
MATHEMATICS (SYLLABUS D)

4024/21

Paper 2 Paper 2

October/November 2018

MARK SCHEME

Maximum Mark: 100

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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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.

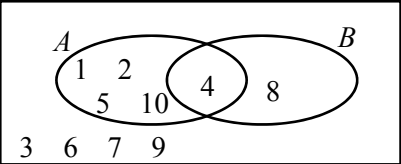
Abbreviations

cao	correct answer only
soi	seen or implied
isw	ignore subsequent working
oe	or equivalent
nfw	not from wrong working
dep	dependent
AG	answer given

Question	Answer	Marks	Partial Marks
1(a)(i)	6 points plotted correctly	2	B1 for 4 or 5 points plotted correctly
1(a)(ii)	Positive	1	
1(a)(iii)	$\frac{3}{5}$ cao	2	B1 for $\frac{6}{10}$ oe seen
1(a)(iv)	Ruled line of best fit	B1	
1(a)(v)	54 to 58	B1	FT reading from <i>their</i> straight line of best fit at 48 km
1(b)(i)	$20 < t \leq 40$	1	
1(b)(ii)	39.5	3	B1 for correct use of midpoints soi M1 for $(10 \times 29 + 30 \times 38 + 50 \times 26 + 70 \times 21 + 90 \times 6) \div 120$ oe
1(b)(iii)	22.5	2	B1 for 21 + 6 or 27 seen

Question	Answer	Marks	Partial Marks
2(a)	395.25 cao	3	B2 for answer 79.05 OR B1 for [time =] 7.75 oe soi M1 for <i>their</i> 7.75×10.20 oe
2(b)	23.75	2	M1 for $(19.80 \times 25 - 400) \div 400$ oe If 0 scored, SC1 for answer 123.75 or 123.8
2(c)	14.5[0]	2	M1 for $\frac{(100+8)}{100}x = 15.66$ soi
2(d)	3744.14 final answer	3	M2 for $3500 \times \left(1 + \frac{1.7}{100}\right)^4$ oe or M1 for $3500 \times \left(1 + \frac{1.7}{100}\right)^k$ oe where $k > 1$

Question	Answer	Marks	Partial Marks
3(a)	$\cos A = \frac{95^2 + 174^2 - 132^2}{2 \times 95 \times 174}$	M2	or M1 for $132^2 = 95^2 + 174^2 - 2 \times 95 \times 174 \times \cos A$
	$A = 48.56[7\dots]$ or 48.57	A1	
3(b)	1580 to 1581	4	M1 for $\frac{1}{2} \times 95 \times 174 \times \sin 48.6$ AND M2 for <i>their</i> area $\times 3 \div 100 \times 8.50$ or M1 for two operations correct in <i>their</i> area $\times 3 \div 100 \times 8.50$ or for $3 \div 100 \times 8.50$ soi

Question	Answer	Marks	Partial Marks
4(a)(i)		2	B1 for 8 or 9 numbers correctly placed or for 1, 2, 4, 5, 8, 10 correctly placed with no numbers placed incorrectly
4(a)(ii)	6	1	FT $n(A \cup B)$ from <i>their</i> Venn diagram
4(a)(iii)	Factors of 10 oe	1	
4(b)(i)	10	2	B1 for Venn diagram with at least 3 numbers correct Or M1 for $30 = 8 + 12 + x$ oe
4(b)(ii)	$\frac{42}{870}$ or $\frac{7}{145}$ oe	2	M1 for $\frac{\text{their } 7}{30} \times \frac{\text{their } 6}{29} [\times 2]$ or SC1 for answer $\frac{49}{900}$ oe , FT <i>their</i> Venn diagram

Question	Answer	Marks	Partial Marks
5(a)	-1.6 oe	1	
5(b)	Correct smooth curve	3	B2FT for 7 or 8 points correctly plotted or B1FT for 5 or 6 points correctly plotted
5(c)(i)	Tangent drawn at (-2, 0.8)	B1	
5(c)(ii)	-3.1 to -2.2	B1	Dependent on tangent drawn at $x = -2$
5(d)	-2.5 to -2.3 1.4 to 1.6 2.7 to 2.9	3	FT reading <i>their</i> graph at $y = 2$ Tolerance ± 1 mm B1 for each one correct After 0 scored, SC1 for $y = 2$ soi

Question	Answer	Marks	Partial Marks
6(a)	$\angle TAO = \angle TCO$ tangent perpendicular to radius $AO = CO$ [equal] radii TO is common Congruent RHS	3	B1 for one correct pair of equal angles and one correct pair of equal sides or for two correct pairs of equal sides B1 for correct reason for two pairs of equal sides/angles
6(b)(i)	$90 - x$	1	
6(b)(ii)	$\frac{90 - x}{2}$ oe	1	FT <i>their</i> algebraic (b)(ii) $\div 2$
6(b)(iii)	$270 - x$	1	
6(c)	16.5 or 16.46[...]	3	M2 for $[OT =] \frac{6}{\sin 35}$ or M1 for $\sin 35 = \frac{6}{[OT]}$

Question	Answer	Marks	Partial Marks
7(a)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$	1	
7(b)	6.71 or 6.708...	2	M1 for $6^2 + (-3)^2$ oe
7(c)	(0, 5)	2	FT <i>their (a)</i> ((<i>their</i> 2 – 2), (<i>their</i> 4 + 1)) B1 for one value in coordinates correct or for $[\overline{CB} =] \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ soi
7(d)(i)	$y = -\frac{1}{2}x + 4$ oe final answer	3	B2 for $y = -\frac{1}{2}x + c$ oe OR M1 for gradient = $\frac{-3}{6}$ soi M1 for (-2, 5) substituted into $y = \text{their } mx + c$
7(d)(ii)	$y = 2x$ oe	1	FT <i>their</i> gradient from (d)(i)

Question	Answer	Marks	Partial Marks
8(a)	$n + 5$ $n + 10$	1	Both correct
8(b)(i)	$(n + 5)^2$ and $n(n + 10)$	M1	
8(b)(ii)	$n^2 + 5n + 5n + 25 - n^2 - 10n = 25$	A1	or $n^2 + 10n - n^2 - 5n - 5n - 25 = -25$
8(c)	63	3	M1 for $n + n + 5 + n + 10 = 174$ oe A1 for $n = 53$ If 0 scored, SC1 for answer 53

Question	Answer	Marks	Partial Marks
9(a)(i)	$\pi \times 3^2 \times 21 + \frac{2}{3} \times \pi \times 3^3$	M3	B1 for cylinder height = 21 soi M1 for $\pi \times 3^2 \times$ their height M1 for $\frac{2}{3} \times \pi \times 3^3$
	= 650.3[...] or 650.4	A1	
9(a)(ii)	452 or 452.3 to 452.4...	3	M2 for $2 \times \pi \times 3^2 + \pi \times 6 \times 21$ or M1 for $2 \times \pi \times 3^2$ or $\pi \times 6 \times 21$
9(a)(iii)	21.2 or 21.22 to 21.23...	2	B1 for $\sqrt[3]{\frac{450}{650}}$ soi or $\sqrt[3]{\frac{650}{450}}$ soi
9(b)	1.57	3	B1 for 4.25 or 335 used M1 for their $4.25 - 8 \times$ their $335 \div 1000$ or for their $4250 - 8 \times$ their 335

Question	Answer	Marks	Partial Marks
10(a)(i)	$\frac{1}{2}x(x-4) \times 15 = 440$	M2	B1 for height = $(x-4)$
10(a)(ii)	Correct expansion and simplification leading to $3x^2 - 12x - 176 = 0$	A1	
10(b)(i)	$\frac{-(-12) \pm \sqrt{(-12)^2 - 4 \times 3 \times -176}}{2 \times 3}$	B2	B1 for $\sqrt{(-12)^2 - 4 \times 3 \times -176}$ or for $\frac{-(-12) \pm \sqrt{\text{their } 2256}}{2 \times 3}$
10(b)(ii)	9.92 and -5.92	B1	
10(c)	5.92	1	FT (their positive root - 4) if result positive
10(d)	18.2 or 18.21 to 18.22...	4	M2 for $[AF =]\sqrt{15^2 + \text{their } 9.92^2}$ Or for $[BF =]\sqrt{\text{their } 9.92^2 + \text{their } 5.92^2 + 15^2}$ oe or M1 for $AF^2 = 15^2 + \text{their } 9.92^2$ soi or for $BF^2 = \text{their } 9.92^2 + \text{their } 5.92^2 + 15^2$ oe AND M1 for $\tan [AFB] = \frac{\text{their } 5.92}{\text{their } 17.98}$ or $\sin [AFB] = \frac{\text{their } 5.92}{\text{their } 18.93}$

Question	Answer	Marks	Partial Marks
11(a)	$\frac{1-2x}{(2x-3)(x-2)}$ or $\frac{1-2x}{2x^2-7x+6}$ final answer	3	B1 for $4(x-2) - 3(2x-3)$ oe isw B1 for denominator $(2x-3)(x-2)$ oe isw
11(b)	$\frac{2x-3}{x-5}$ final answer nfw	3	B1 for $(2x+3)(2x-3)$ seen B1 for $(2x+3)(x-5)$ seen