Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS (US) **0444/04**

Paper 4 (Extended) **For examination from 2020**

MARK SCHEME

Maximum Mark: 130

Specimen

This document has **8** pages. Blank pages are indicated.

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.

MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method mark, awarded for a valid method applied to the problem.
A Accuracy mark, given for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the **M** marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several **B** marks allocated. The notation 'dep' is used to indicate that a particular **M** or **B** mark is dependent on an earlier mark in the scheme.

Abbreviations

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

Question	Answer	Marks	Partial Marks
1(a)	350, 250, 200	**3**	**M1** for 800 ÷ (7 + 5 + 4) implied by 50 and **M1 dep** *their* 50 × any one of 7, 5, or 4
1(b)	275 cao	**3**	**B1** for 100 or 250 (may be implied in next step) and **M1** for $\frac{\textit{their}\ 250 \times 5 \times 2}{100}$ seen
1(c)	200	**2**	**FT** 0.8 × *their* 250 from **(a)** oe correctly evaluated **M1** for 0.8 × *their* 250 from **(a)**
1(d)	11 : 8 : 4 or 2.75 : 2 : 1 cao	**2**	**M1** for 275 or *their* **(b)** : 200 or *their* **(c)** : 100
2(a)	1446 or 246 pm cao	**3**	**M1** for $\frac{60+40}{35}$ (2.857...) could be in parts and **M1** for correct method to convert a decimal time to minutes **FT** a decimal either full answer or decimal part × 60 (e.g., 51.(428), 171.(4...) or 2 hrs 51 or 51 m)
2(b)(i)	260	**1**	
2(b)(ii)	145	**1**	**FT** *their* **(b)(i)** − 115
2(c)	85(.0) cao nfww	**4**	**M2** for $(AC^2 =)\ 40^2 + 60^2 - 2 \times 40 \times 60 \times \cos 115$ or **M1** for correct implicit version and **M1 dep** $(AC =)\ \sqrt{\ }$ of a correct combination
2(d)	39.76 to 39.8 cao nfww	**3**	**M2** for $(\sin A =)\ \frac{\sin 115}{\textit{their}\ \textbf{(c)}} \times 60$ or **M1** for $\frac{\sin A}{60} = \frac{\sin 115}{\textit{their}\ \textbf{(c)}}$
2(e)	73.76–73.81 cao	**3**	**M2** for $40\sin 80 + 60\sin 35$ oe or *their* **(c)** × sin(100 − *their* **(d)**) or *their* **(c)** × cos(*their* **(d)** − 10) or **M1** for either $40\sin 80$ or $60\sin 35$ or implicit trig version using *their* **(c)**

Question	Answer	Marks	Partial Marks
3(a)	1 3	**2**	**M1** for $(x-3)(x-1)$ [= 0] or $\frac{4 \pm \sqrt{(-4)^2 - 4.1.3}}{2}$ or $(x-2)^2 = 1$ or better
3(b)	$\frac{x+1}{2}$ oe	**2**	**M1** for correct first step of rearrangement e.g., $y + 1 = 2x$ or $x + 1 = 2y$ or better
3(c)	$x^2 - 6x + 4 = 0$	**M1**	can be implied by later work (method marks)
	$\frac{p \pm \sqrt{q}}{r}$ with $p = 6$ and $r = 2$	**B1**	**FT** if in the form $ax^2 + bx + c$ (= 0) with $a \neq 0$
	and $q = (-6)^2 - 4.1.4$ oe or 20	**B1**	$[(x-3)^2 - 5 = 0$ **B1** then $x = (\pm)\sqrt{5} + 3$ **B1** is the equivalent for completing the square]
	5.24 cao	**B1**	
	0.76 cao nfww	**B1**	**SC1** for both answers 'correct' but not to 2 dp (5.236 067 977, 0.763 932 022) Can be truncated or correctly rounded
3(d)	29	**2**	**B1** for [f(−2) =] 15 seen or $2x^2 - 8x + 5$ oe seen
3(e)	$4x^2 - 12x + 8$ final answer	**3**	**M1** for $(2x-1)^2 - 4(2x-1) + 3$ **M1** for correct unsimplified expression
4(a)(i)	153.86 to 153.96 or 154	**2**	**M1** for $4\pi\ 3.5^2$
4(a)(ii)	179.5 to 179.62 or 180	**2**	**M1** for $\frac{4}{3}\pi\ 3.5^3$
4(a)(iii)	1005 to 1006 or 1008 or 1010	**2**	**FT** *their* **(ii)** × 5.6 correct to 3 significant figures or better (allow in kg) **M1** for *their* **(ii)** × 5.6
4(b)	9.78 to 9.79	**4**	**M1** for $\pi 8^2 \times 8$ (1608 – 1609) alt $\pi 8^2 d = 2 \times$ *their* **(ii) M1** and **M1 dep** for $\pi 8^2 h = 2 \times$ *their* **(ii)** + $\pi 8^2 \times 8$ alt (2 × *their* **(a)(ii)**) ÷ ($\pi 8^2$) **M1 dep** and **M1 dep** (2 × *their* **(ii)** + $\pi 8^2 \times 8$) ÷ ($\pi 8^2$) alt add 8 **M1 dep**

Question	Answer	Marks	Partial Marks
5(a)	−6.1(11...), 5, 11.9 (11.88)	**3**	**B1** for each
5(b)	Correct graph	**5**	**B2 FT** for 13 to 15 correct points (in correct square) **P1 FT** for 10 to 12 correct points **B1** for correct shape, not ruled, (curves could be joined) **B1** indep for graph not crossing the y-axis
5(c)(i)	0.45 to 0.5	**1**	
5(c)(ii)	−2.4 to −2.1 −0.5 to −0.4 0.3 to 0.4	**3**	**B1** for each If 0 scored, **SC1** for evidence of f(x) = −4
5(d)	g(x) = 3x + 3 correct, ruled, full range	**2**	**B1** for any **one** of correct but short, slope of 3, y-intercept 3 on sloping line, 'good' freehand
5(e)(i)	Gets closer	**1**	any correct comment isw dep on g(x) correct or freehand
5(e)(ii)	Answer rounds to 3.00	**1**	
6(a)	108.16 nfww	**2**	**M1** for 100×1.04^2 oe
6(b)	148(.02...), 324(.3...)	**2**	**B1** for each
6(c)	Correct graph	**4**	**B2 FT** for 4 correct points, **B1 FT** for 3 correct points **B1** for smooth exponential curve, correct shape, through 5 points
6(d)(i)	265 to 270	**1**	
6(d)(ii)	17 or 18 cao	**1**	
6(e)(i)	$\frac{(100) \times 7 \times 20}{(100)}$ oe	**M1**	
	100 + 7 × 20 or better	**A1**	
6(e)(ii)	380	**1**	
6(e)(iii)	Correct straight ruled line for x-range 0 to 35	**2**	**B1 FT** for 2 of (0, 100), (20, 240), (40, 380) correctly plotted
6(f)	27 to 29 cao	**1**	
7(a)(i)	36.0−36.4	**1**	
7(a)(ii)	50.0−50.4	**1**	
7(a)(iii)	28.6−29.4	**1**	
7(a)(iv)	20	**2**	**B1** for 19 or 21 or 180 seen
7(b)(i)	p = 16, q = 4	**2**	**B1** for each If **B0**, **SC1** if p and q add up to 20

Question	Answer	Marks	Partial Marks
7(b)(ii)	36.1 nfww	**4**	**M1** for using mid-values at least four correct from 5, 15, 25, 35, 45, 55, 65, 75 **M1** (dep on x values within the correct class including the boundaries) for Σfx (at least four correct products soi) **M1** (dependent on 2nd **M1**) for dividing sum by 200 or 180 + *their p* + *their q*
7(c)	8.2, 11.4, 5	**4**	**B3** for 2 correct or **B2** for 1 correct If 0 scored, **SC2** for fd's 2.7(3...) oe, 3.8 oe, 1.6(6...) oe or **SC1** for 2 of fd's correct
8(a)(i)	$x = 78$	**B1**	
	alternate angle	**B1**	Dep on **B1**, extras can spoil
	either $y = 144$ or $z = 102$	**B1**	
	(opposite angles of) cyclic quad (= 180)	**B1**	Dep on **B1**, extras can spoil
	and $z = 102$ or $y = 144$	**B1**	
	angles (in **(a)**) quadrilateral (= 360) or (opp angles of) cyclic quad (= 180)	**B1**	Dep on **B1**, extras can spoil
8(a)(ii)	*Their* $z + 36 \neq 180$ oe	**1**	could also use *their* angles x and y provided $x + y \neq 180$
8(a)(iii)	72 or 288	**1**	
8(b)(i)	Similar (or enlargement)	**1**	
8(b)(ii)	9.8 nfww	**2**	**M1** for $\left(\frac{7}{10}\right)^2$ or $\left(\frac{10}{7}\right)^2$ oe seen
8(b)(iii)	4 www	**2**	**M1** for $\frac{1}{2} \times 10 \times \text{height} = 20$
9(a)	Sketch of 4 by 4 diagram	**1**	
9(b)(i)	25, 40	**2**	**B1** for each
9(b)(ii)	n^2	**B1**	
	$(n + 1)^2$ oe	**B1**	
	$(n + 1)^2 + n^2 - 1$ or $2n^2 + 2n$ or $2n(n + 1)$ oe	**B2**	any one of these oe isw and if **B0** allow **SC1** for *their* $(n + 1)^2$ + *their* $(n^2) - 1$ or an expression containing $2n^2$ as the highest order term, soi
9(c)(i)	$\frac{2}{3} + f + g = 4$	**1**	
9(c)(ii)	$\frac{2}{3} \times 2^3 + f \times 2^2 + g \times 2$ oe	**M1**	i.e. for substituting 2
	$4f + 2g = \frac{32}{3}$	**A1**	

Question	Answer	Marks	Partial Marks
9(c)(iii)	$(f=)$ 2, $(g=)$ $\frac{4}{3}$ oe cao	**3**	**M1** for $2f+2g=\frac{20}{3}$, $4f+2g=\frac{32}{3}$ for **correctly** setting up for elimination of one variable accept $\frac{6}{3}$ for 2
9(c)(iv)	880 cao	**1**	
10(a)	$s=\frac{1}{3}$, $t=\frac{1}{4}$, $u=\frac{5}{6}$	**3**	**B1** for each all correctly placed on tree or clearly indicated
10(b)	$\frac{1}{2}$ oe cao	**2**	**M1** for $\frac{2}{3}\times\frac{3}{4}$
10(c)	$\frac{4}{9}$ oe cao	**2**	**M1** for $\frac{2}{3}\times$ *their* $\frac{1}{4}$ + *their* $\frac{1}{3}\times$ *their* $\frac{5}{6}$