

**MARK SCHEME for the October/November 2010 question paper
for the guidance of teachers**

4024 MATHEMATICS (SYLLABUS D)

4024/21

Paper 2, maximum raw mark 100

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.

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Abbreviations

cao	correct answer only
cso	correct solution only
dep	dependent
ft	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
www	without wrong working
art	anything rounding to
soi	seen or implied

1	(a)	(i) -55	1	
		(ii) $(Q =) \frac{4}{7} (P - 15)$ oe	2	M1 for $\frac{7}{4} Q = P - 15$, or $4P = 7Q + 4 \times 15$ or better SC1 for $\frac{4P - 15}{7}$, $\frac{4(P + 15)}{7}$ or $4(\frac{P}{7} - 15)$ oe
		(b) (i) $7(c - 2d)(c + 2d)$	2	B1 for $7(c^2 - 4d^2)$ or $(7c + 14d)(c - 2d)$ or $(7c - 14d)(c + 2d)$ or $(c - 2d)(c + 2d)$ seen
		(ii) $(3x + 2)(x - 3)$	2	B1 for one correct factor seen or signs reversed
	(c)	6.2 oe	2	M1 for $4 = 5(7 - y)$ soi
2	(a)	(i) 74.8 or 74.7	2	Here and elsewhere accept answers rounding to the given 3 significant figure answers. No obvious wrong working seen. M1 for $\tan BAC = \frac{180}{49}$ oe soi
		(ii) 15.2 or 90 – their (a)(i)	1ft	
		(b) (i) 500	2	M1 for $(LP^2 =) 1300^2 - 1200^2$ soi
		(ii) 293 cao	3	M1 for $\sin LPS = \frac{1200}{1300}$ or $\cos LSP = \frac{1200}{1300}$ or for correct use of their (b)(i) A1 for $LPS = 67.4$ cao or $LSP = 22.6$ cao B1 for $360 -$ their LPS or $270 +$ their LSP
		(iii) 9.75	2	M1 for figs $\frac{13}{1604 - 1556}$
3	(a)	(i) 38	1	
		(ii) 38	1ft	Their (i) (must be $< 90^\circ$)
		(iii) 74	1	
		(iv) 68	1ft	$180 -$ (their (iii) + their (i) or (ii)) or $106 -$ their (i) dep on positive ans.
	(b)	$(y =) \frac{1}{2}(90 - x)$ oe	3	B2 for $y + y + 90 + x = 180$ or better B1 for $ABO = y$ or $(OAC =) 90$

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4	(a)	(i) P correct (ii) All 10 elements correctly placed	1 3	In (a) ignore numbers outside the given range B1 for 21 correct B1 for at least two non-empty subsets correct (ignoring the position of 21) If 0 scored then allow SC2 if all the elements other than 21 are correctly placed.
	(b)	(i) 10 (ii) {b, c, d, f, g} (iii) 2 (iv) $\frac{3}{5}$ oe	1 1 1 1	
	(c)	(i) 3 (ii) 51	1 1	
5	(a)	25	1	B1 for $212.67 \times 36 (= 7656.12)$ B1 for $5280 \times \frac{x}{100}$ soi or their (b)(i)/5280 soi M1 for $5280 \times \frac{x}{100} \times 3 =$ their 2376.12 oe M2 for $\frac{30}{130} \times 7040$ oe M1 for $130\% = 7040$ soi
	(b)	(i) 2376.12 (ii) 15	2 3ft	
	(c)	1625 cao	3	
6	(a)	(i) 2.25 isw (ii) 2 www	2 1ft	M1 for $(1 \times 8 + 2 \times 17 + 3 \times 12 + 4 \times 3) \div 40$ B2 for 2 angles correct or 1 angle correct with all “correct” labels B1 for 1 angle correct with wrong or no labels or B1 for at least 2 angles calculated
	(b)	(i) Correct pie chart (ii) 6	3 1	
7	(a)	(i) 9.6 (ii) 16 cm (iii) $2\,200\text{ cm}^2$ (iv) 191	1 2 2ft 3	M1 for $\frac{9600}{20 \times 30}$ B1 for areas 20×30 , their 16×20 and their 16×30 ft for $600 + 100 \times$ their (a)(ii) B1 for $\pi \times 0.8^2 \times 25$ soi M1 for their $(\pi \times 0.8^2 \times 25) \times t = 9600$ B1 for figs $\frac{25 \times 26}{2 \times 3}$ soi M1 for $\frac{3 \times 2.6}{4\pi}$
	(b)	(i) 11 or 10.8(3...) (ii) 0.853 cm	2 2	

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8	(a)	15, 8, 3, 0, -1, 0, 3, 8, 15	2	B1 for at least 7 correct
	(b)	All points plotted ft and curve drawn	3ft	P2 for 9 correct plots ft P1 for at least 5 correct ft and C1 for a smooth curve dependent on at least P1
	(c) (i)	Correct straight line	2	L1 for a correct but short line or with a correct section at least 6cm long but deviates elsewhere.
	(ii)	-1	2ft	M1 for $x = \frac{y+7}{2}$ soi or $3 = \frac{x+7}{2}$ ft from their line
9	(iii) (a)	-1.9 2.4	1ft	ft from their graphs
	(b)	$2x^2 - x - 9 (= 0)$	2	M1 for $\frac{y+7}{2} = x^2 - 1$ SC1 for $x^2 - 0.5x - 4.56$
	(a) (i)	26	1	
	(ii)	11.8	2	M1 for $\frac{BC}{\sin \text{their } 26} = \frac{15}{\sin 34}$
10	(b) (i)	104	4	M1 for $55^2 + 70^2 \pm 2 \times 55 \times 70 \cos 112$ M1 for $\sqrt{55^2 + 70^2 - 2 \times 55 \times 70 \cos 112}$ A1 for 10809(.4). or 71.0 SC2 for 104 anw
	(ii) (a)	11 14	1	
	(b)	71.4	2ft	M1 for $\frac{1}{2} \times 11 \times 14 \sin 112$ ft from their 11 and 14
	(c)	810	2	B1 for use of the factor with figs 25
	(a) (i)	$\begin{pmatrix} 14 \\ -4 \end{pmatrix}$	1	
	(ii)	14.6	2	M1 for $\sqrt{\text{their } 14^2 + \text{their } (-4)^2}$
	(iii)	Convincing demonstration	2	B1 for $\overrightarrow{EF} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ or $\overrightarrow{HG} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$
	(b)	Full description	3	B1 for enlargement B1 for centre (-2, 4) B1 for scale factor 2
	(c) (i)	(5, 0) (7,3) (2,3)	2	B1 for two correct or M1 for $\begin{pmatrix} 5 & 2 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$ seen
	(ii)	$\frac{1}{15} \begin{pmatrix} 3 & -2 \\ 0 & 5 \end{pmatrix}$	2	B1 for determinant 15 or $\frac{1}{15}$ seen or $\begin{pmatrix} 3 & -2 \\ 0 & 5 \end{pmatrix}$ seen Or M1 for $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 5 & 7 & 2 \\ 0 & 3 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$

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11	(a) 3 : 1000 (b) (i) (a) 3 www (b) 487.5 (ii) (a) $x^2 + 34x - 225 = 0$ (b) 5.67 -39.67 (c) 44.0 cao	1 3 1ft 2 4 1ft	M1 for $27 \times 25 \times \frac{15}{10}$ A1 for 1012.5 SC1 for answer 3 anw ft their (a) $\times 500$ – their 1012.5 M1 for $(27 + 3x)(25 + x) = 2 \times 27 \times 25$ oe B1 for $p = -34$ and $r = 2$ B1 for $q = 2056$ or $\sqrt{q} = 45.3(4\dots)$ or B1 for $(x + 17)^{(2)}$ B1 for 22.67 or 514 B1 for one correct final answer or both 5.671... and -39.671....seen (possibly with no working) or both 5.7 and -39.7 SC1 + 1 for 5.67 and -39.67 anw ft $27 + 3 \times$ their +ive x but lost if negative value given as well
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