UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

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

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)	[0]5 38 oe	**1**	Allow 5h 38 but not 5h 38mins
(ii)	92.7 [92.72 to 92.73] oe	**2**	Allow $92\frac{8}{11}$ or $\frac{1020}{11}$ **M1** for 850 ÷ their 9 h 10 min in hours oe Allow 850 ÷ 9.1 for **M1**
(b) (i)	204 or 203. 9[0] to 203.91	**3**	**M1** for 160 × 255 + 330 × 190 + 150 × 180 [130 500] **M1** dep for ÷ 640
(ii)	640 ÷ (4 + 3 + 1) × 3 [= 240]	**M1** **M1**	[Can be in either order or shown together] Accept 240 ÷ 3 × (4 + 3 + 1) = 640 for **M2**
(iii)	150 www 3	**3**	**M2** for 240 ÷ 1.6 oe or **M1** for recognition of 240 = 100 + 60 %
(c)	11 cao www 3	**3**	**M1** for figs 340 or figs 550 ÷ 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

2 (a)	$[\sin =]\frac{10\sin 95}{12}$	**M2**	**M1** for correct implicit equation
	56.1 (56.11 to 56.12) www 3	**A1**	
(b)	$12^2 + 17^2 - 2 \times 12 \times 17\cos 30$ oe	**M2**	**M1** for correct implicit equation
	8.93 [8.925….] www 4	**A2**	**A1** for 79.66 to 79.67 or 79.7
(c) (i)	126 or 126.1 (126.11 to 126.12)	**1ft**	ft their (a) + 70 [provided less than 360]
(ii)	306 or 306.1 (306.11 to 306.12)	**1ft**	ft 180 + their (c)(i) [provided less than 360]
(d)	$[\sin =]\frac{17\sin 30}{their(b)}$ oe or	**M2**	**M1** for correct implicit equation [107.7 to 107.9 or 108 or 72 or 72.1 to 72.3]
	$[\cos =]\frac{12^2 + (their(b)^2 - 17^2}{2 \times 12 \times their(b)}$ oe		
	180 – 95 – their (a)	**M1**	e.g. 28.88 to 28.9 seen – may be on diagram Alt methods possible e.g. $[\sin ABC =]\frac{12\sin 30}{their(b)}$ [42.2...] gets **M1** then 360 – 95 – 30 – their (a) – their 42.2 gets **M2** dep on previous **M1**
	137 [136.5 to 136.9] www 4	**A1**	isw reflex angle 223 or 223.1 to 223.5 after correct answer seen
3 (a)	Triangle with vertices (6, 4), (9, 4), (9, 6)	**2**	Ignore labels and condone good freehand in parts (a), (b) and (d)(i) **SC1** for translation $\begin{pmatrix}5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
(b)	Triangle with vertices (11, 1), (8, 1), (8, 3)	**2**	**SC1** for reflection in $y = 6$
(c) (i)	Rotation	**1**	If other transformations in addition, then 0, 0, 0
	90° [anticlockwise] oe	**1**	
	[centre] (0, 0) oe	**1**	e.g. O, origin
(ii)	$\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$	**2**	**B1** each column
(d) (i)	Triangle with vertices (1, 3), (4, 3), (4, 9)	**2**	**SC1** for (1, 3) and (4, 3), or (4, 9)
(ii)	$\begin{pmatrix}1 & 0\\0 & 3\end{pmatrix}$	**2**	**B1** right-hand column or $\begin{pmatrix}3 & 0\\0 & 1\end{pmatrix}$

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

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	**P3ft**	**P2ft** for 7 or 8, **P1ft** for 5 or 6.
	Smooth curve through at least 8 points and exponential shape	**C1ft**	ft only if correct shape and covers the domain $0 < x < 4$
(c)	$2.3 < x < 2.35$	**1**	
(d)		**M1**	$y = 3x$ ruled to cut curve at all possible points.
	$0.4 < x < 0.5$, $3.25 < x < 3.35$	**A1** **A1**	
(e)	Reasonable tangent with gradient 3	**M2**	Or **M1** for any tangent
	(their x, their y)	**A1**	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 = angle CDY ft 2 × 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 – their x or 4 × their x **M1** for angle K or $I = 90$ – their x or 4 × 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 $x-1=y^3$	**M1**	i.e. two correct steps For **M1**, accept a correct reverse flowchart
	$\sqrt[3]{x-1}$ oe final answer www2	**A1**	After 0 scored allow **SC1** for $\sqrt[3]{x-1}$ seen then spoilt
(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) ÷ (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
	$36(y+1)-36y=25y(y+1)$ oe $36y+36-36y=25y^2+25y$ oe		Accept both all over $y(y + 1)$ Must see at least one of these lines before E mark
	$25y^2+25y-36=0$	**E1**	Final line reached without any errors or omissions
(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 × positive root from (b)(iii) +1 Dep on pos and neg root in (b)(iii)

11 (a)	33, 41 $16\pi, 25\pi$ $20\pi, 30\pi$	**1** **1** **2**	 **B1** each
(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)	$n^2\pi$ oe final answer	**1**	
(ii)	$9n^2\pi$ oe final answer	**1**	Allow $(3n)^2\pi$
(d)	$n(n+1)\pi$ oe final answer	**2**	**SC1** for a quadratic expression e.g. $n(n+1)$, $n^2 + 5$, $n^2 + n\pi$