

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

**MARK SCHEME for the May/June 2013 series**

<b>0444 MATHEMATICS (US)</b>	
<b>0444/41</b>	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.

Cambridge will not enter into discussions about these mark schemes.

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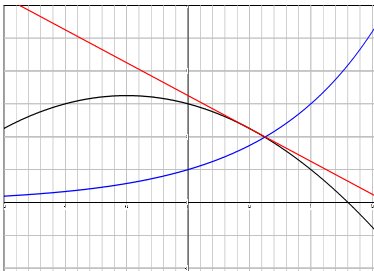
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### Abbreviations

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

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

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

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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 bound 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 $7w + 5 \times w + 2.5 = 114.5$
	(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 – 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

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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] $[\angle ECD = ] 40.57 \dots$	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 $0.5 \times 15.7 \times \text{their } 31.4 \sin(90 - 30)$ oe M1 for $0.5 \times 15.7 \times 16.5 \sin(128 - \text{their } 48.6 \text{ or } 48.57)$ oe M1 for $0.5 \times 16.5 \times 23.4 \sin(40.6 \text{ or } 40.57)$ oe	
8	(a) (i)	118	2	M1 for $(3 \times 180 - 2 \times 110 - 84) [\div 2]$ or better
	(ii)	31	1FT	FT $(180 - \text{their (i)}) \div 2$
	(iii)	22	1FT	FT $84 - 2 \times \text{their (ii)}$ or $2 \times \text{their (ii)} - 40$ , 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 = $2 \times$ angle at circumference soi
	(c) (i)	Opposite angles [cyclic quad] add to $180^\circ$	1	
(ii)	68	3	M1 for $[\text{angle } PRS = ] 102 \div 3 \times 2$ and M1 for angle $PQS = \text{angle } PRS$ or angle $PRQ = \text{angle } PSQ$	
(d)	5.75	3	M2 for $6.9 \times \sqrt{\frac{5}{7.2}}$ oe or M1 for evidence of ratio of areas = $(\text{ratio of slides})^2$ or sf = 1.2	

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9	(a)	$\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-3)}}{2}$  -2.30, 1.30 final answer	2	<b>B3</b> 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 <b>B1</b> for $p = -1$ and $r = 2(1)$ or better
	(b)	4, 30, 53	2	<b>B1B1</b> <b>SC1</b> for -2.30 and 1.30 seen or -2.3 or -2.303 to -2.303 <b>and</b> 1.3 or 1.302 to 1.303 or final answer -1.30 and 2.30
	(c)	$\frac{x-7}{2}$	3	<b>M1</b> for $(2x+7)^2 + (2x+7) - 3$ and <b>B1</b> for $(2x+7)^2 = 4x^2 + 14x + 14x + 49$ oe
	(d)	-2	2	<b>M1</b> for $y-7=2x$ or $x=2y+7$ or -7 <b>then</b> $\div 2$ clearly seen in correct order with arrow or better or $\frac{y-7}{2}$
	(e)	$1.158 \times 10^{77}$	4	<b>B3</b> for $1.16 \times 10^{77}$ or $1.1579 \dots \times 10^{77}$ or $1.1157 \times 10^{77}$ or <b>B2</b> for $2^{256}$ seen or <b>B1</b> for $2^8$ seen or 256
	(f)	Stretch x-axis invariant [factor]2 or $2 \times 2^x$ seen	3	<b>B1</b> <b>B1</b> <b>B1</b>
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	

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(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	<b>B1</b> for $5n^2 + 6n + 10n + 10 + 1$ or better <b>B1</b> for use of $5(n + 1)^2 = 5n^2 + 10n + 5$ oe at any stage <b>B1</b> for use of $6n + 6 = 6(n + 1)$ oe at any stage
11	6.61 (6.614 ...) www	6	<b>B1</b> for $\frac{x+2}{2x+3} = \frac{9}{16}$ oe <b>M1</b> for $16(x + 2) = 9(2x + 3)$ or better <b>A1</b> for $[x =] 2.5$ <b>M2</b> for $\sqrt{\{(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2\}}$ or <b>M1</b> for $(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2$ or <b>SC2</b> for final answer of $4\sqrt{13}$ or $\frac{7\sqrt{15}}{2}$ or better <b>SC1</b> for final answer of $5\sqrt{7}$ or better