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MATHEMATICS **0580/41**

Paper 4 Paper 4 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 130

Published

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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
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	60 and 45	**2**	**M1** for $105 \div (4 + 3)$
(ii)	117.6[0] final answer	**2**	**M1** for 105×1.12 oe
(iii)	125	**3**	**M2** for $105 \div (1 - \frac{16}{100})$ oe or **M1** for 105 seen associated with 84%
(b)	30.68 final answer	**6**	**B5** for 30.7[0] or 30.68… or **B4** for 905 to 906 **and** 875 or 405 to 406… **and** 375 **OR** **M1** for $500 \times \left(1+\frac{2}{100}\right)^{30}$ [− 500] oe **M1** for [500 +] $\frac{500 \times 2.5 \times 30}{100}$ **B1** for 905 to 906 or 875 or 405 to 406 or 375
(c)	480 or 479.8 to 479.9…	**3**	**M2** for $1469 \div \left(1+\frac{3.8}{100}\right)^{30}$ oe or **M1** for $P \times \left(1+\frac{3.8}{100}\right)^{30} = 1469$ oe
(d)	6.5[0] or 6.500…	**3**	**M2** for $\sqrt[11]{\frac{120150}{60100}}$ [$\times 100 - 100$] oe or **M1** for $60100 \times (\ )^n = 120150$ oe where n = 5 or 11 or 55

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Question	Answer	Mark	Part marks
2 (a) (i)	15 to 15.2	1	
(ii)	10.8 to 11	1	
(iii)	9 to 9.2	1FT	**FT** 20 – *their* **(a)(ii)**
(iv)	10	1	
(v)	24	2	**B1** for 176 written
(b) (i)	16.75 nfww	4	isw attempted time conversion after correct answer **M1** for 5, 12.5, 17.5, 25, 45 soi **M1** for Σfx **M1 dep** for their $\Sigma fx \div 200$
(ii)	Fully correct histogram	4	**B1** for each correct block If zero scored, **SC1** for frequency densities of 9.6, 12, 2.6 and 0.6 seen
3 (a) (i)	51.7 or 51.69 to 51.70…	4	**M3** for $(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)\times2.3\,[\div1000]$ oe or **SC3** for figs 517 or figs 5169 to 5170… or **M2** for $(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)$ oe **OR** **M1** for $2\times\frac{2}{3}\times\pi\times13^3$ seen or $\pi\times13^2\times25$ seen **M1indep** for *their* volume × 2.3 ÷ 1000
(ii)	1.96 or 1.957 to 1.958 …	4	**M3** for $(2\times2\times\pi\times13^2+\pi\times2\times13\times25)[\div100^2]\times4.7$ oe or **SC3** for figs 196 or figs 1957 to 1958… **M2** for $(2\times2\times\pi\times13^2+\pi\times2\times13\times25)$ oe **OR** **M1** for $2\times2\times\pi\times13^2$ seen or $\pi\times2\times13\times25$ seen **M1indep** for *their* area divided by 100^2 soi

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(b)	6.2[0] or 6.203 to 6.204	3	**M2** for $x^3 = \frac{500}{\frac{2}{3}\pi}$ oe or better or **M1** for $\frac{1}{3} \times \pi \times x^2 \times 2x = 500$ oe
(c)	286 or 285.7…	3	**M2** for $\frac{180}{A} = \left(\frac{180}{360}\right)^{\frac{2}{3}}$ oe or **M1** for $\left(\sqrt[3]{\frac{360}{180}}\right)^{[2]}$ oe or $\left(\sqrt[3]{\frac{180}{360}}\right)^{[2]}$ oe seen or $\frac{A^3}{180^3} = \frac{360^2}{180^2}$
4 (a)	0.92, …., …., 0.5, – 1, …., …., – 1, 0.5, …., …., 0.92	3	**B2** for 4 or 5 correct or **B1** for 2 or 3 correct
(b)	Fully correct graph	5	**B4** for correct graph but branches joined OR **B3FT** for 11 or 12 correct points or **B2FT** for 9 or 10 correct points or **B1FT** for 7 or 8 correct points **B1indep** for a branch on each side of the *y*-axis, without touching it
(c) (i)	Correct ruled line through (–2, 1) and (2, –3)	2	**B1** for straight line with gradient –1 or cutting *y*-axis at –1 or correct line but freehand or short correct ruled line
(ii)	0.7 to 0.95	1	
(iii)	[p =] 2 and [q =] – 2	3	**B2** for $x^3 + 2x^2 - 2 = 0$ oe or **B1** for $x^2 - 2 = -x^3 - x^2$ oe or better or $1 + 1 - \frac{2}{x^2} + x$ [= 0] or better
(d) (i)	(1.3 to 1.6, 0)	1	
(ii)	Ruled line from (0, –2) to intersection of *their* graph with positive *x*-axis	1FT	
(iii)	Tangent [to curve] *A* or (1.3 to 1.6, 0)	1 1	

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Question	Answer	Mark	Part marks
5 (a) (i)	Image at (–2, – 4), (4, – 4), (4, 0)	**2**	**SC1** for translation $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-8\end{pmatrix}$
(ii)	8.94 or 8.944…	**2**	**M1** for $\sqrt{(-4)^2+(-8)^2}$ or $\sqrt{4^2+8^2}$
(b) (i)	Enlargement [factor] 0.5 oe [centre] (0, 0) oe	**1** **1** **1**	
(ii)	$\begin{pmatrix}0.5 & 0\\0 & 0.5\end{pmatrix}$ oe	**2FT**	**FT** their scale factor from **(b)(i)** dep on enlargement and centre (0, 0) **B1FT** for one row or column
(iii)	0.25 or $\frac{1}{4}$	**1FT**	**Strict FT** *their* matrix but not for identity matrix
6 (a)	126 or 126.4 to 126.5	**3**	**M2** for $\sqrt{220^2-180^2}$ oe or **M1** for $BC^2 + 180^2 = 220^2$ oe
(b)	99.9 or 99.86 to 99.87	**4**	**M2** for $180^2 + 170^2 - 2 \times 180 \times 170 \cos 33$ or **M1** for $\cos 33 = \frac{180^2+170^2-CD^2}{2\times180\times170}$ **A1** for 9970 or 9973 to 9974
(c)	92.6 or 92.58 to 92.59	**2**	**M1** for $\frac{\text{dist}}{170} = \sin 33$ oe
(d)	115.1 or 115.0 to 115.1	**3**	**M1** for $\cos = \frac{180}{220}$ oe **M1dep** for 47 + 33 + *their* angle *BAC*
(e)	19700 or 19708 to 19720	**3**	**M1** for 0.5 × 180 × 170 × sin33 oe or 0.5 × 180 × *their* **(c)** oe **M1** for 0.5 × 180 × *their* **(a)** oe or 0.5 × 180 × 220 × sin(*their BAC*) oe

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Question	Answer	Mark	Part marks
7 (a)	0.7, 0.1 oe correctly placed 0.2, 0.8 oe correctly placed	1 1	
(b) (i)	0.44 nfww oe	3	**M2** for $1 - \textit{their}\,0.7 \times \textit{their}\,0.8$ or for $0.3 + \textit{their}\,0.7 \times \textit{their}\,0.2$ oe or **M1** for *their* 0.7 × *their* 0.8 or for two of 0.3 × 0.9, 0.3 × *their* 0.1, *their* 0.7 × *their* 0.2
(ii)	110	1FT	**FT** 250 × *their* **(b)(i)**
(c)	If late at first two stations then certain to be late at station C oe	1	Indication of certain event (allow 1 or 100% probability or sure) at third station if late at first two stations
8 (a)	$\frac{323}{x} + \frac{323}{x+2} = 36$ oe three term equation	B2	**B1** for $\frac{323}{x}$ seen oe or $\frac{323}{x+2}$ seen oe
	$323(x + 2) + 323x = 36x(x + 2)$ oe or $\frac{323x + 646 + 323x}{x(x+2)} = 36$ oe	M1	i.e. for clearing the fractions (or all still over common denominator) or reducing the two algebraic fractions to one fraction and expanding the brackets in the numerator
	$36x^2 - 574x - 646 = 0$ $18x^2 - 287x - 323 = 0$	A1	answer reached without any omissions or errors with at least one intermediate line with brackets expanded after M1
(b) (i)	17, 19	1	
(ii)	(……. + 19)(……. – 17)	2	**SC1** for (……. + *a*)(……. + *b*) where *a*, *b* are integers and *ab* = –323 or *a* + 18*b* = –287
(iii)	$17, -\frac{19}{18}$ oe	1FT	**FT** *their* **(b)(ii)**
(c)	11 cao	1	

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Question	Answer	Mark	Part marks
9 (a)	236	**3**	**B2** for 243 and 7 or **M2** for $3^{2(2)+1} - (2(3^{[1]}) + 1)$ oe **B1** for h(5) or f(3) soi or **M1** for $3^{2x+1} - (2(3^x) + 1)$ or better
(b)	$6x + 1$ final answer	**2**	**M1** for $3(2x + 1) - 2$
(c)	$x < 3$ oe final answer	**2**	**M1** for $1 + 2 > 3x - 2x$ or $2x - 3x > -2 - 1$ oe
(d)	–2	**1**	
(e)	$\frac{x+2}{3}$ oe final answer	**2**	**M1** for $x = 3y - 2$ or $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$
(f)	$\frac{6x^2 - x + 3}{2x + 1}$ final answer	**3**	**M1** for $5 + (2x + 1)(3x - 2)$ or better isw **B1** for common denominator $2x + 1$ isw
(g)	9	**1**	
10 (a)	115 or 114.5 to 114.6	**3**	**M2** for $\frac{r^2}{\frac{\pi r^2}{360}}$ or better or **M1** for $\frac{w}{360} \times \pi \times r^2 = r^2$
(b)	126	**3**	**M2** for $\frac{x}{360} \times 2\pi r [+2r] = [2r+] \frac{7\pi r}{10}$ or better or **M1** for $\frac{x}{360} \times 2\pi r$
(c)	120	**4**	**B3** for $\frac{y}{2} = 60$ or x (base angle) = 30 OR **M3** for $\cos x$ or $\sin\left(\frac{y}{2}\right) = \frac{\sqrt{3}}{2}$ oe or $\cos y = -\frac{1}{2}$ oe or **M2** for $\cos x$ or $\sin\left(\frac{y}{2}\right) = \frac{q\sqrt{3}}{2q}$ or $[\cos y] = \frac{q^2 + q^2 - \left(q\sqrt{3}\right)^2}{2 \times q \times q}$ oe or **M1** for $\left[\left(q\sqrt{3}\right)^2 =\right] q^2 + q^2 - 2 \times q \times q \cos y$ oe After **M0**, **SC1** for $[h^2 =] q^2 - \left(\frac{1}{2} q\sqrt{3}\right)^2$ or for q replaced by 1, 2, 4, etc.

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