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MATHEMATICS **0580/42**

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)	11 054.25 final answer	**2**	**M1** for $18000\times\left(1-\frac{15}{100}\right)^3$ oe
(ii)	16 500	**3**	**M2** for $14025\div\left(1-\frac{15}{100}\right)$ oe or **M1** for recognition of 14 025 as 85% soi
(b)	260 final answer	**2**	**M1** for $P\left(1+\frac{5}{100}\right)^2=286.65$ oe
(c) (i)	6.18	**3**	**M2** for $\frac{224.72-200}{200\times 2}\times 100$ oe or $\frac{1}{2}\left(\frac{224.72}{200}\times 100-100\right)$ or **M1** for $\frac{200\times r\times 2}{100}$ oe or $\frac{224.72-200}{200\times 2}$ or $\frac{224.72}{200}\times 100-100$ soi by 12.36 If zero scored, **SC1** for 56.18 or 56.2 as final answer
(ii)	6	**3**	**M2** for $\sqrt{\frac{224.72}{200}}$ or $\sqrt{\frac{224.72}{2}}$ soi by 1.06 or 106 or 10.6 or **M1** for $200\left(1+\frac{r}{100}\right)^2=224.72$ oe

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Question	Answer	Mark	Part marks
2 (a)	1 1	**1** **1**	
(b)	Fully correct graph	**4**	**B3FT** for 6 or 7 points plotted or **B2FT** for 4 or 5 points plotted or **B1FT** for 2 or 3 points plotted
(c) (i)	$-1 < \text{ans} < -0.8$ $1.25 < \text{ans} < 1.45$ $2.5 < \text{ans} < 2.6$	**1** **1** **1**	
(ii)	$-0.7 < \text{ans} < -0.5$	**2**	**M1** for evidence of $y = -x$ or $\frac{x^3}{3} - x^2 + 1 = -x$
(d) (i)	$y = 1$ to 1.1 oe	**1FT**	**FT** only if a clear maximum point
	$y = -0.4$ to -0.33 oe	**1FT**	**FT** only if a clear minimum point
(ii)	-0.4 to -0.33 oe	**1FT**	Correct or **FT** *their* graph
3 (a)	$\frac{240\sin 85}{\sin 50}$	**M2**	or **M1** for $\frac{\sin 50}{240} = \frac{\sin 85}{AB}$ oe
	312 or 312.1 ….	**B1**	
(b)	$\frac{1}{2} \times 180 \times 240 \times \sin A = 12000$	**M1**	
	33.748 to 33.749	**A2**	**A1** for $\sin = \frac{24000}{43200}$ or better or 0.555 or 0.556 or $0.5\dot{}$ or 0.5555 to 0.5556
(c)	328 or 328.3 to 328.5	**5**	**B1** for [angle A =] 78.75 seen **M2** for $180^2 + (\textit{their } AB)^2 - 2 \times 180 \times \textit{their } AB \times \cos 78.75$ or **M1** for $\cos 78.75 = \frac{180^2 + (\textit{their} AB)^2 - x^2}{2 \times 180 \times (\textit{their} AB)}$ **A1** for 107 800 to 107 900
(d) (i)	108.75 or 108.7 or 108.8	**1**	
(ii)	288.75 or 288.7 or 288.8	**2FT**	**FT** 180 + *their* **(d)(i)** **M1** for 180 + *their* **(d)(i)** or 360 – (180 – *their***(d)(i)**)

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Question	Answer	Mark	Part marks
4 (a)	15	**2**	**M1** for 10 ÷ 40 [× 60]
(b)	49.2 nfww	**4**	**M1** for 35, 42.5, 47.5, 52.5, 57.5, 70 soi **M1** for Σfx $8 \times 35 + 22 \times 42.5 + 95 \times 47.5 + 55 \times 52.5 + 14 \times 57.5 + 6 \times 70$ **M1 dep** for *their* $\Sigma fx \div 200$
(c)	Fully correct histogram	**4**	**B3** for 4 correct blocks or **B2** for 2 or 3 correct blocks or **B1** for 1 correct block If zero scored, **SC1** for correct frequency densities 0.8, 19, 11, 2.8, 0.3 soi
(d) (i)	125, 180	**1**	
(ii)	Correct diagram	**3**	**B1FT** *their* **(d)(i)** for 6 correct heights within correct square(including boundaries) or touching correct line if should be on a grid line and **B1** for 6 points at upper ends of intervals on correct vertical line and **B1FT** (dep on at least B1) for increasing curve or polygon through 6 points If zero scored, **SC1FT** for 5 correct points plotted
(iii) (a)	48 to 49	**1**	
(b)	55	**1**	
(c)	8 to 14	**2FT**	**B1FT** for 186 to 192 seen

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Question	Answer	Mark	Part marks
5 (a) (i)	$\frac{3}{4}$, $\frac{1}{4}$ $\frac{7}{8}$, $\frac{1}{8}$	**2**	**B1** for any 2 correct
(ii)	$\frac{21}{32}$ oe	**2**	**M1** for $\frac{7}{8}\times\frac{3}{4}$ oe
(iii)	$\frac{441}{1024}$ oe	**2FT**	**M1** for $\left(\frac{7}{8}\times\frac{3}{4}\right)^2$ or *their* **((a)(ii))**^{2} oe
(b)	175	**2**	**M1** for $200 \times \frac{7}{8}$
(c)	2400	**2**	**M1** for 1575 ÷ *their***(a)(ii)**

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Question	Answer	Mark	Part marks
6 (a) (i)	1.32	2	**M1** for $0.8 \times 1.5 \times 1.1$
(ii)	0.725 or 0.7246 to 0.7247…	2	**M1** for $\pi r^2 \times 0.8 = \textit{their}$**(a)(i)** or $\pi r^2 = 1.5 \times 1.1$ oe
(iii)	0.513 to 0.518 nfww	5	**M1** for $2(1.5 \times 1.1 + 1.5 \times 0.8 + 1.1 \times 0.8)$ **M1** for [2 ×] $\pi \times (\textit{their}$ **(a)(ii)**$)^2$ **M2** for $\pi \times 2 \times (\textit{their}$ **(a)(ii)**$) \times 0.8$ or **M1** for $\pi \times 2 \times (\textit{their}$ **(a)(ii)**$)$
(b) (i)	$x + y \geqslant 9$ oe $y \geqslant 2$ oe	1 1	If zero scored, **SC1** for $x + y > 9$ **and** $y > 2$
(ii)	Fully correct diagram with **unwanted** region shaded	4	**B1** for $2x + 3y = 24$ ruled **B1** for $x + y = 9$ ruled **B1** for $y = 2$ ruled
(iii)	20 [x =] 7 [y =] 2	1 1 1	If zero scored, **SC1** for $2x + 3y$ evaluated from integers

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7	**(a)**	54.50 final answer	**2**	**B1** for 54.495 to 54.496 or 54.5 or **M1** for 200 ÷ 3.67
	(b) (i)	$\frac{1000}{x(x+1)}$ final answer	**3**	**M1** for $1000\,(x + 1) – 1000x$ **M1** for denominator $x(x + 1)$
	(ii)	$\frac{1000}{x} - \frac{1000}{x+1} = 4.5[0]$ oe or $\frac{1000}{x(x+1)} = 4.5$	**M1**	Allow *their* **(b)(i)** for first **M1** only for a single fraction
		$1000 = 4.5x\,(x + 1)$ $4.5x^2 + 4.5x – 1000 = 0$ $9x^2 + 9x – 2000 = 0$	**M1dep** **A1**	Correctly multiplying by algebraic denominator Equation reached without any errors or omissions and at least one step after clearing the denominators of the fractions still with brackets included
	(iii)	$\frac{-9 \pm \sqrt{9^2 - 4(9)(-2000)}}{2(9)}$	**2**	**B1** for $\sqrt{9^2 - 4(9)(-2000)}$ If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ then **B1** for $p = – 9$ and $r = 2(9)$
		– 15.42 14.42	**B1** **B1**	**SC1** for answers – 15.4 or – 15.42 to – 15.41 **and** 14.4 or 14.41 to 14.42 or for – 14.42 **and** 15.42 or – 15.42 **and** 14.42 seen but not final answer **Answers without working only score B1, B1 or SC1**
	(iv)	69.34 to 69.37 final answer **must be 2 dp**	**2FT**	**FT** 1000 ÷ *their* positive x with final answer rounded up or down to 2 dp or **M1** for 1000 ÷ *their* positive x

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8	**(a)**	$[u =]$ 80 $[v =]$ 160	**1** **1**	
	(b)	6.24 or 6.244 to 6.245	**3**	**M2** for $\sqrt{8^2 - 5^2}$ oe or **M1** for $l^2 + 5^2 = 8^2$ oe or **B1** for suitable right angled triangle drawn with 5 on correct side
	(c)	5.05 or 5.052….	**2**	**M1** for $\frac{4.8}{2.5} = \frac{9.7}{MN}$ oe
	(d)	4 nfww	**4**	**M3** for $[x^n](x+1) = 4 \times \frac{5}{12}[x^n](x-1)$ oe, n = 1, 2 or 3 or **M2** for $\frac{[x](x+1)}{\frac{5}{12}[x](x-1)} = \left(\frac{2[x]}{[x]}\right)^2$ oe or **M1** for 2^2 or $\left(\frac{1}{2}\right)^2$ soi
9	**(a)** **(i)**	1.5 oe	**1**	
	(ii)	$\frac{3}{y-2}$ oe final answer	**3**	**M1** for correct removal of fraction **M1** for collection of terms in x **and** factorises OR **M1** subtracts 2 from both sides **M1** multiplies by x to remove fraction and **M1** for correct division by expression of the form $ay + b$, a and $b \neq 0$
	(b) **(i)**	–3	**1**	
	(ii)	65 536 final answer	**2**	**B1** for h(16) oe e.g. $h(2^4)$
	(iii)	–6	**2**	**M1** for $2 - x = 2^3$ oe
	(iv)	3	**1**	
10	**(a)**	7.5	**2**	**M1** for $3x + x + 3x + x = 60$ oe
	(b)	5	**3**	**B2** for $3x + 4x + 5x$ [= 60] or better or **M1** for $(3x)^2 + (4x)^2$ oe
	(c)	16.8 or 16.80….	**3**	**M2** for $x + x + \frac{90}{360} \times \pi \times 2 \times x$ [= 60] oe or **M1** for $\frac{90}{360} \times \pi \times 2 \times x$ oe

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