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MATHEMATICS

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MARK SCHEME

Maximum Mark: 130

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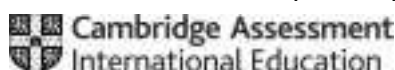
This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began,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

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This document consists of **8** 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.

Abbreviations

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

Question	Answer	Marks	Partial Marks
1(a)(i)	Reflection $y = -1$	2	B1 for each
1(a)(ii)	Triangle at (0, -3), (4, -1), (4, -3)	2	B1 for translation $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$ or for three correct vertices
1(a)(iii)	Triangle at (-2, 2), (-2, 6), (-4, 6)	2	B1 for rotation about (0, 0) 90° clockwise or 90° anticlockwise with wrong centre or for three correct vertices
1(a)(iv)	Triangle at (-3, -1), (-3, -2), (-1, -1)	2	B1 for scale factor $-\frac{1}{2}$ with wrong centre or scale factor $\frac{1}{2}$ with centre (0, 0) or for three correct vertices
1(b)(i)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ cao	1	
1(b)(ii)	4.47 or 4.472...	2	M1 for $(their\ 2)^2 + (their\ 4)^2$
1(b)(iii)	(7, 10)	2	B1 for each
1(b)(iv)	$y = 2x - 4$ oe	3	M1 for gradient = $\frac{6-2}{5-3}$ oe or answer $y = mx - 4$ M1 for substituting (3, 2) or (5, 6) into $y = their\ mx + c$ or into $y - k = their\ m(x - h)$ or into $their\ y = mx - 4$
1(b)(v)	(0, -4)	1	FT their (b)(iv)
2(a)(i)	$\frac{240}{(23+25)} \times 23$	M1	
2(a)(ii)	11 : 10	2	M1 for 110 : 100 or better or SC1 for 10 : 11, following boys 100, girls 110

Question	Answer	Marks	Partial Marks
2(a)(iii)	276	2	M1 for $240 \times \left(1 + \frac{15}{100}\right)$ oe or B1 for 36 seen
2(a)(iv)	150	3	M2 for $\frac{240}{100 + 60} [\times 100]$ oe or M1 for evidence of 160[%] associated 240
2(b)	464 000	3	M1 for $256\,000 \times \left(1 + \frac{2}{100}\right)^{30}$ oe A1 for 463 700 to 463 710 B1 for <i>their</i> more accurate answer seen and rounded to nearest 1000
2(c)	4.5[0]	3	M2 for $[x =] \sqrt[32]{4.09}$ oe or M1 for $(x)^{32} = 4.09$ oe If 0 scored, SC2 for answer 3.6 or 3.59 or 3.588... or SC1 for $\sqrt[32]{3.09}$ or 1.0358 to 1.036 seen
3(a)(i)	427 or 427.2 to 427.3...	2	M1 for $\pi \times 8 \times 17$
3(a)(ii)	1010 or 1005....	4	M2 for $\sqrt{17^2 - 8^2}$ oe or M1 for $h^2 + 8^2 = 17^2$ oe M1 for $\frac{1}{3} \times \pi \times 8^2 \times \text{their } h$ oe
3(a)(iii)	804 or 804.2 to 804.4 or 808	1	FT <i>their (ii)</i> $\times 0.8$
3(a)(iv)	396 or 395.6 to 395.8 or 392	1	FT $1200 - \text{their (iii)}$
3(b)(i)	$\frac{1}{54}$	4	B3 for $\frac{\frac{4}{3}\pi r^3}{72\pi r^3}$ or better or M2 for $\frac{\frac{4}{3} \times \pi \times r^3}{\pi \times (3r)^2 \times 8r}$ or $72 \times \pi \times r^3$ or M1 for $\pi \times (3r)^2 \times 8r$ If 0 scored, SC2 for answer of $\frac{1}{18}$
3(b)(ii)	972π final answer	4	B2 for $r = \frac{9}{2}$ oe or M1 for $4\pi r^2 = 81\pi$ or better M1 for $2 \times \pi \times (3 \times \text{their } r) \times (8 \times \text{their } r)$ isw
4(a)	-1, 3	2	B1 for each

Question	Answer	Marks	Partial Marks
4(b)	Correct graph	3	B2FT for 6 or 7 correct points or B1FT for 4 or 5 correct points
4(c)	Correct ruled tangent and $-2 \leq \text{gradient} \leq -1.5$	3	B2 for close attempt at tangent at $x = -4$ and answer in range OR B1 for ruled tangent at $x = -4$ with no daylight and M1 for rise/run also dep on close attempt at tangent. Must see correct or implied calculation from a drawn tangent.
4(d)	-3, 3	1	
4(e)	Correct graph	4	B3FT for 7 or 8 correct points or B2FT for 5 or 6 correct points or B1FT for 3 or 4 correct points
4(f)(i)	3.6 to 3.85	1	
4(f)(ii)	$x > \text{their (f)(i)}$	1	FT
4(g)	$\frac{x^2}{4} = \frac{9}{x} + \frac{4}{x}$ or $\frac{x^3}{4} - 4 = 9$	M1	Allow $\frac{13}{x}$ for $\frac{9}{x} + \frac{4}{x}$
	52	A1	
5(a)(i)	265 or 265.3 to 265.4 nfw	4	M1 for mid-values 150, 225, 275, 400 soi M1 for Σfx where x is in correct interval including boundaries M1 dep for $\Sigma fx \div 52$ dependent on second M1
5(a)(ii)	Correct histogram	4	B1 for each correct block If 0 scored, SC1 for the four frequency densities seen
5(b)(i)	100	1	
5(b)(ii)	56	1	
5(b)(iii)	62	1	
5(b)(iv)	24	1	
5(b)(v)	88	2	M1 for evidence of 12 written

Question	Answer	Marks	Partial Marks
6(a)	52[.0] or 52.02...	4	M2 for $[\cos =] \frac{13^2 + 4^2 - 11^2}{2 \times 13 \times 4}$ or M1 for $11^2 = 13^2 + 4^2 - 2 \times 13 \times 4 \cos(\dots)$ A1 for $[\cos^{-1} =] \frac{64}{104}$ oe or 0.615 or 0.6153 to 0.6154
6(b)	62.7 or 62.69 to 62.70	4	M3 for $180 - \sin^{-1}\left(\frac{8 \sin 80}{13}\right) - 80$ oe or M2 for $\sin A = \frac{8 \sin 80}{13}$ or M1 for $\frac{13}{\sin 80} = \frac{8}{\sin A}$ oe A1 for 37.3 or 37.30... If 0 scored, M1 for $180 - 80 - \text{their } A$
6(c)	66.7 or 66.68 to 66.71	3	M1 for $0.5 \times 13 \times 4 \times \sin(\text{their } ACB)$ oe M1 for $0.5 \times 8 \times 13 \times \sin(\text{their } ACD)$ oe
7(a)(i)	$\frac{3}{5} > \frac{1}{4}$ oe or $\frac{12k}{20k}$ and $\frac{5k}{20k}$ or 0.6 and 0.25 or 60% and 25%	1	
7(a)(ii)	$\frac{11}{20}$ oe	3	M2 for $\frac{3}{5} \times \frac{3}{4} + \frac{2}{5} \times \frac{1}{4}$ oe or $1 - \frac{3}{5} \times \frac{1}{4} - \frac{2}{5} \times \frac{3}{4}$ oe or M1 for $\frac{3}{5} \times \frac{3}{4}$ or $\frac{2}{5} \times \frac{1}{4}$ oe (but not as part of a larger product)
7(b)(i)	$\frac{6}{60}$ oe	2	M1 for $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3}$ oe If 0 scored, SC1 for answer $\frac{27}{125}$ oe
7(b)(ii)	0	1	Accept $\frac{0}{60}$

Question	Answer	Marks	Partial Marks
7(c)	$\frac{11}{25}$ oe	3	M2 for $\frac{3}{5} \times \frac{3}{5} + \frac{2}{5} \times \frac{1}{5}$ oe or $1 - \frac{3}{5} \times \frac{2}{5} - \frac{2}{5} \times \frac{4}{5}$ oe or M1 for $\frac{3}{5} \times \frac{3}{5}$ or $\frac{2}{5} \times \frac{1}{5}$ or for a correct tree showing all 25 outcomes with the 11 correct outcomes identified
8(a)(i)	4	2	M1 for correct method using similar triangles e.g. $\frac{10}{5} = \frac{8}{DX}$ oe
8(a)(ii)	36.9 or 36.86 to 36.87	2	M1 for $\tan = \frac{6}{8}$ or $\sin = \frac{6}{10}$ or $\cos = \frac{8}{10}$ oe
8(b)	$[v =] 150$	B1	
	$[w =] 15$	B2	FT $(180 - \text{their } v) \div 2$ M1 for $180 - 2w = \text{their } v$ oe or angle $POQ = 180 - \text{their } v$ oe
	$[x =] 15$	B1	FT $\text{their } w$
	$[y =] 10$	B2	M1 for angle $TPS = 5^\circ$ or angle $TXS = 20^\circ$ or $OXp = 20^\circ$ or $TXP = 160^\circ$ (where X is where OT and PS intersect)
8(c)	182 or 182.4...	3	M2 for $\left(\frac{94}{226}\right)^{\frac{3}{2}} \left[= \frac{V}{680} \right]$ oe or M1 for ratio of lengths $= \sqrt{\frac{226}{94}}$ or $\sqrt{\frac{94}{226}}$ or better or for $\frac{V^2}{680^2} = \frac{94^3}{226^3}$ oe
9(a)	0	1	
9(b)	5	2	M1 for $3(3^x) + 4$ or better or $f\left(\frac{1}{3}\right)$ or $f(3^{-1})$
9(c)	$\frac{x+1}{2}$ oe final answer	2	M1 for $x = 2y - 1$ or $y + 1 = 2x$ or $\frac{y}{2} = x - \frac{1}{2}$ or better
9(d)	$9x + 16$	2	M1 for $3(3x + 4) + 4$ oe
9(e)	$9x^2 + 24x + 16$	2	B1 for three terms from $9x^2 + 12x + 12x + 16$ correct
9(f)	27	2	M1 for $x = h(\text{their } g(2))$

Question	Answer	Marks	Partial Marks
10(a)	$\frac{8}{15}$	B1	
	$\frac{n+2}{2n+3}$ oe	B2	B1 for $n+2$ as numerator or $2n+3$ as denominator
10(b)(i)	$1-2n$ oe	2	B1 for $-2n+k$ oe or $pn+1$ ($p \neq 0$) oe
10(b)(ii)	n^3+1 oe	2	M1 for cubic expression