UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

0581 MATHEMATICS

0581/43 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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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

Qu.	Answers	Mark	Part Marks
1	**(a)** 1 min 36 s www	**3**	**M1** for $1.2 \times 0.8 \times 0.5$ (= 0.48) **A1** 1.6 or 96 If **A0**, **B1** for correctly converting to min and sec Dep on **M1**
	(b) 0.954 to 0.956 www	**3**	**M2** for $\frac{\text{their } 0.48}{\pi \times 0.4^2}$ or **M1** for $\pi \times 0.4^2 \times d$ = '0.48'
	(c) 8.09 to 8.10 www	**4**	**M1** for $\pi \times 0.4^2$ (0.503) condone × 2 and **M1** for $\pi \times 0.8 \times 1.2$ (3.02) **M1** for their area × 2.3 (dep **M1 M1**)
2	**(a)** 0.5, 4	**1+1**	
	(b) 6 points plotted ft	**P2**	**P1** for 5 points
	Correct shaped curve through 6 points (exponential)	**C1**	Ignore to left of $x = -2$
	(c) **(i)** Correct ruled line reaching both points	**L1**	
	(ii) 6 ÷ 3 oe	**1**	Allow 'test' with a coordinate on the line (not 0, 2)
	(iii) –0.8 to –0.6	**1**	Dep on **L1**
	(d) Tangent drawn at (1, 2)	**T1**	Not chord, allow up to 1 mm daylight
	Rise/run attempt using correct scales	**M1**	Dep on **T1**
	1.2 to 1.6 cao	**A1**	
3	**(a)** **(i)** 50 www3	**3**	**B1** for angle *ADB* or *ABD* = 70 **B1** for angle *DBC* = 80
	(ii) Angle *DCB* ≠ angle *CBE* oe	**1**	Accept angle *CDB* ≠ angle *ABD*
	(b) 12	**B3**	**M2** for $\frac{5n}{2} = \frac{360}{n}$ oe or **M1** for 360 soi
	(c) 65 www	**3**	*OAC* = 25, *CAB* = 25, *OBA* = 50, *BOC* = 50, *AOB* = 80, *AOC* = 130 **B1** each, max 2

4	**(a)** Image (1, –1), (1, –2), (4, –2), (3, –1)	**2**	**B1** if vertices plotted only or reflects in *y*
	(b) Image (–3, 2), (–4, 2), (–4, 5), (–3, 4)	**2**	**B1** for translation by $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 1 \end{pmatrix}$
	(c) **(i)** Rotation only,	**1**	Spoilt if extras
	90 clockwise oe,	**1**	
	(Centre) (0, 0) oe	**1**	
	(ii) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**B1** for one row or one column correct
	(d) Stretch only,	**1**	Spoilt if extras
	(Factor) 2,	**1**	
	x-axis oe invariant	**1**	
5	**(a)** 55 www	**B4**	**M3** for $3w + 6(w + 5) = 525$ oe in \$ or $(3j – 5) + 6j = 525$ oe in \$ or **M2** for $j = w +$ figs5 oe and $3w + 6j =$ figs525 or **M1** for *w* and *w* + figs5 or *j* and *j* – figs5
	(b) **(i)** $\frac{72}{x} - \frac{72}{x+3} = 2$ oe	**M2**	**M1** for $\frac{72}{x}$ or $\frac{72}{x+3}$
	$72(x + 3) – 72x = 2x(x + 3)$ oe	**M1**	Dep on 3 terms above Fractions removed, isw
	(ii) –12, 9 www	**3**	**M2** for $(x + 12)(x – 9)$ or $\frac{-3 \pm \sqrt{441}}{2}$ or **SC1** for $(x + a)(x + b)$ where $ab = –108$ or $a + b = 3$ or $\frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times -108}}{2}$
	(iii) 30	**1**	ft 3 × a positive root + 3
6	**(a)** **(i)** 13 or 13.0 www	**3**	**M1** for $3^2 + 4^2$ oe Equiv if find *AC* first and **M1** for $\sqrt{12^2 + \text{their } (3^2 + 4^2)}$
	(ii) 13.32 to 13.35 or 13.3	**2**	**M1** for $\sin = \frac{3}{\text{their } AP}$ or $\tan = \frac{3}{\text{their } AC}$ oe
	(b) **(i)** 36.86 to 36.87 or 36.9	**2**	**M1** for $\tan (PBC) = \frac{3}{4}$ oe
	(ii) 2.770 to 2.774 or 2.77	**3**	**M2** for $\frac{4 \sin \text{their (b)(i)}}{\sin 120}$ or **M1** for correct implicit eqn

7	**(a)** $3 < t \leq 4$	**1**	Condone alt. notation used for class
	(b) 1 2.5 3.5 6	**M1**	Mid-interval values soi
	$\sum fx$ with x in correct interval	**M1**	Allow 1 slip (24 170 252 216)
	$662 \div 200$	**M1**	**M1** dep on second **M1**
	3.31 cso	**A1**	
	(c) **(i)** 92, 164	**1**	
	(ii) (2, 24), (3, 92), (4, 164), (8, 200) ft	**P2ft**	**P1ft** for 3 points
	Curve/polygon through the 4 points	**1ft**	ft increasing curve/polygon
	(iii) $3 \leq$ med ≤ 3.2	**B1**	
	$2.4 \leq$ lq ≤ 2.7	**B1**	
	$0.9 \leq$ iqr ≤ 1.5	**B1**	
8	**(a)** 243	**2**	**B1** for (g(–2) =) 5 seen or $3^{(1-2x)}$
	(b) $\frac{1-x}{2}$ or $\frac{x-1}{-2}$ final ans	**2**	**M1** for $x = 1 - 2y$ or $x = (1 - y)/2$
	(c) $\frac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}$	**B2**	**B1** for $\sqrt{1^2 - 4(1)(-1)}$ or better ($\sqrt{5}$) seen anywhere If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for $p = -1$ and $r = 2(1)$
	–1.62, 0.62	**B1B1**	**SC1** for –1.62 and 0.62 seen or –1.6 or –1.618.. and 0.6 or 0.618…
	(d) $4x^2 - 6x + 1$ final ans www3	**3**	**M1** for $(1 - 2x)^2 + (1 - 2x) - 1$ or better and **B1** for $(1 - 2x)^2 = 1 - 2x - 2x + 4x^2$ or better
	(e) 9	**1**	

9			Accept fraction, %, dec equivalents (3sf o when not exact) throughout but not ratio or words isw incorrect cancelling/conversion to other forms
	(a) (i) $\frac{1}{4}$ oe	**1**	
	(ii) 25 cao	**1ft**	ft their $\frac{1}{4} \times 100$ to 3sf or better or rounding or truncating to integer Not 25/100
	(b) $\frac{2}{12}$ oe cao	**2**	**M1** for $\frac{2}{4} \times \frac{1}{3}$ 0.167, 16.7%
	(c) $\frac{7}{20}$ oe cao	**3**	**M2** for $\frac{1}{4} \times \frac{4}{5} + \frac{3}{4} \times \frac{1}{5}$ or **M1** for $\frac{1}{4} \times \frac{4}{5}$ or $\frac{3}{4} \times \frac{1}{5}$ After 0, **SC1** for 7 correct in list (condone UU in addition)
	(d) $\frac{6}{60}$ oe cao	**2**	**M1** for $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} \times \left(\frac{2}{2}\right)$
10	**(a)** $20x + 10y \geq 200$	**1**	In **(a)**, **(b)** −1 once for wrong symbol
	(b) $x + y \leq 15, y \geq 3, y \leq x$	**3**	**B1** for each
	(c)		All lines long enough to make full boundary of region, accept dashed or solid lines, 2 mm acc at intercepts
	$2x + y = 20$ ruled	**B2**	**B1** for ruled line through (10, 0) or (0, 20)
	$x + y = 15$ ruled	**B1**	
	$y = x$ ruled	**B1**	
	$y = 3$ ruled	**B1**	−1 once, freehand
	Quadrilateral identified	**R1**	Allow if slight inaccuracy(s) in diagonal lines Allow any clear indication of region
	(d) (i) 47 cao	**1**	
	(ii) 7, 6 cao	**2**	**M1** for any $5x + 2y$ in their region evaluated to equal their 47

11	**(a) (i)** $\begin{pmatrix}8\\1\end{pmatrix}$	**1**	
	(ii) Point (3, 4) indicated	**1**	
	(iii) $\begin{pmatrix}-3\\1\end{pmatrix}$	**1**	
	(b) (i) $-\frac{5}{12}\mathbf{u}+\frac{2}{3}\mathbf{v}$ oe 2 terms	**4**	**M1** for any correct route L to K e.g. $LU + UK$ and **B1** for $LU = \mathbf{u}/4$ oe or $OL = ¾\mathbf{u}$ oe and **B1** for $UK = 2/3\ (\mathbf{v} - \mathbf{u})$ oe or $VK = 1/3(\mathbf{u} - \mathbf{v})$ oe all **B**s are soi
	(ii) $\frac{13}{24}\mathrm{u}+\frac{1}{3}\mathrm{v}$ oe 2 terms	**2**	**M1** for correct route from O to M e.g. $OL + LM$ (can be in terms of **u**, **v**)
12	**(a) (i)** 12, …, 30	**2**	**B1** each
	(ii) $(n + 1)(n + 2)$ oe	**1**	isw if expand incorrectly
	(iii) $p = 2$	**1**	
	$q = 2$	**1**	
	(iv) 69(th), 70(th)	**2**	**M1** for their $2n + 2 = 140$ soi
	(b) (i) $2 \times 3 + 7$	**1**	Accept $2 \times 3 + 2 \times 2 + 3$
	(ii) 27	**1**	
	(iii) 1707, …, 13 653	**1,1**	