
MATHEMATICS (SYLLABUS D)

4024/21

Paper 2

October/November 2019

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 **6** 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
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	16	2	M1 for $\frac{406 - 350}{350} [\times 100]$ or $\frac{406}{350} \times 100$ After 0 scored, SC1 for answer 84
1(b)	No, maximum possible mass is 23.25 kg	2	B1 for $15.5 + 0.25$ or $1.2 + 0.05$ used or M1 for <i>their</i> $15.75 + 6 \times \textit{their} 1.25$
1(c)	72[.00] final answer	3	M1 for 245×0.73 M1 for $\frac{\textit{their} 178.85 - 124}{0.76}$ oe
1(d)	36.44	3	M1 for $\frac{657}{100} \times 4.3$ M1 for <i>their</i> 28.251×1.29
1(e)	115 805 32.75 131 936 996.84	4	B1 for 115 M1 for $\frac{100 + 6.5}{100} x = 996.84$ soi A1 for 936 B1FT for 32.75 or dinner cost = $(\textit{their} 936 - 805) \div 4$
2(a)(i)	Correct histogram with frequency density axis scaled	3	B1 for 4 or more rectangles on correct bases B1 for 4 or more correct frequency densities soi
2(a)(ii)	49	2	M1 for $56 + 24 + 18$ soi
2(b)(i)	2	1	
2(b)(ii)	2.63	2	M1 for $([0 \times 17] + 1 \times 47 + 2 \times 42 + 3 \times 28 + 4 \times 32 + 5 \times 21 + 6 \times 13) \div 200$ oe
2(b)(iii)	$\frac{34}{200}$ oe	1	

Question	Answer	Marks	Partial Marks
2(b)(iv)	0.1222 final answer	3	M2 for $2 \times \frac{13}{200} \times \frac{187}{199}$ oe or M1 for $\frac{k}{200} \times \frac{200-k}{199} [\times 2]$ oe where $0 < k < 200$ If 0 scored, SC1 for $2 \times \frac{13 \times 187}{200^2}$ oe
3(a)	Centre (7, 1), scale factor 2	2	B1 for each
3(b)	Correct rotation, vertices (3, 0), (4, 0), (4, -2), (3, -1)	2	B1 for correct size and orientation but wrong position or SC1 for correct anticlockwise rotation about (1, 0) vertices (-1, 0), (-2, 0), (-1, 1), (-2, 2)
3(c)(i)	Correct transformation, vertices (-2, -1), (-3, -1), (-3, -3), (-2, -2)	2	B1 for three vertices correct or three correct pairs of coordinates soi
3(c)(ii)	Reflection in $y = -x$ oe	2	B1 for reflection B1 for $y = -x$ oe
4(a)	5030 or 5026 or 5027 or 5026.5 to 5027.2	3	M1 for $\frac{1}{3} \pi \times 4^2 \times 15$ M1 for $\pi \times 4^2 \times 95$ After 0 scored, SC1 for answer 20 100 or 20 110 or 20 106 to 20 109
4(b)	$[l =] \sqrt{15^2 + 4^2} (= \sqrt{241})$	M2	M1 for $[l^2 =] 15^2 + 4^2$ oe
	Curved surface area $= 4\pi \times \sqrt{241} + \pi \times 8 \times 95$	M2	M1 for $4\pi \times \text{their} \sqrt{241}$ or $\pi \times 8 \times 95$
	$= 2582.3$ to $2583.03 = 2580$ AG	A1	
4(c)	4800 or 4797.5 to 4803.2	2	M1 for $\left(\frac{150}{95+15}\right)^2$ or $\left(\frac{95+15}{150}\right)^2$ soi
5(a)(i)	$[a =] 3.5$ oe $[b =] -25.25$	2	B1 for $(x + 3.5)^2$ or $a = 3.5$
5(a)(ii)	$x = -3.5 \pm \sqrt{25.25}$	M1	FT <i>their</i> completed square expression
	1.52 -8.52	A1	After 0 scored, B1 for 1.52 and -8.52
5(b)	$\frac{2x+3}{x-4}$ final answer nfwf	3	B1 for $(2x+3)(2x-3)$ oe factorisation seen B1 for $(2x-3)(x-4)$ oe factorisation seen

Question	Answer	Marks	Partial Marks
5(c)	$x = 16$	4	M1 for $2x(x - 1) + 6(x + 4) = 2(x + 4)(x - 1)$ M1FT for $2x^2 - 2x + 6x + 24 = 2x^2 + 8x - 2x - 8$ M1FT for $24 + 8 = 6x - 4x$ (may be $8x - 6x$)
6(a)	24 35	1	
6(b)	$n(n+2)$ oe	2	B1 for quadratic expression in n
6(c)(i)	35	3	B2 for 35×37 or 35.8 to 35.9 OR M1 for <i>their</i> $n(n + 2) = 1358$ M1 for solution of <i>their</i> quadratic $\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times (-1358)}}{2 \times 1}$
6(c)(ii)	7	2	M1FT for $1358 - \text{their (c)(i)} \times (\text{their (c)(i)} + 2)$
7(a)	$\angle PXQ = \angle SXR$, vertically opposite $\angle QPX = \angle RSX$, angles in same segment $\angle PQX = \angle SRX$, angles in same segment Hence similar	3	B1 for two correct pairs of angles identified B1 for correct reasons for two pairs of angles
7(b)(i)	3.5	2	M1 for $\frac{RX}{6.3} = \frac{4.5}{8.1}$ oe
7(b)(ii)	7 : 5 nfw	2	B1 for 6.3 : 4.5 oe nfw
8(a)	$x - 4$	1	
8(b)	$CB = \text{area} \div \text{length} = \frac{80}{x}$ and $CQ = CB - 4$ oe	1	
8(c)	$[y =]80 - \frac{1}{2}(x - 4)\left(\frac{80}{x} - 4\right)$	M1	FT <i>their</i> expression from (a)
	$80 - \frac{320}{x} - 4x + 16$	M1	FT <i>their</i> expression from (a) of the form $ax + b$
	Correct working leading to $y = 32 + 2x + \frac{160}{x}$ AG	A1	
8(d)	74	1	
8(e)	Correct smooth curve	3	B2FT for 8 or 9 points correctly plotted or B1FT for 6 or 7 points correctly plotted
8(f)	67.4 up to but not including 68	1	

Question	Answer	Marks	Partial Marks
9(a)	$\cos \hat{BAC} = \frac{950^2 + 520^2 - 680^2}{2 \times 950 \times 520}$	M2	or M1 for $680^2 = 950^2 + 520^2 - 2 \times 950 \times 520 \times \cos \hat{BAC}$ oe
	$\hat{BAC} = 44.01 \text{ to } 44.02 [= 44.0^\circ]$	A1	
9(b)	349	1	
9(c)	4 min 53 s	4	M2 for [distance =]520 cos44 or M1 for $\cos 44 = \frac{d}{520}$ oe AND M1 for <i>their</i> distance $\div 4.6$
9(d)	14.8° or 14.78 to 14.79	4	M2 for $h = 950 \tan 10.7$ oe or M1 for $\tan 10.7 = \frac{h}{950}$ oe AND M1 for $\tan [] = \frac{\text{their } h}{680}$ oe
10(a)	10.6[3...]	2	M1 for $\sqrt{(3 - -4)^2 + (5 - -3)^2}$ oe
10(b)	Gradient = $-\frac{1}{3}$ oe	M1	
	Substitutes pair of values into $y = \text{their} \left(-\frac{1}{3}\right)x + c$ to find c	M1	
	$y = -\frac{1}{3}x + \frac{1}{3}$ oe rearranged to $3y + x = 1$ AG	A1	
10(c)	[y =] $3x + 9$	3	B1 for gradient = 3 soi M1 for substituting $(-4, -3)$ into $y = \text{their } 3x + c$