

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

**0580 MATHEMATICS**

**0580/43**

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

<b>1 (a) (i)</b>	[0]5 38 oe	<b>1</b>	Allow 5h 38 but not 5h 38mins
	<b>(ii)</b> 92.7 [92.72 to 92.73] oe	<b>2</b>	Allow $92\frac{8}{11}$ or $\frac{1020}{11}$ <b>M1</b> for $850 \div$ their 9 h 10 min in hours oe Allow $850 \div 9.1$ for <b>M1</b>
	<b>(b) (i)</b> 204 or 203. 9[0] to 203.91	<b>3</b>	<b>M1</b> for $160 \times 255 + 330 \times 190 + 150 \times 180$ [130 500] <b>M1</b> dep for $\div 640$
	<b>(ii)</b> $640 \div (4 + 3 + 1)$ $\times 3 [= 240]$	<b>M1</b> <b>M1</b>	[Can be in either order or shown together] Accept $240 \div 3 \times (4 + 3 + 1) = 640$ for <b>M2</b>
	<b>(iii)</b> 150 www 3	<b>3</b>	<b>M2</b> for $240 \div 1.6$ oe or <b>M1</b> for recognition of $240 = 100 + 60 \%$
	<b>(c)</b> 11 cao www 3	<b>3</b>	<b>M1</b> for figs 340 or figs $550 \div$ speed [e.g. figs 188, figs 306] – can be spoiled by further work and <b>M1</b> for correct conversion of units to give answer in seconds e.g. speed = 50 m/s <b>M's</b> independent

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<p><b>2 (a)</b></p> <p><math>[\sin =] \frac{10 \sin 95}{12}</math> 56.1 (56.11 to 56.12) www 3</p> <p><b>(b)</b></p> <p><math>12^2 + 17^2 - 2 \times 12 \times 17 \cos 30</math> oe 8.93 [8.925....] www 4</p> <p><b>(c) (i)</b></p> <p>126 or 126.1 (126.11 to 126.12)</p> <p><b>(ii)</b></p> <p>306 or 306.1 (306.11 to 306.12)</p> <p><b>(d)</b></p> <p><math>[\sin =] \frac{17 \sin 30}{\text{their}(b)}</math> oe or <math>[\cos =] \frac{12^2 + (\text{their}(b))^2 - 17^2}{2 \times 12 \times \text{their}(b)}</math> oe 180 – 95 – their (a)</p> <p>137 [136.5 to 136.9] www 4</p>		<p><b>M2</b></p> <p><b>A1</b></p> <p><b>M2</b></p> <p><b>A2</b></p> <p><b>1ft</b></p> <p><b>1ft</b></p> <p><b>M2</b></p> <p><b>M1</b></p> <p><b>M1</b></p> <p><b>A1</b></p>	<p><b>M1</b> for correct implicit equation</p> <p><b>M1</b> for correct implicit equation <b>A1</b> 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><b>M1</b> 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. <math>[\sin ABC =] \frac{12 \sin 30}{\text{their}(b)}</math> [42.2...] gets <b>M1</b> then 360 – 95 – 30 – their (a) – their 42.2 gets <b>M2</b> dep on previous <b>M1</b></p> <p><b>A1</b> isw reflex angle 223 or 223.1 to 223.5 after correct answer seen</p>
<p><b>3 (a)</b></p> <p>Triangle with vertices (6, 4), (9, 4), (9, 6)</p> <p><b>(b)</b></p> <p>Triangle with vertices (11, 1), (8, 1), (8, 3)</p> <p><b>(c) (i)</b></p> <p>Rotation 90° [anticlockwise] oe [centre] (0, 0) oe</p> <p><b>(ii)</b></p> <p><math>\begin{pmatrix} 0 &amp; -1 \\ 1 &amp; 0 \end{pmatrix}</math></p> <p><b>(d) (i)</b></p> <p>Triangle with vertices (1, 3), (4, 3), (4, 9)</p> <p><b>(ii)</b></p> <p><math>\begin{pmatrix} 1 &amp; 0 \\ 0 &amp; 3 \end{pmatrix}</math></p>		<p><b>2</b></p> <p><b>2</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>2</b></p> <p><b>2</b></p> <p><b>2</b></p>	<p>Ignore labels and condone good freehand in parts (a), (b) and (d)(i)</p> <p><b>SC1</b> for translation <math>\begin{pmatrix} 5 \\ k \end{pmatrix}</math> or <math>\begin{pmatrix} k \\ 3 \end{pmatrix}</math></p> <p><b>SC1</b> for reflection in <math>y = 6</math></p> <p>If other transformations in addition, then 0, 0, 0 e.g. O, origin</p> <p><b>B1</b> each column</p> <p><b>SC1</b> for (1, 3) and (4, 3), or (4, 9)</p> <p><b>B1</b> right-hand column or <math>\begin{pmatrix} 3 &amp; 0 \\ 0 &amp; 1 \end{pmatrix}</math></p>

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<b>4 (a) (i)</b>	Median = 2    www 2	<b>2</b>	<b>M1</b> for identifying mid-value [e.g. List with indication or 10 <sup>th</sup> and 11 <sup>th</sup> seen in working] or 10.5 soi
	Mode = 3	<b>1</b>	
	<b>(ii)</b> 54    www 2	<b>2</b>	<b>M1</b> for $3 \div 20 \times 360$ oe
<b>(b)</b>	184    www 4	<b>4</b>	<b>M1</b> for 175, 185, 195    soi <b>M1</b> for $5 \times a + 12 \times b + 3 \times c$ where $a, b, c$ are in correct interval, including boundaries [3680] <b>M1</b> (dep on 2 <sup>nd</sup> M) $\div 20$
<b>5 (a) (i)</b>	980 (979.6 to 980.3....)    www 4	<b>4</b>	<b>M3</b> for $(\pi \times 8^2 \times 6) - \left(2 \times \frac{4}{3} \times \pi \times 3^3\right)$ <b>Or M1</b> for $\pi \times 8^2 \times 6$ <b>and M1</b> for $\left[2 \times \frac{4}{3}\right] \times \pi \times 3^3$
	<b>(ii)</b> 0.98[0] (0.9796 to 0.9803...)	<b>1ft</b>	ft their (i) $\div 1000$ but not in terms of $\pi$
	<b>(b)</b> 1.2[0] (1.195 to 1.196)	<b>2ft</b>	ft their (a)(i) $\times 1.22 \div 1000$ <b>or</b> their (a)(ii) $\times 1.22$ <b>SC1ft</b> for figs 12[0] or 1195 to 1196 Apply ft to SC
<b>(c)</b>	4.88 or 4.87 (4.871 to 4.878..)    www 2	<b>2ft</b>	ft their (a)(i) $\div \pi 8^2$ provided their (a)(i) is not $384 \pi$ or 1206... <b>M1</b> 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)			<b>Penalise once for first correct none 4 dp dec answer to at least 3sf or correct fraction answer in parts (d) and (e)</b>
	(i)	0.5617	2	Accept 56.1715%, do not accept 0.562 ww <b>M1</b> for $\frac{180}{240} \times \frac{179}{239}$ [0.56171 to 0.56172], $\frac{537}{956}$ oe
	(ii)	0.3766	3	Accept 37.6569% <b>M2</b> for $2 \times \frac{180}{240} \times \frac{60}{239}$ oe [0.37656 to 0.37657] $\frac{90}{239}$ oe Or <b>M1</b> 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 <b>M2</b> for $\frac{150}{180} \times \frac{149}{179}$ [0.69366 to 0.69367] $\frac{745}{1074}$ oe or <b>M1</b> for $\frac{150}{180}$ oe soi

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

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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 A1	i.e. two correct steps For M1, accept a correct reverse flowchart After 0 scored allow SC1 for $\sqrt[3]{x-1}$ seen then spoil
	(d)	A, F, D	3	B1 each
	(e)	29	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	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
		$36(y+1) - 36y = 25y(y+1)$ oe		
		$36y + 36 - 36y = 25y^2 + 25y$ oe } $25y^2 + 25y - 36 = 0$		
	(ii)	$(5y+9)(5y-4)$	2	Accept $(25y-20)(y+1.8)$ oe SC1 for $(5y+m)(5y+n)$ where $mn = -36$ or $m+n = 5$
(iii)	-1.8 oe, 0.8 oe	1ft	ft only SC1 from (b)(ii)	
(iv)	2.6[0]	1ft	ft $2 \times$ positive root from (b)(iii) +1 Dep on pos and neg root in (b)(iii)	

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<b>11 (a)</b>	33, 41 16 $\pi$ , 25 $\pi$ 20 $\pi$ , 30 $\pi$	<b>1</b> <b>1</b> <b>2</b>	<b>B1</b> each
<b>(b) (i)</b>	8n + 1 oe final answer	<b>2</b>	e.g. 9 + 8(n - 1), condone n = 8n + 1 <b>SC1</b> for 8n + k
<b>(ii)</b>	137 www2	<b>2</b>	<b>M1</b> for their (b)(i) = 1097
<b>(c) (i)</b>	n <sup>2</sup> $\pi$ oe final answer	<b>1</b>	
<b>(ii)</b>	9n <sup>2</sup> $\pi$ oe final answer	<b>1</b>	Allow (3n) <sup>2</sup> $\pi$
<b>(d)</b>	n(n + 1) $\pi$ oe final answer	<b>2</b>	<b>SC1</b> for a quadratic expression e.g. n(n + 1), n <sup>2</sup> + 5, n <sup>2</sup> + n $\pi$