
MATHEMATICS (SYLLABUS D)

4024/21

Paper 2

October/November 2017

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.

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Abbreviations

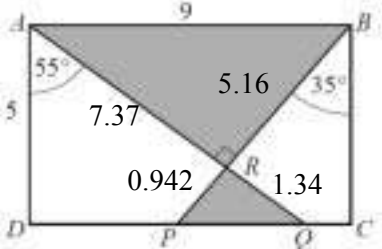
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfwf	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	503.5[0] final answer	3	M2 for $12.50 \times 38 \times 1.06$ oe or $12.50 \times 38 \times 0.06$ oe or M1 for 12.50×38 or 12.50×1.06 oe soi or 12.50×0.06 oe soi
1(a)(ii)	12	2	M1 for $(525 - 462) \div 525$ oe After M0 , SC1 for answer 88
1(a)(iii)	2400 nfwf	2	M1 for $1.03x = 2472$ soi
1(b)	192	3	M1 for 520×0.74 M1 for $(\text{their } 384.8 - 260) \div 0.65$
2(a)	14.35 or 14.4	3	B1 for use of correct midpoints soi M1 for $(2.5 \times 35 + 7.5 \times 42 + 15 \times 30 + 25 \times 28 + 40 \times 15) \div 150$
2(b)	Correct histogram with linear scale on frequency density axis	3	B2 for all 5 bar heights correct with frequency density axis scaled OR B1 for at least 3 correct heights drawn or 3 correct frequency densities calculated B1 for 5 bars correct width and position
2(c)	18 to 20	2	M1 for $(15 + 14) \div 150$
3(a)	040	1	
3(b)	$BC = \frac{\sqrt{25^2 + 38^2 - 2 \times 25 \times 38 \cos(360 - 220)}}{}$	M2	or M1 for $25^2 + 38^2 - 2 \times 25 \times 38 \times \cos(360 - 220)$
	$BC = 59.36$ to 59.37	A1	

Question	Answer	Marks	Partial Marks
3(c)	204.1 to 204.3[2...]	4	B3 for 24.1 to 24.3[2...] OR M2 for $\sin B = \frac{38 \times \sin(360 - 220)}{59.4}$ or M1 for $\frac{\sin B}{38} = \frac{\sin(360 - 220)}{59.4}$ and M1 for $180 + \text{their } B$
4(a)	$\frac{5}{9}$ oe	1	
4(b)(i)	$\frac{25}{81}$ oe	1	
4(b)(ii)	$\frac{40}{81}$ oe	2	M1 for $\frac{\text{their } 5}{9} \times \frac{(9 - \text{their } 5)}{9}$ soi or $\frac{\text{their } 5}{9} \times \frac{4}{9}$
4(c)	$\frac{4}{9}$ oe nfw	3	M2 for $\frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{3}{8}$ or M1 for $\frac{4}{9} \times \frac{3}{8}$ or $\frac{5}{9} \times \frac{4}{8}$
5(a)	-3 , 2 nfw	3	M1 for $y^2 + 5y = 4y + 6$ M1 for $(y + 3)(y - 2) [= 0]$
5(b)	$t = \frac{2p-1}{4+p}$ or $t = \frac{1-2p}{-4-p}$ final answer	3	M1 for $p(2 - t) = 4t + 1$ or better M1FT for $2p - 1 = 4t + pt$ M1FT for completion to explicit formula for t Max 2 marks if final answer incorrect
5(c)	$\frac{3x-2}{x+4}$ final answer	3	B1 for $(3x - 2)(x - 4)$ seen B1 for $(x + 4)(x - 4)$ seen
6(a)(i)	$[\hat{A}CB =] 38$	1	
6(a)(ii)	$[\hat{A}EF =] 38,$ angles in same segment are equal	1	Strict FT <i>their</i> (i)
6(a)(iii)	$[\hat{C}DE =] 112$	1	
6(a)(iv)	$[\hat{B}CD =] 106$	2	FT $180 - \text{their } CDE + \text{their } ACB$ M1 for $\hat{A}CD = 180 - \text{their } 112$ soi

Question	Answer	Marks	Partial Marks
6(b)	156	3	B1 for sum of angles in pentagon = 540 soi M1 for $8x + 124 = \text{their } 540$ oe
6(c)	105.5	2	B1 for two of 65.5, 131.5 and 57.5 seen After B0 , SC1 for answer 108.5
7(a)(i)	$y = -2x + 5$ oe	2	B1 for $y = -2x + c$ oe or for $y = mx + 5$ oe or M1 for gradient = $\frac{5+3}{0-4}$ oe
7(a)(ii)	$y = -2x - 1$ oe FT <i>their</i> gradient from (a)(i)	2	B1 for answer $y = \text{their } (-2)x + k$, where $k \neq \text{their } 5$ or M1 for $3 = \text{their } (-2) \times -2 + k$ oe
7(b)(i)	3.5	1	
7(b)(ii)	Correct smooth curve through 8 correct points	3	B2FT for 7 or 8 points correctly plotted or B1FT for 5 or 6 points correctly plotted
7(b)(iii)	Clear correct tangent drawn at (1, 1)	M1	
	-2.4 to -1.6	A1	
7(b)(iv)	0.6 to 0.8 and 4.2 to 4.4	2	FT reading from <i>their</i> graph at $y = 2$ B1 for one correct or for $y = 2$ soi
8(a)	$[x^2 =] 6^2 + 12^2$	M1	or $[x =] \sqrt{6^2 + 12^2}$
	$[x =] 13.41[6\dots]$ or 13.42	A1	
8(b)	478.7 to 479.4	3	M1 for $\left[\frac{1}{2} \times\right] 4 \times \pi \times 6^2$ seen M1 for $\pi \times 6 \times 13.4$ seen After 0 scored, SC1 for consistent use of $r = 3$ in formula for [hemi]sphere and cone
8(c)	904.7 to 905 nfww	3	M1 for $\left[\frac{1}{2} \times\right] \frac{4}{3} \times \pi \times 6^3$ seen M1 for $\frac{1}{3} \times \pi \times 6^2 \times 12$ seen After 0 scored, SC1 for consistent use of $r = 3$ in formula for [hemi]sphere and cone
8(d)(i)	4310 or FT $9 \times \text{their (b)}$	2	M1 for $\left(\frac{6}{2}\right)^2$ soi
8(d)(ii)	113 or FT $\frac{1}{8} \times \text{their (c)}$	2	M1 for $\left(\frac{1}{2}\right)^3$ soi

Question	Answer	Marks	Partial Marks
9(a)	7 cao	2	M1 for $\frac{12}{3000} \times 1750$ oe
9(b)(i)	$\frac{2500}{x}$	1	
9(b)(ii)	$\frac{2500}{x} - \frac{2500}{x+20} = 15$	M1	Or equivalent unsimplified equation
	$2500(x+20) - 2500x = 15x(x+20)$	M1	FT elimination of <i>their</i> fractions with algebraic denominators
	Correct simplification leading to $3x^2 + 60x - 10\,000 = 0$ AG	A1	
9(b)(iii)	48.59 and -68.59 final answer	3	B1 for $\sqrt{60^2 - 4 \times 3 \times -10000}$ soi B1 for $\frac{-60 \pm \sqrt{\text{their } 123600}}{2 \times 3}$
9(b)(iv)	36 minutes 27 seconds	3	M2 for $\frac{2500}{\text{their } 48.59 + 20}$ or M1 for $\frac{2500}{\text{their } 48.59}$
10(a)(i)	Triangle <i>B</i> at (2, -3), (3, -3), (3, -5)	2	B1 for translation of correct triangle <i>B</i>
10(a)(ii)	Triangle <i>C</i> at (3, 3), (3, 9), (6, 3)	2	B1 for two vertices correct or for $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} 1 & 2 & 1 \\ 1 & 1 & 3 \end{pmatrix}$ oe
10(a)(iii)	$\begin{pmatrix} \frac{1}{3} & 0 \\ 0 & \frac{1}{3} \end{pmatrix}$ oe	1	
10(a)(iv)	Enlargement Centre (3, -1.5) SF $-\frac{1}{3}$	3	B1 for each
10(b)(i)	$\begin{pmatrix} 4 \\ 8 \end{pmatrix}$	2	B1 for one component correct or M1 for $2 \begin{pmatrix} 6 \\ 3 \end{pmatrix} - \begin{pmatrix} 8 \\ -2 \end{pmatrix}$ oe After 0 scored, SC1 for answer $\begin{pmatrix} -4 \\ -8 \end{pmatrix}$
10(b)(ii)	$\begin{pmatrix} 9 \\ 0 \end{pmatrix}$	2	B1 for one component correct or M1 for $-\frac{3}{4}(\text{their } \overline{SR})$ or $\frac{1}{4}(\text{their } \overline{SR})$ soi

Question	Answer	Marks	Partial Marks
11(a)	$\angle ARB = \angle PRQ$, [vertically] opposite $\angle RAB = \angle RQP$, alternate [angles] $\angle RBA = \angle RPQ$ alternate [angles] $\triangle ARB$ and $\triangle QRP$ similar, equal angles	3	B1 for one pair of angles stated with reason or for two pairs with no reasons or incorrect reasons B1 for a further correct pair of angles with reason
11(b)(i)	[AQ =] 8.72 or 8.717[...]	2	M1 for $\cos 55 = \frac{5}{AQ}$ or $\sin 35 = \frac{5}{AQ}$ oe
11(b)(ii)	[AR =] 7.37[2...]	2	M1 for $\cos 35 = \frac{AR}{9}$ or $\sin 55 = \frac{AR}{9}$ oe
11(b)(iii)	[Area ARB =] 18.8 to 19.2[...] or FT their AR	2	M1 for $\frac{1}{2} \times \text{their } 7.37 \times 9 \times \sin 35$ oe Or $\frac{1}{2} \times \text{their } 7.37 \times \sqrt{9^2 - (\text{their } 7.37)^2}$
11(b)(iv)	19.6 to 19.7 nfww 	3	M1 for $\tan 35 = \frac{PR}{\text{their } RQ}$ oe or $\frac{PR}{\text{their } RQ} = \frac{\text{their } RB}{\text{their } AR}$ oe where $\text{their } RQ = (\text{their } 8.72 - \text{their } 7.37)$ M1 for their area ARB + $\frac{1}{2} \times \text{their } RQ \times \text{their } PR$