

MARK SCHEME for the May/June 2014 series

0580 MATHEMATICS

0580/42

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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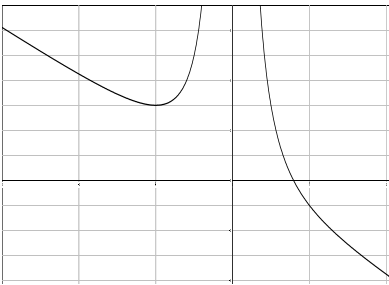
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Abbreviations

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)	$240 \div (5 + 7) \times 7$ [=140] oe	M2	M1 for $240 \div (5 + 7)$ or 240×7
	(b)	2 : 3 final answer	2	B1 for ratio of form $2x : 3x$ seen or SC1 for 3 : 2
	(c)	144	3	M2 for $120 + \frac{120 \times 4 \times 5}{100}$ oe or M1 for $\frac{120 \times 4 \times 5}{100}$
	(d)	89.99 cao mark final answer	3	B2 for 89.9[8...] shown but not spoiled or answer 90[.0..] nfw or M1 for $80 \times \left(\frac{104}{100}\right)^3$ oe If M1 spoiled by adding 80 or subtracting 80 then SC1 for answers 169.99 or 9.99
	(e)	4.08	3	M2 for $\frac{200 \times r \times 2}{100} = 200 \times 1.04^2 - 200$ oe or M1 for 200×1.04^2 [216.3[2]] oe or $\frac{200 \times r \times 2}{100}$ oe

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Qu		Answers	Mark	Part Marks
2	(a)	3, 3, – 1	3	B1 B1 B1
	(b)	Complete correct curve 	5	B3FT 11 points or B2FT for 9 or 10 points or B1FT for 7 or 8 points And B1indep two separate branches not touching or crossing y-axis
	(c)	0.5 to 0.6	1	
	(d)	Correct line and 0.4 to 0.5 or no line and 0.4 to 0.5 nfw	3	Must check line - not if wrong line B2 for $y = 2x + 3$ ruled correctly or SC1 for correct freehand line or ruled line with either gradient 2 or y-intercept 3 but not $y = 3$
	(e) (i)	Tangent at $x = -1.5$	1	No daylight at $x = -1.5$. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = -1.7$ and -1.3
	(ii)	– 2 to – 1	2	Dependent on tangent mark awarded Allow integer/integer if in range Or M1 for rise/run also dep on any tangent drawn or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent

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Qu		Answers	Mark	Part Marks
3	(a)	86.8 or 86.83....	3	M2 for $\frac{80 \sin 55}{\sin 49}$ or M1 for $\frac{80}{\sin 49} = \frac{x}{\sin 55}$ oe
	(b)	51.2 or 51.15 to 51.16	4	M2 for $[\cos =] \frac{95^2 + 90^2 - 80^2}{2 \cdot 95 \cdot 90}$ oe or M1 for $80^2 = 95^2 + 90^2 - 2 \cdot 90 \cdot 95 \cdot \cos BCD$ A1 for $\frac{10\,725}{17\,100}$ or $\frac{143}{228}$ etc. or 0.627.....
	(c)	6700 or 6698 to 6703	3	M2 for $0.5 \times 80 \times \text{their(a)} \times \sin(180-55-49)$ oe [3368 – 3370...] [If <i>AB</i> used then <i>AB</i> = 102.8 to 103] + $0.5 \times 90 \times 95 \times \sin(\text{their(b)})$ oe [3329 – 3332] or M1 for one of these triangle area methods oe
	(d)	2180 or 2176 to 2179	3FT	FT <i>their</i> (c) $\times 0.325$ correctly evaluated to 3 sf or better M2 for <i>their</i> (c) $\times \frac{3250}{10\,000}$ or SC1 FT for figs 218 or figs 2176 to 2179

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Qu		Answers	Mark	Part Marks
4	(a)	Image at $(-3, 2), (-5, 2), (-5, 4), (-3, 3)$	2	SC1 reflection in $y = -1$ or $x = k$ or 4 correct points not joined
	(b) (i)	Image at $(-2, -4), (-6, -4), (-6, -8), (-2, -6)$	2	SC1 other enlargement of scale factor -2, correct size and correct orientation or 4 correct points not joined
	(ii)	$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	2	SC1 for $\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$, k may be algebraic or numeric but not 0 or 1
	(c) (i)	Image at $(1, 4), (3, 4), (3, 8), (1, 6)$	2	SC1 for trapezium with vertices at $(1, 6)$ and $(3, 8)$ or correct stretch with y -axis invariant or 4 correct points not joined
	(ii)	$\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$	2	SC1 for $\begin{pmatrix} 1 & 0 \\ 0 & k \end{pmatrix}$ k may be algebraic or numeric but not 0 or 1 or for $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$
	(iii)	$\frac{1}{2} \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ oe isw	2FT	FT inverse of their (c)(ii) (algebraic or numeric) B1FT their (c)(ii) for $\frac{1}{2} \begin{pmatrix} a & c \\ b & d \end{pmatrix}$ or $P \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ ie FT their correct fraction or their transposed matrix FT for 2 and 1 mark dependent on $\det \neq 0$
	(iv)	Stretch, [factor] $\frac{1}{2}$, invariant [line] x -axis oe	3	B1 B1 B1 each independent cao

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Qu		Answers	Mark	Part Marks
5	(a) (i)	2412 to 2413....	B2	Must be at least 4 figures shown M1 for $\pi \times 8^2 \times 12$ oe
	(ii)	2.41[0]	B1	
	(b)	1 min 24 s	4	B3 for 83.76 to 83.8[0] or 84 or 1.396 to 1.397 or 1.4 or 1 min 23.76 to 1 min 23.8 seen or M2 for $\frac{1}{3}\pi \times 4^2 \times 10 \div 2$ [80/3 π] or M1 for $\frac{1}{3}\pi \times 4^2 \times 10$ [160/3 π or 167.5 to 167.6]
	(c)	14	3	M1 for $\frac{2410}{\frac{1}{3}\pi \times 4^2 \times 10}$ or $\frac{2410}{\text{their cone vol from part (b)}}$ A1 for 14.3 to 14.4....
6	(a) (i)	[x =] 21, [y =] 42	2	B1 B1
	(ii)	3.79 or 3.8[0] or 3.792 to 3.802	2	M1 for $\frac{3.31}{TQ} = \frac{8.23}{9.43}$ oe or $\frac{\sin 21 \text{ or } \sin \text{their } x}{TQ} = \frac{\sin 117}{9.43}$ oe
	(b)	40	4	B3 for angle between <i>HE</i> and tangent = 25 or GFH = 40 or EGH = 25 and angle <i>EHG</i> = 115 (accept 90 and 25 at <i>H</i> for 115) B2 for angle <i>EGH</i> = 25 or angle <i>EHG</i> = 115 (accept 90 and 25 at <i>H</i> for 115) B1 for angle <i>FEG</i> = 25 or angle <i>EFG</i> = 65
	(c)	38	5	B4 for angle <i>ADC</i> = 104 or M4 for $x + 14 + 20 + x + 70 = 180$ or better or B3 for angle <i>OBA</i> = 20 and angle <i>OBC</i> = 56 or angle <i>CBA</i> = 76 or reflex angle <i>AOC</i> = 208 or B2 for angle <i>OAB</i> or <i>OBA</i> = 20 and angle <i>ACB</i> = 70 or obtuse angle <i>AOC</i> = 152 or angle <i>BOC</i> = 68 or B1 for angle <i>OAB</i> or <i>OBA</i> = 20 or angle <i>ACB</i> = 70

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Qu		Answers	Mark	Part Marks
7	(a) (i)	$(100 - 70) \times 0.4 [= 12]$ or better	1	Accept $\frac{24}{78} \times 39$ oe
	(ii)	60.9 or 60.89... nfw	5	B1 for 3 or 4 correct extra frequencies 3, 6, 10, 8 soi M1 for at least 4 of mid-interval values 15, 40, 55, 65, 85 soi M1 for Σfx where x is any value in each interval allow <i>their</i> frequencies provided integers and they must be shown $[3 \times 15 + 6 \times 40 + 10 \times 55 + 8 \times 65 + 12 \times 85]$ [2375] M1 (dependent on second M1) for $\div 39$ or $\div (3 + 6 + 10 + 8 + 12)$
	(b)	60.5	3	M2 for $20 \times 70 - 19 \times 70.5$ oe or M1 for either 20×70 or 19×70.5
8	(a) (i)	$\frac{600}{x}$	1	Not $x = \frac{600}{x}$
	(ii)	$\frac{600}{x+1}$	1	Not $x = \frac{600}{x+1}$
	(b) (i)	$\frac{600}{x} - \frac{600}{x+1} = 20$ oe	M1FT	FT <i>their</i> (a)(i) – <i>their</i> (a)(ii) = 20 oe If M0 , SC1FT for <i>their</i> (a)(ii) – <i>their</i> (a)(i) = 20 oe
		$600(x+1) - 600x = 20x(x+1)$ or better	A1	May still be over common denominator and can be implied by third line. Allow recovery if bracket omitted
		$600x + 600 - 600x = 20x^2 + 20x$ $0 = 20x^2 + 20x - 600$ $x^2 + x - 30 = 0$	A1	Dep on M1A1 and conclusion reached with at least one of the interim lines and without any errors or omissions

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Qu		Answers	Mark	Part Marks
	(ii)	$x = 5$	B3	B2 for $(x + 6)(x - 5) [= 0]$ oe or SC1 for $(x + a)(x + b)$ where $ab = -30$ or $a + b = 1$ or B2 for $\frac{-1 + \text{or} - \sqrt{1^2 - 4.1. - 30}}{2.1}$ or $\sqrt{30 + \left(\frac{1}{2}\right)^2} - \frac{1}{2}$ or B1 for $\frac{-1 + \text{or} - \sqrt{q}}{2.1}$ or $\sqrt{1^2 - 4.1 - 30}$ or $\left(x + \frac{1}{2}\right)^2$
		100	B1FT	FT $600 \div (\text{their } x + 1)$ if $x > 0$ correctly evaluated
9	(a)	$\frac{1}{4}, \frac{9}{10}, \frac{1}{3}, \frac{2}{3}$	3	B1 for $\frac{1}{4}$ B1 for $\frac{9}{10}$ B1 for $\frac{1}{3}$ and $\frac{2}{3}$
	(b)	45	1	
	(c)	$\frac{3}{40}$ oe	2	M1 for $\frac{3}{4} \times \frac{1}{10}$ oe
	(d)	$\frac{101}{120}$ oe	3	M2 for $\frac{3}{4} \times \frac{9}{10} + \frac{1}{4} \times \frac{2}{3}$ only or $1 - \text{their (c)} - \frac{1}{4} \times \frac{1}{3}$ only or M1 for $\frac{3}{4} \times \frac{9}{10}$ or $\frac{1}{4} \times \frac{2}{3}$ or $\text{their (c)} + \frac{1}{4} \times \frac{1}{3}$
	(e)	$\frac{781}{1024}$ oe	2	M1 for $1 - \left(\frac{3}{4}\right)^5$ oe

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Qu		Answers	Mark	Part Marks
10	(a)	2	2	B1 for $g\left(\frac{1}{2}\right) = \frac{1}{2}$ soi or $[fg=] \frac{1}{1-x}$
	(b)	$1 - x$	1	Accept equivalents e.g. $-(x - 1)$
	(c)	$x^2 - 2x + 2$	3	M1 for $(1 - x)^2 + 1$ B1 for $[(1 - x)^2 =] 1 - x - x + x^2$ or better
	(d)	-6	1	
	(e)	$\sqrt{(-3)^2 - 4(1)(1)}$ or better $p = -(-3)$ and $r = 2 \times 1$ oe 0.38, 2.62	B1 B1 B1B1	or for $\left(x - \frac{3}{2}\right)^2$ Must see $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ or both or for $\frac{3}{2} + or - \sqrt{\left(\frac{3}{2}\right)^2 - 1}$ SC1 for answers 0.4 and 2.6 or 0.3819 to 0.3820 and 2.618... or 0.38 and 2.62 seen in working or for -0.38 and -2.62 as final ans
	(f)	$f(x)$ and $g(x)$	1	Accept f and g or $1/x$ and $1 - x$

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Qu	Answers	Mark	Part Marks
11	$\frac{1}{3}$ $\frac{72}{360}$ oe $\frac{1}{4}$ $\frac{1}{6}$ $\frac{\pi-2}{\pi}$ or $1-\frac{2}{\pi}$ or 0.363 or 0.3630 to 0.3635	1 1 2 2 4	Allow equivalent decimal throughout (3sf or better where necessary) M1 for $\left(\frac{1}{2}\right)^2$ or $(2)^2$ or $1^2:2^2$ or $2^2:1^2$ oe seen M1 for $[X=6 \times] 0.5 \times l^2 \times \sin 60$ or $[X=6 \times] 0.5 \times l^2 \times \sin 120$ Or recognition that the area of the obtuse-angled triangle shaded is equal to the area of one of the 6 equilateral triangles from the centre If fraction given as answer, check if it falls into range B1 for [sector=] $\frac{1}{4}\pi r^2$ oe B1 for [triangle=] $\frac{1}{2}r^2$ oe M1dep for $\frac{\text{their sector} - \text{their triangle}}{\text{their sector}}$ dep on B1B1 earned