CAMBRIDGE
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Cambridge IGCSE™

MATHEMATICS **0580/41**

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.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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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.

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

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Question	Answer	Marks	Partial Marks
1(a)(i)	2 × 5 × 7 [=70]	**2**	**B1** for 2, 5, 7
1(a)(ii)	14	**2**	**M1** for [112 =] $2^4 \times 7$ oe or for answer 2 × 7
1(a)(iii)	$560x^4y^5$	**2**	**B1** for answer kx^4y^5 or for answer $560x^ay^b$ or for correct answer seen then spoiled
1(b)(i)	a^8	**1**	
1(b)(ii)	$\frac{c}{8}$ final answer	**2**	**M1** for $\frac{5bc}{40b}$ or better
1(c)	5.5 or $\frac{11}{2}$ or 5½	**2**	**M1** for $2x = 15 - 4$ oe or $2 + x = \frac{15}{2}$ oe
1(d)	–2	**3**	**M1** for $34 + 2x = 5(4 - x)$ oe or better **M1** dep for reaching $ax = b$ FT *their* first step
1(e)(i)	11	**2**	**M1** for $7 + \sqrt[3]{(-8)^2}$ oe
1(e)(ii)	$[\pm]\sqrt{(P-d)^3}$ oe final answer	**3**	**B1** for $P - d = \sqrt[3]{m^2}$ oe **M1** for cube both sides **M1** for square root leading to final answer
2(a)(i)	Triangle at (1, –1) (1, –3) (–3, –3)	**2**	**B1** for reflection in $x = k$ or for reflection in $y = 1$
2(a)(ii)	Triangle at (3, –1) (5, –1) (3, 0)	**2**	**B1** for correct size and orientation but wrong position
2(b)	Rotation 90 clockwise oe [centre] (2, 4) oe	**3**	**B1** for each
2(c)	(a, $2k - b$) oe isw	**2**	**B1** for each coordinate
3(a)	30.875	**4**	**M1** for 5, 15, 30, 45, 65 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div 120$ dep on 2nd M1

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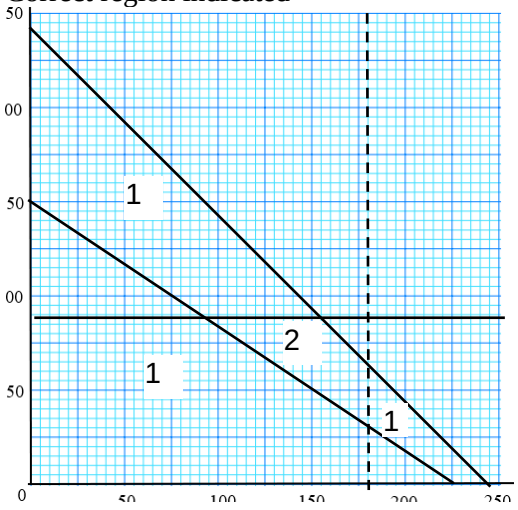
Question	Answer	Marks	Partial Marks
3(b)	Draws correct bar to height 1.75	**4**	**B3** for [height =] 1.75 OR **M2** for [90 –](10 × 1.3 + 20 × 1.5 + 30 × 0.4) oe or **M1** for 10 × 1.3 or 20 × 1.5 or 30 × 0.4 **M1dep** for *their* frequency ÷ 20 dep on at least M1 After 0 scored **SC1** for bar of correct width and height between 1.7 and 1.8
4(a)(i)	22.5	**2**	**M1** for $\frac{11.25}{11.25+18.75+20}[\times 100]$ oe
4(a)(ii)	9 : 15 : 16	**2**	**M1** for 1125 : 1850 : 2000 or better
4(a)(iii)(a)	$\frac{5}{9}$ or 0.556 or 0.5555 to 0.5556	**3**	**M2** for $\frac{20\times 25}{15[\times 60]}$ oe or **M1** for 20 × 25 or for *their* distance ÷ (15 [× 60]) oe

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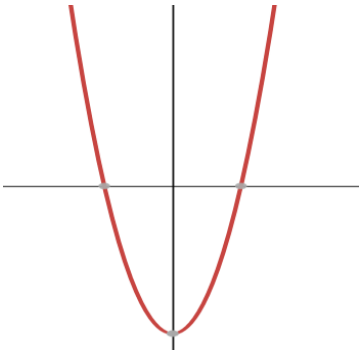
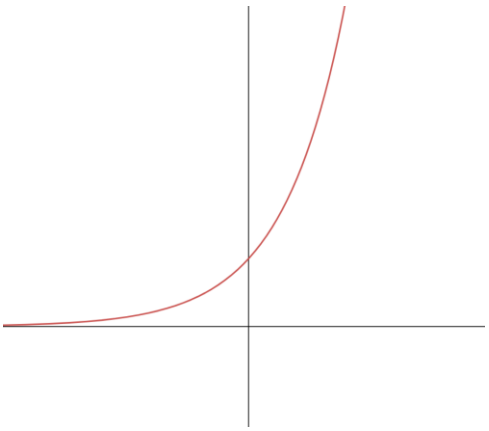
Question	Answer	Marks	Partial Marks
4(a)(iii)(b)	2 h 40 mins	**4**	**Approach 1** **B3** for $\frac{8}{3}$[h]oe or 160 [mins] or 9600[s] Or **M3** for 5000 ÷ (18.75 × 25 × 4)[h] oe or 5000 ÷ (18.75 × 25 ÷ 15)[mins] oe or 5000 ÷ ((18.75 × 25 × 4) ÷ (60 × 60))[secs] oe Or **M2** for (18.75 × 25 × 4)[m/h] oe or (18.75 × 25 ÷ 15)[m/min] oe or (18.75 × 25 × 4) ÷ (60 × 60))[m/sec] oe Or **B1** for 200 or 1 km =1000m soi After 0 scored **SC1** for time *Figs* 267 or *figs* 2666 to 2667 or *figs* 16 or *figs* 96 **Approach 2** **B3** for 160 [mins] Or **M3** for 15 × 5000 ÷ (18.75 × 25) [mins] oe Or **M2** for 5000 ÷ (18.75 × 25) oe Or **B1** for 200 or 1 km =1000m soi After 0 scored **SC1** for time *figs* 16
4(a)(iv)	17.1 or 17.14 to 17.15	**3**	**M2** for $20 \times \left(\frac{100-5}{100}\right)^3$ oe or **M1** for $20 \times \left(\frac{100-5}{100}\right)^k$ where k is 2, or 4 or for $20 \times \left(\frac{100-5}{100}\right)^3$ oe seen and spoiled
4(b)	2500	**3**	**M2** for $\frac{425 \text{ to } 450}{10+0.5}$ or $\frac{450-12.5}{10 \text{ to } 11}$ or $\frac{425 \text{ to } 450}{630}$ or $\frac{450-12.5}{600 \, to \, 660}$ or **M1** for 10.5 or 9.5 or 437.5 or 462.5 or 630[s] or 570[s]

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Question	Answer	Marks	Partial Marks
5(a)	$\frac{5}{8}$ oe	**1**	
5(b)(i)	Tree diagram correct probabilities on 3 pairs of branches $\frac{3}{8}$ $\frac{5}{8}$	**2**	**B1FT** for one pair of branches of first stage or second stage correct
5(b)(ii)	$\frac{17}{32}$ oe	**3**	**M2FT** for *their* $\left(\frac{3}{8}\times\frac{3}{8}\right)+\left(\frac{5}{8}\times\frac{5}{8}\right)$ oe or **M1FT** for one correct product seen
5(c)	$\frac{15}{56}$ oe	**3**	**M2 FT** for $\frac{3}{8}\times\frac{2}{7}\times\frac{5}{6}\times k$ where k is 1, 2 or 3 or **M1FT** for $\frac{3}{8}$ and $\frac{2}{7}$ and $\frac{5}{6}$ seen oe or for showing the 3 possible combinations If 0 scored, **SC1** for answer $\frac{135}{512}$ oe
6(a)	$\sqrt{420^2+830^2-2\times420\times830\times\cos106}$ oe	**M2**	or **M1** for $420^2+830^2-2\times420\times830\times\cos106$ oe **A1** for 1 057 474 ….
	1028.3...	**A1**	
6(b)	99[.0] or 98.98 to 99.1[0…]	**4**	**B3** for 80.89 to 81.02 or **M2** for $\sin[ACB=]\frac{1150\sin 62}{1028}$ oe or **M1** for $\frac{1028}{\sin 62}=\frac{1150}{\sin ACB}$ oe

Question	Answer	Marks	Partial Marks
6(c)	2477 cao nfww	**4**	**B3** for answer 2476.9… or **M2** for $\frac{1}{2}\times 420\times 830\times \sin 106\times \frac{P}{10\,000}=41\,500$ oe or **M1** for $\frac{1}{2}\times 420\times 830\times \sin 106$ oe
7(a)	180 and 240	**2**	**B1** for 180 or for 240
7(b)	$12x + 18y \geq 2700$ and completion to $2x + 3y \geq 450$	**1**	with no errors seen
7(c)	$x = 180$ broken straight line and $y = 90$ solid ruled line and $x + y = 240$ solid ruled line and $2x + 3y = 450$ solid ruled line	**B5**	**B1** for $x = 180$ broken straight line **B1** for $y = 90$ solid ruled line **B1** for $x + y = 240$ solid ruled line **B2** for $2x + 3y = 450$ solid ruled line or **B1** for line with a negative gradient passing through (0, 150) or (225, 0)
	Correct region indicated  	**B2**	**B1** for region satisfying 3 of the inequalities
7(d)	4200	**2**	**B1** for 150 and 90 or **M1** for *their* 150 × 10 + *their* 90 × 30
8(a)(i)	6 and –6	**2**	**M1** for $x^2 = 20 + 16$ or better Or **B1** for 6 or -6

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Question	Answer	Marks	Partial Marks
8(a)(ii)	$\frac{7-x}{3}$ oe final answer	**2**	**M1** for $x = 7 - 3y$ or $\frac{y}{3} = \frac{7}{3} - x$ or $y - 7 = -3x$ oe or better
8(a)(iii)	$9x^2 - 42x + 34$ final answer	**3**	**M1** for $(7 - 3x)^2 - 16$ [+ 1] oe **B1** for $49 - 21x - 21x + 9x^2 + k$
8(a)(iv)	Correct sketch with roots marked at –4 and 4 and y – intercept and turning point at $y = -16$ 	**4**	**B1** for correct parabola shape **B2** for roots at –4 and 4 on graph and no extras or **B1** for $(x - 4)(x + 4)$ [= 0] or for one correct root on graph or for -4 and 4 seen **B1** for turning point at (0, –16)
8(a)(v)	[$y =$] $-6x - 25$	**5**	**M1** for derivative = $2x$ **M1** for x = -3 substituted into *their* derivative **B1** for (– 3, –7) soi **M1** substitution of (– 3, *their* –7) into $y =$ *their* $-6x + c$ oe dep on 2nd M1
8(b)(i)	Correct sketch with y – intercept above x – axis 	**2**	**B1** for correct shape
8(b)(ii)	$y = 0$	**1**	
9(a)	1360	**1**	

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Question	Answer	Marks	Partial Marks
9(b)	772	**3**	**M2** for **[**2 ×] (10 × 8 + 10 × 17 + 8 × 17) oe or **M1** for 10 × 8 oe or 10 × 17 oe or 8 × 17 oe
9(c)	53 or 53.0 to 53.01	**4**	**M3** for tan [*GAC*] = $\frac{17}{\sqrt{10^2+8^2}}$ oe or **M2** for $10^2 + 8^2$ oe or for $10^2 + 8^2 + 17^2$ oe or **M1** for recognising angle *GAC* is required
9(d)	19[.0] or 19.02 to 19.03	**4**	**M3** for $3^2 + 8^2 + 17^2$ oe **OR** **B1** for *QG* = 2 soi or *HQ* = 8 **M1** for $(5 – 2)^2 + 8^2$ or $(5 – 2)^2 + 17^2$
10(a)(i)	$2x^2 + 5x –187$ [= 0]	**M2**	**M1** for $(2x + 3)(x + 1) = 190$
	$(2x –17)(x + 11)$ [= 0] oe	**M1**	
	Leading to $x = 8.5$ with no errors	**A1**	
10(a)(ii)	59	**2**	**M1** for 6 × 8.5 + 8 oe or $6x + 8$ oe or **B1** for 9.5 and 20
10(b)(i)	$\frac{50}{360}\pi \times r^2 – \frac{1}{2}r^2 \times \sin 50 = 30$ oe	**M3**	**M1** for $\frac{50}{360}\pi \times r^2$ **M1** for $\frac{1}{2}r^2 \times \sin 50$ oe
	23.70[9] to 23.72…	**A1**	must see at least 4 sig figs

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Question	Answer	Marks	Partial Marks
10(b)(ii)	40.7 or 40.8 or 40.71 to 40.75…	**4**	**M2** for $2 \times 23.7 \times \sin 25$ oe or $\sqrt{23.7^2 + 23.7^2 - 2 \times 23.7 \times 23.7 \cos 50}$ oe or $\frac{23.7 sin 50}{\sin\left(\frac{180-50}{2}\right)}$ oe or **M1** for $\frac{x}{23.7} = \sin 25$ oe or for $23.7^2 + 23.7^2 - 2 \times 23.7 \times 23.7 \cos 50$ oe or $\frac{AB}{sin 50} = \frac{23.7}{\sin\left(\frac{180-50}{2}\right)}$ oe **AND** **M1** for $\frac{50}{360} \times 2 \times \pi \times 23.7$ oe

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