

**MARK SCHEME for the May/June 2012 question paper
for the guidance of teachers**

0581 MATHEMATICS

0581/43

Paper 4 (Extended), maximum raw mark 130

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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

<p>1 (a) (i) [0]5 38 oe</p> <p>(ii) 92.7 [92.72 to 92.73] oe</p> <p>(b) (i) 204 or 203. 9[0] to 203.91</p> <p>(ii) $640 \div (4 + 3 + 1) \times 3 [= 240]$</p> <p>(iii) 150 www 3</p> <p>(c) 11 cao www 3</p>	<p>1 Allow 5h 38 but not 5h 38mins</p> <p>2 Allow $92\frac{8}{11}$ or $\frac{1020}{11}$ M1 for $850 \div$ their 9 h 10 min in hours oe Allow $850 \div 9.1$ for M1</p> <p>3 M1 for $160 \times 255 + 330 \times 190 + 150 \times 180$ [130 500] M1 dep for $\div 640$</p> <p>M1 [Can be in either order or shown together] M1 Accept $240 \div 3 \times (4 + 3 + 1) = 640$ for M2</p> <p>3 M2 for $240 \div 1.6$ oe or M1 for recognition of $240 = 100 + 60 \%$</p> <p>3 M1 for figs 340 or figs $550 \div$ speed [e.g. figs 188, figs 306] – can be spoiled by further work and M1 for correct conversion of units to give answer in seconds e.g. speed = 50 m/s M's independent</p>
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<p>2 (a)</p> <p>$[\sin =] \frac{10 \sin 95}{12}$ 56.1 (56.11 to 56.12) www 3</p> <p>(b) $12^2 + 17^2 - 2 \times 12 \times 17 \cos 30$ oe 8.93 [8.925....] www 4</p> <p>(c) (i) 126 or 126.1 (126.11 to 126.12)</p> <p>(ii) 306 or 306.1 (306.11 to 306.12)</p> <p>(d) $[\sin =] \frac{17 \sin 30}{\text{their}(b)}$ oe or $[\cos =] \frac{12^2 + (\text{their}(b))^2 - 17^2}{2 \times 12 \times \text{their}(b)}$ oe 180 – 95 – their (a)</p> <p>137 [136.5 to 136.9] www 4</p>		<p>M2</p> <p>A1</p> <p>M2</p> <p>A2</p> <p>1ft</p> <p>1ft</p> <p>M2</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>M1 for correct implicit equation</p> <p>M1 for correct implicit equation A1 for 79.66 to 79.67 or 79.7</p> <p>ft their (a) + 70 [provided less than 360]</p> <p>ft 180 + their (c)(i) [provided less than 360]</p> <p>M1 for correct implicit equation [107.7 to 107.9 or 108 or 72 or 72.1 to 72.3]</p> <p>e.g. 28.88 to 28.9 seen – may be on diagram <u>Alt methods possible</u> e.g. $[\sin ABC =] \frac{12 \sin 30}{\text{their}(b)}$ [42.2...] gets M1 then 360 – 95 – 30 – their (a) – their 42.2 gets M2 dep on previous M1</p> <p>A1 isw reflex angle 223 or 223.1 to 223.5 after correct answer seen</p>
<p>3 (a)</p> <p>Triangle with vertices (6, 4), (9, 4), (9, 6)</p> <p>(b) Triangle with vertices (11, 1), (8, 1), (8, 3)</p> <p>(c) (i) Rotation 90° [anticlockwise] oe [centre] (0, 0) oe</p> <p>(ii) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$</p> <p>(d) (i) Triangle with vertices (1, 3), (4, 3), (4, 9)</p> <p>(ii) $\begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$</p>		<p>2</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>2</p> <p>2</p>	<p>Ignore labels and condone good freehand in parts (a), (b) and (d)(i)</p> <p>SC1 for translation $\begin{pmatrix} 5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$</p> <p>SC1 for reflection in $y = 6$</p> <p>If other transformations in addition, then 0, 0, 0</p> <p>e.g. O, origin</p> <p>B1 each column</p> <p>SC1 for (1, 3) and (4, 3), or (4, 9)</p> <p>B1 right-hand column or $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$</p>

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4	(a) (i)	Median = 2 www 2	2	M1 for identifying mid-value [e.g. List with 10 th and 11 th seen in working] or 10.5 soi
		Mode = 3	1	
	(ii)	54 www 2	2	M1 for $3 \div 20 \times 360$ oe
	(b)	184 www 4	4	M1 for 175, 185, 195 soi M1 for $5 \times a + 12 \times b + 3 \times c$ where a, b, c are in correct interval, including boundaries [3680] M1 (dep on 2 nd M) $\div 20$
5	(a) (i)	980 (979.6 to 980.3....) www 4	4	M3 for $(\pi \times 8^2 \times 6) - \left(2 \times \frac{4}{3} \times \pi \times 3^3\right)$ Or M1 for $\pi \times 8^2 \times 6$ and M1 for $\left[2 \times \frac{4}{3} \times \pi \times 3^3\right]$
	(ii)	0.98[0] (0.9796 to 0.9803...)	1ft	ft their (i) $\div 1000$ but not in terms of π
	(b)	1.2[0] (1.195 to 1.196)	2ft	ft their (a)(i) $\times 1.22 \div 1000$ or their (a)(ii) $\times 1.22$ SC1ft for figs 12[0] or 1195 to 1196 Apply ft to SC
	(c)	4.88 or 4.87 (4.871 to 4.878..) www 2	2ft	ft their (a)(i) $\div \pi 8^2$ provided their (a)(i) is not 384π or 1206... M1 for their (a)(i) $\div \pi 8^2$

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6	(a) (i)	180	1	
	(ii)	20	1	
	(b)	220	1	
	(c) (i)	$\frac{170}{240}$ oe isw	1	Allow 0.708, 0.7083... or % equivalents
	(ii)	$\frac{150}{240}$ oe isw	1	Allow 0.625 or % equivalents
	(d)			Penalise once for first correct none 4 dp dec answer to at least 3sf or correct fraction answer in parts (d) and (e)
	(i)	0.5617	2	Accept 56.1715% , do not accept 0.562 ww M1 for $\frac{180}{240} \times \frac{179}{239}$ [0.56171 to 0.56172], $\frac{537}{956}$ oe
	(ii)	0.3766	3	Accept 37.6569% M2 for $2 \times \frac{180}{240} \times \frac{60}{239}$ oe [0.37656 to 0.37657] $\frac{90}{239}$ oe Or M1 for one correct product seen, implied by 0.18828... or 0.1883
	(e)	0.6937	3	Accept 69.3669%, do not accept 0.694 ww M2 for $\frac{150}{180} \times \frac{149}{179}$ [0.69366 to 0.69367] $\frac{745}{1074}$ oe or M1 for $\frac{150}{180}$ oe soi

7 (a)	1,, 11.3[1..], 16	3	B1 each
(b)	9 points plotted Smooth curve through at least 8 points and exponential shape	P3ft C1ft	P2ft for 7 or 8, P1ft for 5 or 6. ft only if correct shape and covers the domain $0 < x < 4$
(c)	$2.3 < x < 2.35$	1	
(d)	$0.4 < x < 0.5$, $3.25 < x < 3.35$	M1 A1 A1	$y = 3x$ ruled to cut curve at all possible points.
(e)	Reasonable tangent with gradient 3 (their x , their y)	M2 A1	Or M1 for any tangent Dep on M2. Their point of contact
8 (a)	$u = 24$ $v = 92$ $w = 184$	2 1 1ft	SC1 for angle $DBA = 88$ or $u = \text{angle } CDY$ ft $2 \times \text{their } v$ Allow all seen in diagram
(b)	10.8	2	M1 for area factor of 3^2 soi e.g. dividing by 9
(c) (i)	18	2	M1 for $4x + x = 90$ or better
(ii)	72	2ft	ft $90 - \text{their } x$ or $4 \times \text{their } x$ M1 for angle K or $I = 90 - \text{their } x$ or $4 \times \text{their } x$
(iii)	54	1	Allow all seen in diagram

9 (a) (i)	$-\frac{1}{3}$ oe	2	B1 for $f(2) = -3$ soi
(ii)	-7	1	
(b)	$\frac{x-2}{x}$ final answer www	2	M1 for $1 - \frac{2}{x}$ seen
(c)	$y-1 = x^3$ or $x = y^3 + 1$ $x = \sqrt[3]{y-1}$ or $x-1 = y^3$ $\sqrt[3]{x-1}$ oe final answer www2	M1	i.e. two correct steps For M1, accept a correct reverse flowchart
(d)	A, F, D	A1	After 0 scored allow SC1 for $\sqrt[3]{x-1}$ seen then spoilt
(e)	29	3	B1 each
		2	M1 for $x = k(2)$ or $\sqrt[5]{x+3} = 2$ (Variable can be y in second method)
10 (a)	1.3[0]	3	M2 for $(31.7[0] - 7) \div (12 + 7)$ or better Or M1 for $12x + 7(x + 1) = 31.7[0]$ or better or $31.7[0] - 7$ or better
(b) (i)	$\frac{36}{y} - \frac{36}{y+1} = 25$ oe $36(y+1) - 36y = 25y(y+1)$ oe $36y + 36 - 36y = 25y^2 + 25y$ oe } $25y^2 + 25y - 36 = 0$	M2	SC1 for $\frac{36}{y}$ oe or $\frac{36}{y+1}$ oe seen Accept both all over $y(y+1)$ Must see at least one of these lines before E mark
(ii)	$(5y+9)(5y-4)$	E1	Final line reached without any errors or omissions
(iii)	-1.8 oe, 0.8 oe	2	Accept $(25y-20)(y+1.8)$ oe SC1 for $(5y+m)(5y+n)$ where $mn = -36$ or $m+n = 5$
(iv)	2.6[0]	1ft	ft only SC1 from (b)(ii)
		1ft	ft $2 \times$ positive root from (b)(iii) +1 Dep on pos and neg root in (b)(iii)

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11 (a)	33, 41 16π, 25π 20π, 30π	1 1 2	
(b) (i)	8n + 1 oe final answer	2	e.g. 9 + 8(n - 1), condone n = 8n + 1 SC1 for 8n + k
(ii)	137 www2	2	M1 for their (b)(i) = 1097
(c) (i)	n ² π oe final answer	1	
(ii)	9n ² π oe final answer	1	Allow (3n) ² π
(d)	n(n + 1)π oe final answer	2	SC1 for a quadratic expression e.g. n(n + 1), n ² + 5, n ² + nπ