to –1.850 and 1.350 to 1.351 or –1.9 and 1.4 or –1.35 and 1.85
7(a)(i)	88	**2**	**M1** for $\frac{1}{2}(9+13)\times 8$ oe
7(a)(ii)(a)	$\frac{1}{2}(y+4+y+1)\times(y+2)$ [=264] or $\frac{1}{2}\times 3\times(y+2)+(y+1)\times(y+2)$ [=264]	**M1**	
	$2y^2+5y+4y+10$	**B1**	
	Leading to $2y^2+9y-518=0$	**A1**	No errors or omissions
7(a)(ii)(b)	$(2y+37)(y-14)$	**B2**	**B1** for $(2y+a)(y+b)$ where $ab = -518$ or $a + 2b = 9$ or $2y(y-14)+37(y-14)$ or $y(2y+37)-14(2y+37)$
	14	**B1**	
7(b)	26.5 or 26.47...	**3**	**B2** for 10.5 or 10.47… or $\frac{10\pi}{3}$ OR **M2** for $8 + 8 + \frac{75}{360}\times 2\pi 8$ or **M1** for $\frac{75}{360}\times 2\pi 8$
7(c)	$25 + \frac{25}{2}\pi$	**4**	**M2** for $\frac{90}{360}\times\pi\times(\sqrt{(5^2+5^2)})^2$ or **M1** for [radius ^{2} =] 5^2+5^2 **M1** for [triangle area =] [2×] $\frac{1}{2}\times 5\times 5$ oe

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Question	Answer	Marks	Partial Marks
8(a)	126	**2**	**M1** for $\frac{35}{100}\times 360$
8(b)	48.375	**4**	**M1** for mid-values 35, 42.5, 47.5, 60 soi **M1** for 15 × 35 + 20 × 42.5 + 35 × 47.5 + 30 × 60 **M1 dep** $\frac{\Sigma fx}{100}$ **dep** on second **M1**
8(c)	Correct histogram with correct widths and heights 1.5, ... 7, 1.5	**3**	**B1** for each column If 0 scored, **SC1** for freq. densities 1.5, ...7, 1.5 seen or $\frac{15}{10}$, $\frac{35}{5}$, $\frac{30}{20}$
9(a)(i)	$\frac{5}{8}$ oe	**1**	
9(a)(ii)	75	**1**	**FT** *their* **(a)(i)**
9(b)(i)	$\frac{17}{32}$ oe	**3**	**M2** for $\frac{5}{8}\times\frac{5}{8}+\frac{3}{8}\times\frac{3}{8}$ or **M1** for $\frac{5}{8}\times\frac{5}{8}$ or $\frac{3}{8}\times\frac{3}{8}$
9(b)(ii)	$\frac{15}{32}$ oe	**1**	**FT** *their* **(b)(i)**
9(c)	$\frac{15}{28}$ oe	**3**	**M2** for $\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}\times k$, k = 1 or 2 or 3 oe **M1** for $\frac{5}{8}$ and $\frac{4}{7}$ and $\frac{3}{6}$ or showing the three possible combinations oe If 0 scored **SC1** for $\frac{225}{512}$ oe
10(a)	$2 - 2x$	**2**	**B1** for $k - 2x$ or $2 - kx$ or $3 + 2 - 2x$
10(b)(i)	Gradient (m) = correct substitution of –1 into *their* (a) 2 – 2(–1)	**M1**	
	0 = *their* m × –1 + c or y [– 0] = *their* $m(x$ – –1) oe	**M1**	Dep on previous M1
	c = 4 and leading to $y = 4x + 4$	**A1**	

Question	Answer	Marks	Partial Marks
10(b)(ii)	$-\frac{1}{4}x+\frac{7}{2}$ oe	**3**	**M1** for $-\frac{1}{4}$ **M1** for 3 = *their m* × 2 + *c* or better or $y - 3$ = *their m*$(x - 2)$ or better
10(c)	(1, 4)	**3**	**B2** for $x = 1$ or **M1** for *their* **(a)** = 0 **M1** for substituting *their* 1 into $y = 3 + 2x - x^2$ OR **B2** for $x = 1$ or **M2** for $4 - (x - 1)^2$ or **M1** for $(x - 1)^2$
11(a)	7	**1**	
11(b)	$-4x^2-12x+13$ final answer	**4**	**B1** for $(2x + 5)(1 - 2x)$ **B1** for $2x - 4x^2 + 5 - 10x$ oe **B1** for $2(1 - 2x) + 5$
11(c)	$\frac{1-x}{2}$ oe final answer	**2**	**M1** for $x=1-2y$ or $2x=1-y$ or $\frac{y}{2}=\frac{1}{2}-x$
11(d)	$\frac{2}{3}$ oe	**2**	**M1** for $\mathrm{h}\left(\frac{1}{2}\right)$ or $\frac{1}{\frac{1}{x+1}+1}$ oe
11(e)	$\frac{-x-4}{(2x+5)(x+1)}$ or $\frac{-x-4}{2x^2+7x+5}$ or $-\frac{x+4}{2x^2+7x+5}$ final answer	**3**	**M1** for $x+1-(2x+5)$ oe **M1** for common denominator $(2x+5)(x+1)$ seen
11(f)	–5	**1**	
11(g)	1	**1**	
12(a)	$\sqrt{8.7^2+11.4^2-2\times8.7\times11.4\cos119}$	**M2**	**M1** for $8.7^2+11.4^2-2\times8.7\times11.4\cos119$ **A1** for 301.8...
	17.372 to 17.373	**A1**	

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Question	Answer	Marks	Partial Marks
12(b)	13.[0] or 13.02 to 13.03	**4**	**M2** for $\sin E = \frac{17.37\sin 20}{10.9}$ or **M1** for $\frac{10.9}{\sin 20} = \frac{17.37}{\sin E}$ oe **M1** for $\angle ACE = 180 - 20 -$ *their* obtuse *AEC* oe
12(c)	40.9 or 40.91 to 40.94	**3**	**M1** for a correct implicit trig statement for *AD* e.g. $\sin(\textit{their acute } ACE) = \frac{AD}{17.37}$ oe **M1** for a correct implicit statement for *CD* e.g. $\cos(\textit{their acute } ACE) = \frac{CD}{17.37}$ oe or $CD^2 = 17.37^2 - (\textit{their}AD)^2$ or for a correct statement for *ED* eg $\tan(180 - \textit{their}$ obtuse $\angle AEC) = \frac{\textit{their}AD}{ED}$

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