

**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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### 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
<b>1</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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Qu.	Answer	Mark	Part marks
2	(a)	3	B1 for each correct value
	(b)	3	B2FT for 7 correct points or B1FT for 5 or 6 correct points
		3	B2FT for 7 correct points or B1FT for 5 or 6 correct points
3	(c) (i)	1	
	(ii)	1	Not from a line other than $y = 4$ ( $\pm 1$ mm)
	(iii)	1	
	(d)	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)	1	
	(ii)	1	
	(iii)	1	
	(iv)	1	
	(b) (i)	2	B1 for 2 correct
	(ii)	2	M1 for frequency of 60 or 140 seen in workspace

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Qu.	Answer	Marks	Part marks	
4	(a)	Enlargement	1	
		[centre] (-3, 4)	1	
		[scale factor] 3	1	
	(b) (i)	Image at (1, 5), (4, 5), (4, 6), (1, 7)	2	Do not allow column vector for coordinates
	(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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<b>Qu.</b>	<b>Answer</b>	<b>Marks</b>	<b>Part marks</b>
<b>6 (a)</b>	31.4	<b>3</b>	<b>M2</b> for $\frac{15.7}{\sin 30}$ or <b>M1</b> for correct implicit statement
<b>(b)</b>	$[\sin E =] \frac{15.7 \times \sin 52}{16.5}$ 48.573...	<b>M2</b> <b>A1</b>	<b>M1</b> for correct implicit statement
<b>(c) (i)</b>	$[\angle ACE =] 180 - 52 - 48.57$  $[= 79.43]$  $[\angle ECD =] 40.57...$	<b>M1</b>  <b>A1</b>	
<b>(ii)</b>	15.3 or 15.27 to 15.281 www	<b>4</b>	<b>M2</b> for $[(DE)^2 =] 16.5^2 + 23.4^2 - 2 \times 16.5 \times 23.4 \cos(40.6 \text{ or } 40.57)$ or <b>M1</b> for full correct implicit statement <b>A1</b> for 233 to 234
<b>(d)</b>	466 or 466.34 to 466.5	<b>4</b>	<b>M1</b> for $0.5 \times 15.7 \times \text{their } 31.4 \sin(90 - 30)$ oe  <b>M1</b> for $0.5 \times 15.7 \times 16.5 \sin(128 - \text{their } 48.6 \text{ or } 48.57)$ oe  <b>M1</b> 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	<p><b>B1</b> for <math>\frac{x+2}{2x+3} = \frac{9}{16}</math> oe</p> <p><b>M1</b> for <math>16(x+2) = 9(2x+3)</math> or better</p> <p><b>A1</b> for <math>[x =] 2.5</math></p> <p><b>M2</b> for <math>\sqrt{\{(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2\}}</math> or <b>M1</b> for <math>(2 \times \text{their } x + 3)^2 - (\text{their } x + 2)^2</math> or <b>SC2</b> for final answer of <math>4\sqrt{13}</math> or <math>\frac{7\sqrt{15}}{2}</math> or better</p> <p><b>SC1</b> for final answer of <math>5\sqrt{7}</math> or better</p>
(b) (i)	White = 8.5, red = 11	5	<p><b>B3</b> for <math>7w + 5(w + 2.5) = 114.5</math> or for <math>7(r - 2.5) + 5r = 114.5</math> oe</p> <p><b>B1</b> for 8.5 or 11 or <b>SC2</b> for <math>7w + 5 \times w + 2.5 = 114.5</math> leading to 9.33[3...] or <b>SC1</b> for <math>7w + 5 \times w + 2.5 = 114.5</math></p> <p>OR</p> <p><b>B1</b> for <math>r = w + 2.5</math> oe <b>B1</b> for <math>7w + 5r = 114.5</math> oe <b>M1</b> for elimination of a variable <b>A1</b> for 8.5 or 11</p>
(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	<p><b>M1</b> for <math>\frac{7}{12} \times \frac{6}{11}</math></p>
(ii) (b)	$\frac{70}{132}$ or $\frac{35}{66}$  (0.53[0] or 0.5303...)	3	<p><b>M2</b> for <math>\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11}</math> or <math>1 -</math> <i>their</i> (a) <math>-\frac{5}{12} \times \frac{4}{11}</math> or <b>M1</b> for <math>\frac{7}{12} \times \frac{5}{11}</math> or <math>\frac{35}{132}</math> or <b>SC1</b> for <math>\frac{70}{144}</math> oe from replacement</p>

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Qu.	Answer	Mark	Part marks	
8	(a) (i)	118	<b>M1</b> for $(3 \times 180 - 2 \times 110 - 84) [\div 2]$ or better	
	(ii)	31	<b>1FT</b> FT $(180 - \textit{their (i)}) \div 2$	
	(iii)	22	<b>1FT</b> FT $84 - 2 \times \textit{their (ii)}$ or $2 \times \textit{their (ii)} - 40$ , only if positive answer and less than 84	
	(b)	32	<b>4</b> <b>B2</b> for $360 - 3y = 2(4y + 4)$ oe and <b>B1</b> for $11y = 352$ oe or <b>M1</b> for angle at centre = $2 \times$ angle at circumference soi	
	(c) (i)	Opposite angles [cyclic quad] add to 180	<b>1</b>	
	(ii)	68	<b>3</b>	<b>M1</b> for [angle $PRS =$ ] $102 \div 3 \times 2$ and <b>M1</b> for angle $PQS =$ angle $PRS$ or angle $PRQ =$ angle $PSQ$
(d)	5.75	<b>3</b>	<b>M2</b> for $6.9 \times \sqrt{\frac{5}{7.2}}$ oe or <b>M1</b> for evidence of ratio of areas = (ratio of sides) <sup>2</sup> or sf = 1.2	
9	(a)	$\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-3)}}{2}$ -2.30, 1.30 final answer	<b>2</b> <b>B1</b> for $\sqrt{1^2 - 4 \times 1 \times (-3)}$ or better and if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ <b>2</b> then <b>B1</b> for $p = -1$ and $r = 2(1)$ or better <b>B1 B1</b> <b>SC1</b> for -2.30 and 1.30 seen or -2.3 or -2.303 to -2.302 <b>and</b> 1.3 or 1.302 to 1.303 or final answer -1.30 and 2.30	
	(b)	4, 30, 53	<b>3</b> <b>M1</b> for $(2x + 7)^2 + (2x + 7) - 3$ and <b>B1</b> 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	<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 $\frac{y-7}{2}$
(d)	-2	1	
(e)	$1.158 \times 10^{77}$	4	<b>B3</b> for $1.16 \times 10^{77}$ or $1.1579... \times 10^{77}$ or $1.157 \times 10^{77}$ or <b>B2</b> for $2^{256}$ seen or <b>B1</b> for $2^8$ seen or 256
<b>10 (a)</b>	50, 70	1	
	$10n$ oe	1	
	51, 71	1	
	$10n+1$ oe	1	
<b>(b) (i)</b>	212	1	
<b>(ii)</b>	$20n+12$	1	
<b>(iii)</b>	$20n+152$	1	
<b>(c) (i)</b>	$5 \times 3^2 + 6 \times 3 = 63$	1	
	and $11 + 21 + 31 = 63$		
	or $32 + 31 = 63$ or $11 + 52 = 63$	1	
<b>(ii)</b>	560	1	
<b>(d)</b>	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	<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