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MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 130

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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	Marks	Partial marks
1(a)	2915	**2**	**M1** for 10 494 ÷ (13 + 5) oe
1(b)	1056	**2**	**M1** for 384 ÷ (10 – 6) oe
1(c)(i)	52.2 or 52.17…	**2**	**M1** for 20 ÷ 23 or 20 × 60 or 23 ÷ 60 isw If zero scored, **SC1** for answer 52.6 (from use of 0.38)
1(c)(ii)	63[.0] or 63.03 to 63.05…	**5**	**M4** for $\frac{\textit{their}\ 52.17... - 32}{32} \times 100$ oe or **M3** for $\frac{\textit{their}\ 52.17... - 32}{32}$ oe or $\frac{\textit{their}\ 52.17...}{32} \times 100$ oe OR **B2** for $\frac{5}{8}$ [hours] oe or 37.5 [minutes] or **M1** for 20 ÷ 32 or better and **M2** for $\frac{\textit{their}\ 37.5 - 23}{23} \times 100$ oe or **M1** for $\frac{\textit{their}\ 37.5 - 23}{23}$ or $\frac{\textit{their}\ 37.5}{23} \times 100$
1(d)	0.06 final answer nfww	**3**	**M1** for 11.99 ÷ 0.9276 or 12.99 × 0.9276 **A1** for 12.93 or 12.925 to 12.926
1(e)	9750	**3**	**M2** for $7605 \div \left(1 - \frac{22}{100}\right)$ oe or **M1** for (100 – 22)[%] correctly associated with 7605 seen

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Question	Answer	Marks	Partial marks
2(a)	122	**4**	**B3** for 238 or 61 or 58 correctly identified in working or on diagram or **B2** for 952 seen or 74 or 119 or 29 correctly identified in working or on diagram OR Method 1 using sum of interior angles **M1** for (8 – 2) × 180 or 1080 isw **M1** for *their* 1080 – 4 × 32 **M1** for 360 – *their* 952 ÷ 4 OR Method 2 using isosceles triangles and square **M1** for (180 – 32) ÷ 2 or for 90 **M1** for *their* 74 × 2 + 90 or 90 – *their* 74 **M1** for 360 – *their* 74 × 2 + 90 or 90 + 2(90 – *their* 74) OR Method 3 using four kites joined to centre **M1** for 360 ÷ 4 **M1** for (360 – (*their* 90 + 32)) ÷ 2 **M1** for 2(180 – *their* 119) OR Method 4 using square around outside **M1** for 90 – 32 **M1** for (90 – 32) ÷ 2 **M1** for 180 – 2(*their* 29)
2(b)	105	**3**	**M2** for 360 = 2 × y + (2y – 60) oe or 2(180 – y) = 2y – 60 oe or **B1** identifying in working or on diagram a relevant angle in terms of y
3(a)	–2.75 or $-2\frac{3}{4}$	**2**	**M1** for 11x – 3x = –7 – 15 or better
3(b)(i)	(x + 11)(x – 2) final answer	**2**	**M1** for (x + a)(x + b) where ab = –22 or a + b = 9
3(b)(ii)	–11 and 2 final answer	**1**	
3(c)	[x] = $\frac{2a}{2-y}$ or $\frac{-2a}{y-2}$ nfww final answer	**4**	**M1** for clearing the x term in the denominator **M1** for correctly removing the bracket (expand or divide by 2) **M1** for factorising to obtain single x term **M1** for *their* factor and division Incorrect answer scores 3 out of 4 maximum
3(d)	$\frac{x}{x+6}$ nfww final answer	**3**	**M1** for x(x – 6) **M1** for (x + 6)(x – 6)

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4(a)	10, 7	**2**	**B1** for each value
4(b)	Correct curve	**4**	**B3 FT** for 10 or 11 correct points **B2 FT** for 8 or 9 correct points **B1 FT** for 6 or 7 correct points **FT** *their* table
4(c)	–1.7 to –1.55	**1**	**FT** *their* graph if one answer
4(d)	Tangent ruled at $x = 3.5$	**B1**	No daylight between tangent and curve at point of contact
	6.5 to 11	**B2**	**dep** on tangent drawn or close attempt at tangent at $x = 3.5$ **M1** for rise/run also dep on tangent or close attempt at $x = 3.5$
4(e)	line $y = 2x + 10$ ruled AND –1.3 to –1.1 1 4.1 to 4.25	**4**	**B3** for correct line (could be short) and 1 correct value or **B2** for correct line (could be short) or **B1** for [$y =$] $2x + 10$ seen If zero scored, **SC1** for no/wrong line and 3 correct values
5(a)	54, 76, 96	**3**	**B1** for each
5(b)	187 or 186.8 to 186.9 nfww	**4**	**M1** for 155, 175, 185, 200, 225 soi **M1** for Σfm with *their* frequencies from **(a)** 155 × *their* 54 + 175 × *their* 76 + 185 × *their* 96 + 200 × 92 + 225 × 42 **M1** (dep on second **M1**) for *their* $\Sigma fm \div 360$
6(a)	18 22 $4n + 2$ oe 17 26 $n^2 + 1$ oe	**6**	**B2** for 18, 22, 17, 26 or **B1** for two or three correct values AND **B2** for $4n + 2$ oe or **B1** for $4n + k$ oe or $pn + 2$ ($p \neq 0$) AND **B2** for $n^2 + 1$ oe or **B1** for $n^2 + k$ oe
6(b)	242	**1**	**FT** *their* $4n + 2$ provided a linear expression
6(c)	15	**1**	
6(d)	3	**2**	**M1** for $2 \times 1^2 + 2 \times 1 + q = 7$ oe

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Question	Answer	Marks	Partial marks
7(a)	–7	**1**	
7(b)	$\frac{4}{64}$ or better	**2**	**M1** for g(4^3) soi or $\frac{4}{4^x}$ or better
7(c)	$\frac{3-x}{2}$ oe final answer	**2**	**M1** for $x = 3 - 2y$ or $2x = 3 - y$ or $\frac{y}{2} = \frac{3}{2} - x$ or $\frac{y-3}{-2}$ oe as final answer
7(d)	4^{3-2x}	**M1**	
	Correctly interprets the indices	**M1**	Dep on previous **M1** e.g. $4^3 \times 4^{-2x}$ or $4^3 \times \frac{1}{4^{2x}}$ or $\frac{4^3}{4^{2x}}$
	$\frac{64}{16^x}$ nfww	**A1**	Correct completion with no errors
7(e)	1.5	**2**	**B1** for $4^x = 8$ or better
8(a)	$\pi \times \frac{5}{2} \times l + \frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2 = \frac{115\pi}{4}$ oe or $\frac{115\pi}{4} - \frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2 = \pi \times \frac{5}{2} \times l$ oe	**M2**	**M1** for $\pi \times \frac{5}{2} \times l$ or $\frac{4}{2} \times \pi \times \left(\frac{5}{2}\right)^2$
	$\frac{5\pi l}{2} = \frac{65\pi}{4}$ oe or [l =] $\left(\frac{115\pi}{4} - 2 \times \pi \times 2.5^2\right) \div 2.5\pi$ oe	**B1**	nfww oe both terms must be written in terms of π nfww or correct complete method for l with decimals
	[l =] $\frac{65\pi \times 2}{4 \times 5\pi}$ or $\frac{65\pi}{10\pi}$ oe = 6.5	**A1**	Correct calculation with no errors and **B1** earned
8(b)	6	**3**	**M2** for $\sqrt{6.5^2 - 2.5^2}$ or **M1** for $h^2 + 2.5^2 = 6.5^2$ If zero scored, **SC2dep** for answer 4.15[3]…

Question	Answer	Marks	Partial marks
8(c)	72[.0…] or 71.99… nfww	**4**	**M3** for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times$ *their* 6 $+ \frac{1}{2} \times \frac{4\pi}{3} \times \left(\frac{5}{2}\right)^3$ oe or **M1** for $\frac{\pi}{3} \times \left(\frac{5}{2}\right)^2 \times$ *their* 6 oe and **M1** for $\frac{1}{2} \times \frac{4\pi}{3} \times \left(\frac{5}{2}\right)^3$ oe If zero scored, **SC3dep** for $\frac{\pi}{3} \times (5)^2 \times$ *their* 4.15 $+ \frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe or **SC1dep** for $\frac{\pi}{3} \times (5)^2 \times$ *their* 4.15 oe **SC1dep** for $\frac{1}{2} \times \frac{4\pi}{3} \times (5)^3$ oe
8(d)	53.7 or 53.65 to 53.67	**3**	**M1** for figs (*their* **(c)**) × 19.3 × 38.62 or better **M1** for ÷ 1000 soi
9(a)(i)	52	**2**	**M1** for (1 – 0.35) × 80 oe
9(a)(ii)	84	**1**	
9(b)(i)	$\frac{27}{729}$ oe	**2**	**M1** for $\frac{3}{9} \times \frac{3}{9} \times \frac{3}{9}$
9(b)(ii)	$\frac{144}{729}$ oe	**3**	**M2** for $\frac{2}{9} \times \frac{3}{9} \times \frac{4}{9} \times 6$ oe or **M1** for $\frac{2}{9} \times \frac{3}{9} \times \frac{4}{9}$ oe isw
9(c)	$\frac{42}{60}$ oe	**4**	**M3** for $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} + \frac{3}{5} \times \frac{2}{4} \times \frac{2}{3} \times 3$ oe or **M2** for $\frac{3}{5} \times \frac{2}{4} \times \frac{2}{3} \times 3$ oe or for $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3} + \left(\frac{3}{5} \times \frac{2}{4} \times \frac{2}{3}\right)$ [×2] or **M1** for $\frac{3}{5} \times \frac{2}{4} \times \frac{1}{3}$ or $\frac{3}{5} \times \frac{2}{4} \times \frac{2}{3}$ oe isw or for PPG, PGP, GPP and PPP selected soi

Question	Answer	Marks	Partial marks
10(a)	$12.5^2 = x^2 + 8.5^2 - 2 \times x \times 8.5\cos 60$ oe isw	**M2**	**M1** for $\cos 60 = \frac{x^2 + 8.5^2 - 12.5^2}{2 \times x \times 8.5}$
	$156.25 = x^2 + 72.25 - 8.5x$	**A1**	or better
	$2x^2 - 17x - 168 = 0$	**A1**	with no errors or omissions
10(b)	$\frac{[--]17 \pm \sqrt{([-]17)^2 - 4(2)(-168)}}{2 \times 2}$	**2**	**B1** for $\sqrt{([-]17)^2 - 4(2)(-168)}$ or better seen and if in form $\frac{p + or - \sqrt{q}}{r}$ **B1** for $p = [- -]\ 17$ **and** $r = 2 \times 2$
	14.35, –5.85 final answers	**1, 1**	**SC1** for 14.352 to 14.353 and –5.853 to –5.852 seen or 14.3 or 14.4 and –5.8 or –5.9 as final answers or –14.35 and 5.85 as final answers or 14.35 and –5.85 seen in working
10(c)	12.2 or 12.17… nfww	**3**	**M2** for $\frac{their\ 14.35 \times \sin 46}{\sin 58}$ or **M1** for $\frac{\sin 46}{CD} = \frac{\sin 58}{their 14.35}$
10(d)	138 or 137.5 to 137.8 nfww	**3**	**M1** for $0.5 \times their\ 14.35 \times 8.5\sin 60$ **M1** for $0.5 \times their\ 14.35 \times their 12.2 \times \sin 76$
11(a)(i)	$\begin{pmatrix} 1 & -18 \\ 6 & 13 \end{pmatrix}$	**2**	**M1** for two or three correct elements
11(a)(ii)	$\frac{1}{11}\begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}$ or better isw	**2**	**M1** for det = 11 or $[k]\begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}$ isw
11(b)	Reflection	**1**	
	y-axis oe	**1**	
11(c)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**B1** for one correct column or row

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Question	Answer	Marks	Partial marks
11(d)(i)	$\frac{1}{7}(4\mathbf{a} + 3\mathbf{b})$ or $\frac{4}{7}\mathbf{a} + \frac{3}{7}\mathbf{b}$	**3**	**M2** for correct unsimplified answer seen or $\overrightarrow{AP} = \frac{3}{7}(\mathbf{b} - \mathbf{a})$ oe or $\overrightarrow{BP} = \frac{4}{7}(\mathbf{a} - \mathbf{b})$ oe or **M1** for $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ or $\overrightarrow{BA} = \mathbf{a} - \mathbf{b}$ or correct route for $\overrightarrow{OP}$
11(d)(ii)	$[m =] \frac{7}{3}$ $[k =] \frac{4}{3}$	**2**	**B1** for each value or **M1** for $\frac{m}{7}(4\mathbf{a} + 3\mathbf{b}) = \mathbf{b} + k\mathbf{a}$ oe