Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2021**

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.

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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 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.

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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.

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)(i)	683	**3**	**M2** for [2]((19.4 × 9.2) + (5.7 × 9.2) + (19.4 × 5.7)) oe or **M1** for one of 19.4 × 9.2 or 5.7 × 9.2 or 19.4 × 5.7
1(a)(ii)	1.93[0] or 1.932 to 1.933	**3**	**M2** for 19.4 × 9.2 × 5.7 × 1.9 or **M1** for 19.4 × 9.2 × 5.7
1(b)	39 375	**3**	**M2** for 9000 ÷ 200 × 175 × 5 or **M1** for 9000 ÷ 200 soi or for $\frac{175}{200}$ soi
1(c)	10th July	**3**	**B2** for 4.1 to 4.2 or $4\frac{1}{6}$ or 4 days 1.5 hours Or **M2** for answer 9th July or 11th July or **M1** for 1500 ÷ (9 × 40)
1(d)	167 or 166.9 to 167.0…	**3**	**B2** for answer with figs 167 or figs 1669 to 1670.. or **M1** for $\pi \times 22.5^2 \times 105$ oe If 0 scored **SC1** for answer 668 or 667.9 to 668.1
2(a)(i)	71.4 or 71.42 to 71.43	**1**	
2(a)(ii)	97 [min] 25 [s]	**3**	**B2** for 13 min 55 sec seen or 97.4 or 97.41 to 97.42 seen or 5845 seen OR **M2** for 55.66… ÷ 4 × 7 oe or 3340 ÷ 4 × 7 oe or for 7/4 × 55 + 7/4 × 40 oe or **M1** for 55 min 40 sec ÷ 4 oe or **M1** for **total time** ÷ 16 soi
2(b)(i)	60.8[0]	**2**	**M1** for $47.5 \times \left(1+\frac{28}{100}\right)$ oe or **B1** for 13.3[0]
2(b)(ii)	71.25	**3**	**B2** for 118.75 Or **M2** for $47.50 \div \left(1-\frac{60}{100}\right) - 47.50$ or **M1** for $x \times \left(1-\frac{60}{100}\right) = 47.50$ oe or better

Question	Answer	Marks	Partial Marks
2(c)	15 380	**4**	**M3** for (1 120 000 – 5000) ÷ (70 + 2.5) oe or **B2** for answer figs 15 379 to figs 15 380 or **M2** for (1 120 000 ± 5000) ÷ (70 ± 2.5) oe or **M1** for one of figs 675, 725, 1115, 1125 seen
2(d)	1.8[0] or 1.801 to 1.802 [million] nfww	**2**	**M1** for figs $16 \times \left(1+\frac{2.4}{100}\right)^5$ oe
3(a)	Correct box-and-whisker plot	**4**	**B1** for lowest value and highest value at 30 and 90 **B1** for LQ and UQ at 50 and 72 **B1** for median at 63
3(b)(i)	56	**2**	**M1** for 24 soi
3(b)(ii)	16	**2**	**B1** for 64 written
3(c)(i)	14, 22	**1**	
3(c)(ii)	61.5	**4**	**M1** for 35, 45, 55, 65, 75, 85 soi **M1** for Σfx **M1 dep** for *their* Σfx ÷ (8 + 12 + *their* 14 + *their* 22 + 14 + 10) or Σfx ÷ 80
3(c)(iii)	$\frac{35}{69}$ oe	**3**	**M2** for [2] $\left(\frac{10}{24}\times\frac{14}{23}\right)$ oe or **M1** for $\frac{10}{24}$ or $\frac{14}{24}$ oe seen If 0 scored, **SC1** for answer $\frac{35}{72}$ oe
4(a)(i)	$\frac{10}{3}$ or $3\frac{1}{3}$ or 3.33[3…]	**3**	**M1** for $42 - 12x = 3x - 8$ oe or for $7 - 2x = \frac{3x}{6} - \frac{8}{6}$ oe **M1** for reaching $ax = b$ correctly FT *their* first step
4(a)(ii)	–2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	**3**	**M1** for $3 \times 2x = 2(x - 5)$ oe **M1** for reaching $ax = b$ correctly FT *their* first step

Question	Answer	Marks	Partial Marks
4(b)(i)	$2(x + 12y)(x – 12y)$ final answer	**3**	**B2** for $(2x + 24y)(x – 12y)$ or $(2x – 24y)(x + 12y)$ or for $2(x + 12y)(x – 12y)$ seen OR **M2** for $k(x + 12y)(x – 12y)$ or **M1** for $2(x^2 – 144y^2)$
4(b)(ii)	$(5x – 8)(x + 5)$ final answer	**2**	**M1** for $5x(x + 5) – 8(x + 5)$ or $x(5x – 8) + 5(5x – 8)$ or for $(5x + a)(x + b)$ where $ab = – 40$ or $a + 5b = 17$
4(c)	$4x^2 – 17x + 9$ [= 0] oe	**B1**	
	$\frac{[- -]17 \pm \sqrt{([-]17)^2 - 4(4)(9)}}{2 \times 4}$	**B2**	**FT** *their* 3 term quadratic **B1FT** for $\sqrt{([-]17)^2 - 4(4)(9))}$ or better or $\left(x - \frac{17}{8}\right)^2$ oe or $\sqrt{\frac{([-]17)^2 - 4(4)(9)}{4}}$ or better and **B1FT** for $\frac{[- -]17 + \sqrt{q}}{2(4)}$ or $\frac{[- -]17 - \sqrt{q}}{2(4)}$ or better or $\frac{17}{8} + \sqrt{\frac{145}{64}}$ oe or $\frac{17}{8} - \sqrt{\frac{145}{64}}$ oe or $\frac{\frac{[- -]17}{2} + \sqrt{q}}{4}$ or $\frac{\frac{[- -]17}{2} - \sqrt{q}}{4}$
	0.62 and 3.63 cao	**B2**	**B1** for each **SC1** for 0.6[0] or 0.619 to 0.620 **and** 3.6[0] or 3.6301 to 3.6302 or 0.62 and 3.63 seen in working or –0.62 and–3.63 as final answers
5(a)(i)	62 and Angle at centre is twice angle at circumference oe	**2**	**B1** for either
5(a)(ii)	117 and Isosceles [triangle] and Opposite angles in a cyclic quadrilateral are supplementary	**4**	**B2** for 117 or **B1** for [angle *OCD* =] 28 **B1dep** for isosceles [triangle] and **B1** for opposite angles in a cyclic quadrilateral are supplementary

Question	Answer	Marks	Partial Marks
5(b)	24.9 or 24.94 to 24.95	**5**	**B1** for angle $PQS = 42$ **M2** for $QS = 5.9 \div \cos 42$ oe or **M1** for $\cos 42 = \frac{5.9}{QS}$ oe **M1**dep for *their* $SQ \times \pi$ oe
6(a)(i)	9.5, 4.8 and 8.5	**3**	**B1** for each
6(a)(ii)	correct curve	**5**	**B4** for correct curve, but branches joined or touching y axis or **B3FT** for 9 or 10 correct plots or **B2FT** for 7 or 8 correct plots or **B1FT** for 5 or 6 correct plots AND **B1 indep** two separate branches not touching or cutting *y*-axis
6(b)	$y = \frac{24}{5} - 2x$ ruled and – 0.4 to – 0.2 and 1.45 to 1.7	**4**	**B2** for correct ruled line crossing curve twice or **B1** for correct freehand or for short ruled line or for line with negative gradient through (0, 4.8) or for line with gradient – 2 **B1** for each value
6(c)	[a =] 10 [b =] 20 [c =] – 48	**4**	**B3** for $10x^3 - 15 = 48x - 20x^2$ oe or better or **B2** for 2 correct values or **B1** for 1 correct value or for $5x^2 - \frac{15}{2x} = 24 - 10x$ or better or for $2x^3 - 3 = \frac{48}{5}x - 4x^2$ or better or for $x^3 - \frac{3}{2} = \frac{24}{5}x - 2x^2$ After 0 scored SC1 for correct elimination of a denominator of 5, x or $2x$ from a four term expression.
7(a)(i)(a)	Shape at (–2, 1) (–4, 1) (–4, 7) (0, 7)	**2**	**B1** for 3 correct points or for enlargement SF2 from any centre
7(a)(i)(b)	Shape at (2, –2) (2, –3) (5, –1) (5, –3)	**3**	**B2** for correct orientation but wrong position or for 3 correct points or **B1** for $y = x - 1$ drawn

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Question	Answer	Marks	Partial Marks
7(a)(ii)	Rotation 90 [anticlockwise] oe (0, 0) oe	**3**	**B1** for each
7(b)	$\frac{3}{4}\mathbf{p}+\frac{1}{2}\mathbf{q}$ or $\frac{1}{4}(3\mathbf{p}+2\mathbf{q})$ or $\frac{3\boldsymbol{p}+2\boldsymbol{q}}{4}$ final answer	**3**	**M2** for $AM = \overrightarrow{AM} = \frac{1}{2}\left(\mathbf{-p}+\mathbf{q}+\frac{1}{2}\mathbf{p}\right)$ oe or **M1** for correct route for $\overrightarrow{AB}$ oe soi by $-\frac{1}{2}\,\mathbf{p}+\mathbf{q}$ or for $\overrightarrow{OM}$ soi
8(a)(i)	1.6 oe	**2**	**M1** for $3-5x=-5$
8(a)(ii)	$\frac{3-x}{5}$ oe final answer	**2**	**M1** for $x = 3 - 5y$ or $\frac{y}{5}=\frac{3}{5}-x$ or better, or $y - 3 = -5x$ oe
8(b)(i)	$20.25-(1.5+x)^2$	**3**	Method 1 **B1** for $(\pm 1.5 \pm x)^2$ seen **B1** for [b =] 18 + *their* 1.5^2 OR Method 2 **B1** for $b-a^2-2ax-x^2$ or for b = 20.25 **B1** for a = 1.5
8(b)(ii)	Correct sketch with max in correct quadrant at $(-1.5,\ 20.25)$	**3**	**FT** *their* $20.25-(\textit{their}1.5+x)^2$ provided in that form **B1** for $\cap$ shape or for $\cup$ shape if in form $c+(d+x)^2$ in part **(b)(i)** **B1** for TP at $(-1.5,\ k)$ or $(k,\ 20.25)$ FT *their* $20.25\pm(\textit{their}1.5+x)^2$ or for (–1.5, 20.25) seen
8(b)(iii)	[y =] $34 - 11x$	**6**	**B2** for $-3-2x$ or **B1** for either kx –3, $k \neq 0$ or $-2x$ + n or for $18 - 3 - 2x$ **M1dep** for gradient = *their* (–3 – 2(4)) **B1** for y-value at $x = 4$, is –10 **M1dep** for *their* –10 = (*their* –11)4 + c oe

Question	Answer	Marks	Partial Marks
9(a)	3.5 oe	**3**	**M1** for $2(x + x + 3) = 20$ oe **M1** for correct $ax = b$ for *their* linear equation
9(b)	116.8 or 116.83 to 116.85 nfww	**5**	**M2** for $\sin p = \frac{5\sin 20}{2.5}$ or **M1** for $\frac{2.5}{\sin 20} = \frac{5}{\sin p}$ **A1** for 43.2 or 43.15 to 43.17 **M1**dep for 180 – (20 + *their* 43.2) After 0 scored, **SC1** for length of side = 5
9(c)	5.07 or 5.068 to 5.071	**6**	**B3** for 7.41 or 7.412 to 7.413 or **M2** for $r + r + \frac{40}{360} \times 2 \times \pi \times r = 20$ oe or **M1** for $\frac{40}{360} \times 2 \times \pi \times r$ oe seen **M2** for $2 \times 7.41 \times \sin 20$ oe or $7.41^2 + 7.41^2 - 2(7.41^2) \cos 40$ oe or $\frac{7.41\sin 40}{\sin 70}$ oe or **M1** for implicit version