CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0444 MATHEMATICS (US)

0444/41 Paper 4, 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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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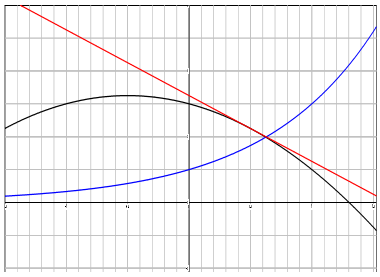
Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

CAMBRIDGE
International Examinations

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 Answers
1 (a)	Enlargement	**1**	
	[centre] (–3, 4)	**1**	
	[scale factor] 3	**1**	Do not allow column vector for coordinates
(b) (i)	Image at (1, 5), (4, 5), (4, 6), (1, 7)	**2**	**SC1** for translation by $\begin{pmatrix}5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$
(ii)	Image at (5, 1), (8, 1), (8, 3), (5, 2)	**2**	**SC1** for reflection in $y = 2$
(iii)	Image at (–4, 3), (–4, 5), (–7,5), (–7, 4)	**2**	**SC1** for rotation of 180° about a different point
2 (a) (i)	[0] 8 15	**1**	
(ii)	$\frac{1.8}{27}\times 60$ [= 4] oe	**M2**	**M1** for $\frac{1.8}{27}$ oe [0.0667 or better]
(b) (i)	275	**3**	**M2** for $\frac{15-4}{4}\times 100$ or $\frac{15}{4}\times 100-100$ oe or **M1** for $\frac{15-4}{4}$ or $\frac{15}{4}\times 100$ or oe 375
(ii)	73.3[3…]	**3**	**M2** for $\frac{1.8}{15}\times 60$ [= 7.2 min] and $\frac{27-\textit{their}\,7.2}{27}\times 100$ oe or **M1** for $\frac{1.8}{15}\times 60$ [= 7.2 min] or final answer of 26.6[6…] or 26.7
(iii)	25	**2**	**M1** for $\frac{9}{\textit{figs}\ 36}$ oe

3	(a)	3, 0.33[3…], 1	3	**B1** for each correct value
	(b)	Correct quadratic curve	3	**B2FT** for 7 correct points or **B1FT** for 5 or 6 correct points
		Correct exponential curve 	3	**B2FT** for 7 correct points or **B1FT** for 5 or 6 correct points
	(c) (i)	Answer in range $1.2 < x < 1.4$	1	
	(ii)	Answer in range $1.2 < x < 1.35$	1	Not from a line other than $y = 4$ (± 1mm)
	(iii)	Answer in range $0.55 < x < 0.7$	1	
	(d)	Correct tangent drawn and answer in range $-2.5 < m < -1.5$	3	**B1** for correct tangent at $x = 0.5$ **B2** for answer in range dep on close attempt at tangent **M1** for $[-]\frac{rise}{run}$ used with values soi from tangent, dep on close attempt at tangent or answer in range $-1.5 < m < -1.5$ or **SC1** for close attempt at tangent to exponential curve and answer in the range $-1.6 < m < 2.2$
4	(a) (i)	3.2	1	
	(ii)	4.2	1	
	(iii)	4.6	1	
	(iv)	196	1	
	(b) (i)	100, 46, 12	2	**B1** for 2 correct
	(ii)	4	2	**M1** for frequency of 60 or 140 seen in workspace

5	**(a)**	171.25 (or 171 or 171.2 or 171.3) www	**4**	**M1**for at least 3 mid-values seen **M1** for $\sum fx$ with x's in intervals including boundaries **M1** (dep on second **M1**) for their $\sum fx \div 42$
	(b)	$160 < x < -165$ oe	**1**	
	(c)	Blocks with heights of 1.8, 1.2, 1, with correct interval widths and no gaps	**4**	**B3** for 2 correct blocks or **B2** for 1 correct block or **B1** for 3 correct frequency densities or heights or 3 correct widths
6	**(a)**	White = 8.5 Red = 11	**5**	**B3** for $7w + 5(w + 2.5) = 114.5$ or for $7(r - 2.5) + 5r = 114.5$ oe **B1** for 8.5 or 11 or **SC2** for $7w + 5 \times w + 2.5 = 114.5$ leading to 9.33[3…] or **SC1** for $7w + 5 \times w + 2.5 = 114.5$ OR **B1** for $r = w + 2.5$ oe **B1** for $7w + 5r = 114.5$ oe **M1** for elimination of a variable **A1** for 8.5 or 11
	(b) (i)	$\frac{42}{132}$ or $\frac{21}{66}$ or $\frac{14}{44}$ or $\frac{7}{22}$ (0.318 or 0.3181 to 0.3182)	**2**	**M1** for $\frac{7}{12} \times \frac{6}{11}$
	(ii)	$\frac{70}{132}$ or $\frac{35}{66}$ (0.53[0] or 0.5303…)	**3**	**M2** for $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11}$ or $1 - \textit{their}$ **(a)** $- \frac{5}{12} \times \frac{4}{11}$ or **M1** for $\frac{7}{12} \times \frac{5}{11}$ or $\frac{35}{132}$ or **SC1** for $\frac{70}{144}$ oe from replacement

7	**(a)**	31.4	**3**	**M2** for $\frac{15.7}{\sin 30}$ or **M1** for correct implicit statement
	(b)	[sin E =] $\frac{15.7 \times \sin 52}{16.5}$ 48.573	**M2** **A1**	**M1** for correct implicit statement
	(c) (i)	[$\angle ACE$ =] 180 – 52 – 48.57 [= 79.43] [$\angle ECD$ =] 40.57 …	**M1** **A1**	
	(ii)	15.3 or 15.27 to 15.281 www	**4**	**M2** for [$(DE)^2$ =] $16.5^2 + 23.4^2 – 2 \times 16.5 \times 23.4 \cos(40.6 \text{ or } 40.57)$ or **M1** for full correct implicit statement **A1** for 233 to 234
	(d)	466 or 466.34 to 466.5	**4**	**M1** for 0.5 × 15.7 × *their* 31.4 sin(90 – 30) oe **M1** for 0.5 × 15.7 × 16.5 sin(128 – *their* 48.6 or 48.57) oe **M1** for 0.5 × 16.5 × 23.4 sin(40.6 or 40.57) oe
8	**(a) (i)**	118	**2**	**M1** for (3 × 180 – 2 × 110 – 84) [÷ 2] or better
	(ii)	31	**1FT**	FT (180 – *their* **(i)**) ÷ 2
	(iii)	22	**1FT**	FT 84 – 2 × *their* **(ii)** or 2 × *their* **(ii)** – 40, only if positive answer and less than 84
	(b)	32	**4**	**B2** for 360 – 3y = 2(4y + 4) oe and **B1** for 11y = 352 oe or **M1** for angle at centre = 2 × angle at circumference soi
	(c) (i)	Opposite angles [cyclic quad] add to 180°	**1**	
	(ii)	68	**3**	**M1** for [angle PRS =] 102 ÷ 3 × 2 and **M1** for angle PQS = angle PRS or angle PRQ = angle PSQ
	(d)	5.75	**3**	**M2** for $6.9 \times \sqrt{\frac{5}{7.2}}$ oe or **M1** for evidence of ratio of areas = (ratio of slides)^2 or sf = 1.2

9	**(a)**	$\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-3)}}{2}$	**2**	**B3** for $\sqrt{1^2 - 4 \times 1 \times (-3)}$ or better and if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ then **B1** for $p = -1$ and $r = 2(1)$ or better
		–2.30, 1.30 final answer	**2**	**B1B1** **SC1** for –2.30 and 1.30 seen or –2.3 or –2.303 to –2.303 **and** 1.3 or 1.302 to 1.303 or final answer –1.30 and 2.30
	(b)	4, 30, 53	**3**	**M1** for $(2x + 7)^2 + (2x + 7) - 3$ and **B1** for $(2x + 7)^2 = 4x^2 + 14x + 14x + 49$ oe
	(c)	$\frac{x - 7}{2}$	**2**	**M1** for $y - 7 = 2x$ or $x = 2y + 7$ or –7 **then** $\div 2$ clearly seen in correct order with arrow or better or $\frac{y - 7}{2}$
	(d)	–2	**1**	
	(e)	1.158×10^{77}	**4**	**B3** for 1.16×10^{77} or $1.1579 \ldots \times 10^{77}$ or 1.1157×10^{77} or **B2** for 2^{256} seen or **B1** for 2^8 seen or 256
	(f)	Stretch x-axis invariant [factor]2 or 2×2^x seen	**3**	**B1** **B1** **B1**
10	**(a)**	50, 70 $10n$ oe 51, 71 $10n + 1$ oe	**1** **1** **1** **1**	
	(b) (i)	212	**1**	
	(ii)	$20n + 12$	**1**	
	(iii)	$20n + 152$	**1**	
	(c) (i)	$5 \times 3^2 + 6 \times 3 = 63$ $11 + 21 + 31 = 63$ or $32 + 31 = 63$ or $11 + 52 = 63$	**1** **1**	
	(ii)	560	**1**	

(d)	Complete solution with no errors seen and a conclusion E.g. $5n^2 + 6n + 10(n + 1) + 1$ $= 5n^2 + 6n + 10n + 10 + 1$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5(n + 1)^2 + 6(n + 1)$	**4**	**B1** for $5n^2 + 6n + 10n + 10 + 1$ or better **B1** for use of $5(n + 1)^2 = 5n^2 + 10n + 5$ oe at any stage **B1** for use of $6n + 6 = 6(n + 1)$ oe at any stage
11	6.61 (6.614 …) www	**6**	**B1** for $\frac{x+2}{2x+3} = \frac{9}{16}$ oe **M1** for $16(x + 2) = 9(2x + 3)$ or better **A1** for $[x =]$ 2.5 **M2** for $\sqrt{\{(2 \times \textit{their } x + 3)^2 - (\textit{their } x + 2)^2\}}$ or **M1** for $(2 \times \textit{their } x + 3)^2 - (\textit{their } x + 2)^2$ or **SC2** for final answer of $4\sqrt{13}$ or $\frac{7\sqrt{15}}{2}$ or better **SC1** for final answer of $5\sqrt{7}$ or better