

MARK SCHEME for the May/June 2013 series

0580 MATHEMATICS

0580/41

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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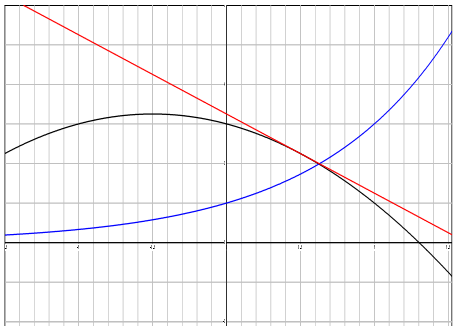
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Abbreviations

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.	Answer	Mark	Part marks
1 (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 $\frac{1.8}{15} \times 60 [=7.2 \text{ min}]$ and $\frac{27 - \text{their } 7.2}{27} \times 100$ oe or M1 for $\frac{1.8}{15} \times 60 [=7.2 \text{ min}]$ or final answer of 26.6[6...] or 26.7
(iii)	25	2	M1 for $\frac{9}{\text{figs } 36}$ oe

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Qu.	Answer	Mark	Part marks
2	(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 $y = 4$ (± 1 mm)
	(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 $[-] \frac{\text{rise}}{\text{run}}$ used with values soi from tangent, dep on close attempt at tangent or answer in range $1.5 < m < 2.5$ or SC1 for close attempt at tangent to exponential curve and answer in the range $1.6 < m < 2.2$
3	(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

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Qu.	Answer	Marks	Part marks
4 (a)	Enlargement [centre] $(-3, 4)$ [scale factor] 3	1 1 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 $(-4, 3), (-1, 3), (-1, 6), (-4, 9)$	2	SC1 for three correct vertices or shape with vertices at $(-4, 1)$ and $(-1, 1), (-1, 4)$ and $(-4, 7)$
(iv)	$\begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$	2	SC1 for $\begin{pmatrix} 1 & 0 \\ 0 & k \end{pmatrix}, k \neq \pm 1$ or $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$
(c)	Reflection $y = x$ oe	2	B1 B1 independent
5 (a)	171.25 (or 171 or 171.2 or 171.3) www	3	M1 for $5 \times 155 + 9 \times 162.5 + 18 \times 172.5 + 10 \times 185$ [= 7192.5] and M1 (dep on M1) for <i>their</i> $\Sigma fx \div 42$
(b)	$160 < x \leq 165$ 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

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Qu.	Answer	Marks	Part marks
6 (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]	M1	
	$[\angle ECD =] 40.57...$	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

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Qu.	Answer	Mark	Part marks
7 (a)	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 $\sqrt{\{(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2\}}$ or M1 for $(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2$ 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
(b) (i)	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
(ii) (a)	$\frac{42}{132}$ 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) (b)	$\frac{70}{132}$ 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 $1 -$ <i>their</i> (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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Qu.	Answer	Mark	Part marks
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	1	
	(ii) 68	3	M1 for [angle $PRS =$] $102 \div 3 \times 2$ 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 sides) ² or sf = 1.2
9	(a) $\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-3)}}{2}$ -2.30, 1.30 final answer	2 2	B1 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 B1 B1 SC1 for -2.30 and 1.30 seen or -2.3 or -2.303 to -2.302 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

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Qu.	Answer	Mark	Part marks
(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 $1.1579... \times 10^{77}$ or 1.157×10^{77} or B2 for 2^{256} seen or B1 for 2^8 seen or 256
10 (a)	50, 70	1	
	$10n$ oe	1	
	51, 71	1	
	$10n+1$ oe	1	
(b) (i)	212	1	
(ii)	$20n+12$	1	
(iii)	$20n+152$	1	
(c) (i)	$5 \times 3^2 + 6 \times 3 = 63$	1	
	and $11 + 21 + 31 = 63$		
	or $32 + 31 = 63$ or $11 + 52 = 63$	1	
(ii)	560	1	
(d)	Complete solution with no errors seen and a conclusion e.g. $5n^2 + 6n + 10(n+1) + 1$ $= 5n^2 + 6n + 10n + 10 + 1$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5(n+1)^2 + 6(n+1)$	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