

MARK SCHEME for the May/June 2014 series

0580 MATHEMATICS

0580/43

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

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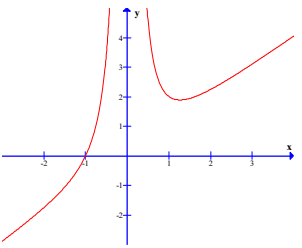
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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Qu		Answers	Mark	Part Marks
1	(a)	62100[.00] Final answer	2	B1 for 62 074[. 35] or 62 070
	(b)	39300	3	M2 for $45\,981 \div 1.17$ oe or M1 for 45 981 associated with 117 [%]
	(c)	20436	2	M1 for $45\,981 \div (3+4+2)$ or $45\,981 \times 4$
	(d)	4	3	M2 for $\frac{1.5 \times 1000}{330}$ oe or M1 for figs 4545... or 455
	(e)	25545	2	M1 for $45\,981 \times \frac{5}{9}$
2	(a)	$10 < x \leq 25$ $25 < x \leq 30$ $30 < x \leq 35$ $35 < x \leq 50$ $50 < x \leq 60$	2	5 correct B1 for 3 or 4 correct or SC1 for all correct but in the form 10 to 25 or 10 – 25
	(b)	13 33 19 [4] 15 6 25.1[0] or 25.13 to 25.14 nfw	3 4	B2 for 4 correct or B1 for 3 correct M1 for mid-values soi, condone one error or omission 5 17.5 27.5 32.5 42.5 55 soi and M1 for $\sum fx$ for any x in intervals including boundaries, but all fs must be integers, condone one further error or omission and M1 dep for $\sum fx \div 90$ Dep on 2nd M mark earned

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Qu		Answers	Mark	Part Marks
3	(a) (i)	72[.0] or 71.98 to 71.99 nfw	3	M2 for $[\sin P =] \frac{97}{\frac{1}{2} \times 12 \times 17}$ oe or M1 for implicit version
	(ii)	16.2 or 16.18 to 16.19 nfw	4	M2 for $6^2 + 17^2 - 2 \times 6 \times 17 \times \cos(\text{their } 72)$ or M1 for implicit form and A1 for $[XR^2 =] 261.8$ to 262
	(b)	7.61 or 7.612... nfw	4	M3 for $[a =] 9.4 \times \sin 37 \div \cos 42$ oe or $[a =] 9.4 \sin 37 / \sin(90 - 42)$ or M2 for $[a =]$ their height $\div \cos 42$ oe or $\frac{a}{\sin 37} = \frac{9.4}{\sin(90 - 42)}$ oe or M1 for their height $\div a = \cos 42$ or for $[\text{their height} =] 9.4 \times \sin 37$ oe or B1 for 48° correctly used or seen in correct position on diagram
	(c)	50 130	1 1	
4	(a)	0, 4.5, 3.11[1...]	3	B1, B1, B1
	(b)	Complete correct curve with minimum below $y = 2$ 	5	B3 FT for 9 points correctly plotted B2 FT for 7 or 8 points correctly plotted or B1 FT 5 or 6 points correctly plotted and B1 indep two separate branches not touching or cutting y -axis
	(c)	- 0.5 to - 0.6 0.6 to 0.7 2.8 to 2.9	1 1 1	if 0 SC1 for $y = 3$ indicated
	(d)	Correct line or no line and - 0.7 to - 0.6 nfw	3	Must check line - not if wrong line B2 for $y = 1 - x$ ruled correctly or SC1 for ruled line with either gradient -1 or y -intercept 1 but not line $y = 1$ or correct freehand line

Qu		Answers	Mark	Part Marks
	(e)	tangent ruled at $x = 2$ and 0.62 to 0.8	3	Accept integer/integer provided in range B1 for correct tangent drawn and M1 for change in y / change in x dep on any tangent or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent
	(f)	$\frac{1}{x^2} = -x$ or $1 + x^3 = 0$	M1	
		$1 = -x^3$ or $x^3 = -1$	M1	dep M1
$x = \sqrt[3]{-1}$		A1	dep M2	
5	(a) (i)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$	1	
	(ii)	5.83 to 5.831	2	M1 for $3^2 + 5^2$ seen
	(b) (i)	$-2\mathbf{p} + \mathbf{q}$ oe	1	accept unsimplified
	(ii)	$\overrightarrow{PS} = -\mathbf{p} + 2\mathbf{q}$ or $\overrightarrow{SP} = \mathbf{p} - 2\mathbf{q}$	B1	
		$\overrightarrow{MS} = -\frac{2}{3}\mathbf{p} + \frac{4}{3}\mathbf{q}$ seen or $\overrightarrow{SM} = \frac{2}{3}\mathbf{p} - \frac{4}{3}\mathbf{q}$ seen	B1	
		or $\overrightarrow{RM} = \frac{2}{3}(-2\mathbf{p} + \mathbf{q})$ soi		
		or $\overrightarrow{MR} = \frac{2}{3}(2\mathbf{p} - \mathbf{q})$ soi		
		or $\overrightarrow{MQ} = \frac{1}{3}(-2\mathbf{p} + \mathbf{q})$ soi		
	or $\overrightarrow{QM} = \frac{1}{3}(2\mathbf{p} - \mathbf{q})$ soi			
	$\overrightarrow{PM} = \mathbf{p} + \overrightarrow{RM}$ or $\mathbf{p} - \overrightarrow{MR}$ or $-\mathbf{p} + \mathbf{q} + \overrightarrow{QM}$ or $-\mathbf{p} + \mathbf{q} - \overrightarrow{MQ}$ $[-\frac{1}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}]$ 1 : 3 nfww	M1	Any correct route for \overrightarrow{PM} eg $\overrightarrow{PR} + \overrightarrow{RM}$	
		A1	After 0 scored, SC1 for 1 : 3	

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Qu		Answers	Mark	Part Marks
6	(a) (i)	$\frac{1}{6}$	1	
	(ii)	$\frac{4}{6}$ oe	1	
	(iii)	$\frac{2}{6}$ oe	1	
	(b)	$\frac{16}{36}$ oe	3	M2 $\frac{2}{6} \times \frac{4}{6} + \frac{4}{6} \times \frac{2}{6}$ only oe or M1 for one of $\frac{2}{6} \times \frac{4}{6}$ or $\frac{4}{6} \times \frac{2}{6}$ soi by $\frac{2}{9}$
	(c)	$\frac{48}{360}$ oe	3	M2 for $\frac{4}{6} \times \frac{3}{5} \times \frac{2}{4} \times \frac{2}{3}$ only oe or M1 for denominators 6, 5, 4, 3 soi in product of four fractions
7	(a) (i)	148	1	
	(ii)	122	2	B1 for 58 seen at <i>A</i> or 32 seen at <i>Y</i>
	(iii)	148	1	
	(iv)	106 nfw	3	B1 for [sum of interior angles =] 720 and M1 for $\frac{1}{2} \{(their\ 720) - (p+q+t+90)\}$
	(b) (i)	63	2	B1 for angle <i>RPS</i> = 27 or 90 at <i>P</i> or at <i>S</i> seen or stated
	(ii)	54	2	B1 for <i>their x</i> or 63 or letter <i>x</i> at <i>Q</i> seen or state

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Qu		Answers	Mark	Part Marks
8	(a) (i)	$7 \times 2 + (2x - 3)(x + 4) = 2(x + 4)$	M1	Allow if bracket[s] omitted but recovers
		$2x^2 + 8x - 3x - 12$ or better seen	B1	
		$2x^2 + 3x - 6 = 0$	A1	with no errors seen and brackets correctly expanded on both sides and no omission of brackets
	(ii)	$\sqrt{(3)^2 - 4(2(-6))}$ or better	B1	or $\left(x + \frac{3}{4}\right)^2$
		$p = -3$ and $r = 2(2)$	B1	Must see $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or both
		1.14 and -2.64 cao	B1B1	Or $-\frac{3}{4} +$ or $-\sqrt{\frac{57}{16}}$ SC1 for 1.1 and -2.6 final answer or 1.137 and -2.637 final answer or 1.14 and -2.64 seen in working or for -1.14 and 2.64 as final ans
	(b)	$\pi \times x^2 + \pi \times x \times 3x$	M2	or M1 for $\pi \times x \times 3x$
		$4[\pi]x^2 = [\pi]r^2$	M1	Dep on M2
		$2x = r$	A1	with no errors seen
9	(a)	$4 - 6x$ final answer	1	
	(b)	$9x - 8$ final answer	2	M1 for $4 - 3(4 - 3x)$ seen
	(c)	$\frac{1}{27}$ final answer	3	M2 for 3^{-3} soi by final answer 0.037037... to 3sf or better or M1 for $[g(-1) =] 3$ soi
	(d)	$\frac{4-x}{3}$ oe final answer	2	M1 for a correct first step $3x = 4 - y$ oe or $x = 4 - 3y$ or $\frac{y}{3} = \frac{4}{3} - x$
	(e)	$\frac{4}{3}$ or $1\frac{1}{3}$ or 1.33 or better	3	M2 for $3x - 4 = 0$ or better or M1 for $3^{-(4-3x)}$

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Qu		Answers	Mark	Part Marks
10	(a)	[r =] 2.30[9...]	3	B2 for [r =] 2.31 or M2 for $4 \tan 30$ or M1 for $\frac{r}{4} = \tan 30$
	(b)	333 or 332.5 to 332.6	4	M3 for $0.5 \times 8 \times 8 \times \sin 60 \times 12$ oe or M2 for $0.5 \times 8 \times 8 \times \sin 60$ oe or M1 for <i>their</i> triangle area $\times 12$ shown dep on ' $\frac{1}{2}$ ', used within <i>their</i> area of triangle method
	(c) (i)	30	3	M2 for $12 \div 0.4$ or $120 \div 4$ or SC1 for figs 3
	(ii)	6.65 or 6.647 to 6.648[...]	2	M1 for $\pi \times 2.3^2 \times 0.4$ or SC1 for $\pi \times 2.3^2 \times 4$ soi by 66.5 or 66.47 to 66.48[...]
	(iii)	40[.0] or 40.1 or 40.0 to 40.2 nfw	3	M2 for $100 - \frac{\text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$ or $\frac{\text{their}(b) - \text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$ or M1 for $\frac{\text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)} \times 100$ or $\frac{\text{their}(b) - \text{their}(c)(i) \times \text{their}(c)(ii)}{\text{their}(b)}$
11	(a)	$\frac{1}{8} \frac{1}{16} \frac{1}{32}$	2	B1 for 2 correct
		$\frac{1}{2^{n-1}}$ oe	2	SC1 for $\frac{1}{2^n}$ oe
		$2^{-3} 2^{-4} 2^{-5}$	1	
		2^{1-n} or $2^{-(n-1)}$	1	
	(b) (i)	64 256 1024	1	
		$2^6 2^8 2^{10}$	1	
	(ii)	$2^{2(n-1)}$ or 2^{2n-2}	1	
(c)	16384	2	B1 for $n = 8$	