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**MATHEMATICS**

**0580/43**

Paper 4 (Extended)

**May/June 2017**

MARK SCHEME

Maximum Mark: 130

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**Published**

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.

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**Abbreviations**

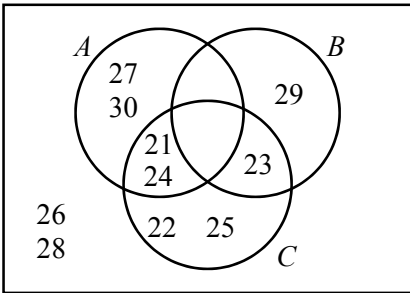
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Part marks
1(a)(i)	9550	1	
1(a)(ii)	23 158 750	2FT	FT <i>their (a)(i)</i> × 2425 correctly evaluated M1 for <i>their</i> lower bound × 2425
1(a)(iii)	23 160 000	1FT	FT <i>their (a)(ii)</i> rounded to 4 sf
1(a)(iv)	$2.316 \times 10^7$	1FT	FT <i>their (a)(iii)</i> or <i>their (a)(ii)</i> rounded to 3sf or more and in standard form
1(b)	520 nfww	3	M2 for $546 \times \frac{100}{(100+5)}$ oe or M1 for 105[%] associated with 546 oe
1(c)	3380 or 3376 to 3377	2	M1 for $3000 \times \left(1 + \frac{3}{100}\right)^4$ oe
2(a)	38	1	
	118	1	
	62	1FT	FT 180 – <i>their y</i>
2(b)	69	3	B2 for $ACB = 42$ or B1 for $ADB = 42$ If zero scored, SC1 for $ACB = \textit{their ADB}$
2(c)	107	2	B1 for $QPS = 73$ or [reflex] $QOS = 214$
3(a)	0 2.25 2 1.25	4	B1 for each
3(b)	Fully correct smooth curve	4	B3 FT for 7 or 8 points or B2 FT for 5 or 6 points or B1 FT for 3 or 4 points

Question	Answer	Marks	Part marks
3(c)	1	1	
3(d)(i)	$[y =] x + 1$	1	
3(d)(ii)	-2.2 to -2.1	1	
	-0.45 to -0.4	1	
	0.51 to 0.6	1	If zero scored, <b>SC1</b> for <i>their</i> line in <b>(d)(i)</b> drawn. It must be of the form $y = mx + c$ ( $m \neq 0$ ) and drawn 'fit for purpose'
3(e)	$-1.33 < k < 0$ to 0.1	2FT	<b>FT</b> Strict fit of <i>their</i> max point and min point dep on cubic graph or accept correct answer from calculus <b>B1</b> for each If zero scored, <b>SC1</b> for two correct values reversed
4(a)(i)	17.5 or 17.46....nfw	6	<b>B3</b> for triangle height 3.46[4...] or $\sqrt{12}$ oe or <b>M2</b> for $\sqrt{4^2 - 2^2}$ or <b>M1</b> for $h^2 + 2^2 = 4^2$  <b>and M2</b> for $2 \times 7 + \frac{1}{2} \times 2 \times \text{their } h$ oe  or <b>M1</b> for $\frac{1}{2} \times 2 \times \text{their } h$
4(a)(ii)	140 or 139.6 to 139.7...	1FT	<b>FT</b> <i>their</i> (a) $\times 8$
4(b)(i)	2.62 or 2.618...	3	<b>M2</b> for $[r^2 =] \frac{280}{13\pi}$ oe  or <b>M1</b> for $280 = \pi \times r^2 \times 13$
4(b)(ii)	10.2 or 10.20... or $10\frac{10}{49}$	3	<b>M2</b> for $\frac{280}{14^3} [\times 100]$ oe  or <b>B1</b> for 2744 or $14^3$ seen
5(a)(i)	80 33 20	1, 1, 1	
5(a)(ii)	17.3 nfw	4	<b>M1</b> for 5, 15, 22.5, 27.5, 40 soi  <b>M1</b> for $\sum fx$ with <i>their</i> $f$ 's and $x$ in correct interval including both boundaries  <b>M1</b> (dep on 2nd <b>M1</b> ) for $\sum fx \div 200$

Question	Answer	Marks	Part marks
5(b)(i)	$\frac{30}{210}$ oe	2	<b>M1</b> for $\frac{6}{15} \times \frac{5}{14}$ If zero scored, <b>SC1</b> for answer $\frac{36}{225}$ oe
5(b)(ii)	$\frac{108}{210}$ oe	3	<b>M2</b> for $\frac{6}{15} \times \frac{9}{14} + \frac{9}{15} \times \frac{6}{14}$ oe or $1 - \frac{9}{15} \times \frac{8}{14} - \frac{6}{15} \times \frac{5}{14}$ or <b>M1</b> for $\frac{6}{15} \times \frac{9}{14}$ or $\frac{9}{15} \times \frac{6}{14}$ or $\frac{9}{15} \times \frac{8}{14} + \frac{6}{15} \times \frac{5}{14}$ If zero scored, <b>SC1</b> for answer $\frac{108}{225}$ oe
5(c)	150	1	
6(a)(i)	Translation	1	
	$\begin{pmatrix} 3 \\ -13 \end{pmatrix}$ oe	1	
6(a)(ii)	Enlargement	1	
	[sf] $-\frac{1}{2}$ oe	1	
	(0, -4)	1	
6(b)	Image at (0, 0) (0, 6) (-4, 6) (-4, 2)	2	<b>B1</b> for rotation of 90° anticlockwise about the wrong centre or 90° clockwise about (3, -1) or 4 points correct but not joined.
6(c)	Image at (4, 0) (10, 0) (10, -4) (6, -4)	2	<b>B1</b> for reflection in $y = k$ or in $x = 1$ or 4 points correct but not joined
6(d)	Enlargement	1	
	[sf] 3	1	
	Origin oe	1	

Question	Answer	Marks	Part marks
7(a)	[x =] -5 [y =] 7 with correct working	4	<b>M1</b> for correctly equating one set of coefficients <b>M1</b> for correct method to eliminate one variable OR <b>M1</b> for correctly rearranging one equation <b>M1</b> for correct method to eliminate one variable  <b>A1</b> $x = -5$ <b>A1</b> $y = 7$ both dep on <b>M2</b>  If zero scored, <b>SC1</b> for 2 values satisfying one of the original equations  <b>SC1</b> if no correct working shown, but 2 correct answers given
7(b)	[a =] 36 [b =] -6	3	<b>B2</b> for either correct or <b>M1</b> for $a = b^2$ or for $x^2 + bx + bx + b^2$ or better or for $(x - 6)^2$ seen and <b>M1</b> for $2b = -12$ soi
7(c)	$\frac{7x^2 - 12x - 10}{(2x - 5)(x - 1)}$ oe final answer nfw	4	<b>B1</b> for common denom $(2x - 5)(x - 1)$ seen oe isw <b>M1</b> for $x(x - 1) + (3x + 2)(2x - 5)$ soi isw <b>B1</b> for $6x^2 - 15x + 4x - 10$ soi
8(a)(i)	4 points correctly plotted	2	<b>B1</b> for 2 or 3 points correctly plotted
8(a)(ii)	Positive	1	
8(b)	mean 3.1	3	<b>M2</b> for $\frac{\text{sum of products}}{30}$  or <b>M1</b> for at least 4 correct products soi
	median 3	2	<b>M1</b> for 15.5 oe indicated
	mode 5	1	
	range 5	1	
8(c)	24 nfw	3	<b>M1</b> for $\frac{x \times 52 + 45 \times 75 + 11 \times 91}{x + 45 + 11}$ [= 70.3] <b>M1</b> for clearing <i>their</i> fraction

Question	Answer	Marks	Part marks
9(a)	1120 or 1121. ....	4	<b>M2</b> for $[AC^2 =]$ $525^2 + 872^2 - 2 \times 525 \times 872 \times \cos 104$ or <b>M1</b> for implicit version <b>A1</b> for 1257000 to 1258000
9(b)	$[QB \text{ or } x =] 872 \times \tan 1$ seen	<b>M2</b>	<b>M1</b> for $\tan 1 = \frac{QB}{872}$
	$\tan = \text{their } QB \div 525$	<b>M1</b>	
	1.7 or 1.660 to 1.661 nfw	<b>A1</b>	dep on <b>M3</b>
9(c)(i)	222 000 or 222 100. .... or 222 101	2	<b>M1</b> for $\frac{1}{2} \times 525 \times 872 \times \sin 104$
9(c)(ii)	5.55 or 5.550 to 5.553 nfw	2FT	<b>FT</b> <i>their (c)(i)</i> $\times 100^2 \div 20\,000^2$ <b>M1</b> for <i>their (c)(i)</i> $\times 100^2 \div 20\,000^2$ or restart
10(a)		4	All 8 regions correct <b>M3</b> for 6 or 7 regions correct <b>M2</b> for 4 or 5 regions correct <b>M1</b> for 3 regions correct
10(b)(i)	$\notin$	1	
10(b)(ii)	$\emptyset$	1	
10(c)	21, 23, 24, 29	2FT	Correct or <b>FT</b> <b>SC1</b> for 1 omission or 4 correct and 1 extra
10(d)(i)	5	1FT	Correct or <b>FT</b> if less than 10
10(d)(ii)	9	1FT	Correct or <b>FT</b> if less than 10
10(e)	$\subset$ or $\subseteq$	1	

Question	Answer	Marks	Part marks
11	64 $(n+3)^2$ oe final answer	1, 2	M1 for a quadratic expression seen or second differences 2
	17 $3n+2$ oe final answer	1, 2	B1 for $3n+k$ (any $k$ ) or $kn+2$ ( $k \neq 0$ )
	47 $(n+3)^2 - (3n+2)$ oe isw	1, 2FT	FT <i>their</i> difference expressions $A - B$ M1 for expression $an^2 + bn + c$ seen or second differences 2
	$\frac{7}{6} \frac{n+2}{n+1}$ oe final answer	1, 2	B1 for $\frac{n+k+1}{n+k}$ seen