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**MATHEMATICS**

**0580/43**

Paper 4 (Extended)

**October/November 2016**

MARK SCHEME

Maximum Mark: 130

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**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
nfw	not from wrong working
soi	seen or implied

Question	Answer	Mark	Part marks	
<b>1</b>	<b>(a)</b>	<b>(i)</b>	1050	<b>2</b> <b>M1</b> for $924 \div 22$ oe or $924 \div 0.88$ oe If zero scored, <b>SC1</b> for 126 seen
		<b>(ii)</b>	12	<b>1</b>
		<b>(iii)</b>	5 ¼ hrs or 5.25 hrs	<b>2</b> <b>M1</b> for $9 \div (7 + 5)$ or $540 \div (7 + 5)$ If zero scored, <b>SC1</b> for answer 3.75h or 3h 45 mins
	<b>(b)</b>	24.6[0]	<b>3</b>	<b>M2</b> for $15.99 \div \left(1 - \frac{35}{100}\right)$ oe or <b>M1</b> for 65% associated with 15.99
	<b>(c)</b>	63	<b>3</b>	<b>M2</b> for $35 \times \sqrt{\frac{2835}{875}}$ oe or <b>M1</b> for $\sqrt{\frac{2835}{875}}$ or $\sqrt{\frac{875}{2835}}$ or better or $\frac{\sqrt{2835}}{?} = \frac{\sqrt{875}}{35}$ oe OR <b>M2</b> for $\sqrt{2835 \times \frac{35}{their(875 \div 35)}}$ oe or <b>M1</b> for $\frac{35}{their(875 \div 35)}$ or $\frac{their(875 \div 35)}{35}$
	<b>(d)</b>	<b>(i)</b>	0.661[0]	<b>1</b>
		<b>(ii)</b>	48	<b>3</b> <b>M2</b> for $\frac{18.50 - 12.50}{12.50} \times 100$ or <b>M1</b> for $\frac{18.50 - 12.50}{12.50}$ or $\frac{18.50}{12.50} \times 100$

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Question	Answer	Mark	Part marks
2 (a)	-4.5 and 10.5	2	<b>B1</b> for each value
(b)	Correct curve	5	<b>B4</b> for correct curve with branches joined OR <b>B3 FT</b> for 9 or 10 points or <b>B2 FT</b> for 7 or 8 points or <b>B1 FT</b> for 5 or 6 points <b>and</b> <b>B1</b> independent for one branch on each side of the $y$ -axis and <b>not touching</b> or crossing the $y$ -axis
(c)	5	1	
(d) (i)	Line $y = 15 - 3x$ ruled and -0.4 to -0.31 0.35 to 0.45 2.2 to 2.3	4	<b>B3</b> for correct line and 2 correct values or <b>B2</b> for correct line or <b>M1</b> for ruled line with gradient $-3$ or through $(0, 15)$ or <b>SC2</b> for no/wrong line and three correct values or <b>SC1</b> for no/wrong line and two correct values or for correct freehand line
(ii)	$[a =] 6$ $[b =] -14$ $[c =] 0$	3	<b>B2</b> for $6x^3 - 14x^2 + 2 = 0$ oe or <b>M1</b> for correct removal of denominator or collection of terms on one side
3 (a)	2.25 oe	2	<b>M1</b> for $8x + 4x = 22 + 5$ or better
(b)	$x \geq 3.5$ final answer	2	<b>M1</b> for $6x - 2x \geq 14$ or better
(c)	$(x - 7)(x + 3)$ final answer	2	<b>M1</b> for $x(x + 3) - 7(x + 3)$ or $x(x - 7) + 3(x - 7)$ or for $(x + a)(x + b)$ where $ab = -21$ or $a + b = -4$
(d)	$12x^2 + xy - 6y^2$ final answer	3	<b>M2</b> for $12x^2 + 9xy - 8xy - 6y^2$ or <b>M1</b> for any two of the four terms correct
4 (a)	Triangle drawn at $(-4, 3), (-1, 3), (-1, 4)$	2	<b>SC1</b> for correct reflection in $x = k$ or $y = 1$
(b)	Triangle drawn at $(1, 7), (1, 6), (4, 6)$	2	<b>SC1</b> for translation by $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$
(c)	Triangle drawn at $(2, 3), (2, 1), (8, 1)$	2	<b>M1</b> for two correct vertices or <b>SC1</b> for correct enlargement about the wrong centre
(d)	Rotation $90^\circ$ clockwise oe $(7, 4)$	1 1 1	Accept $-90^\circ$

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Part marks</b>
<b>5 (a)</b>	$\frac{1}{64}$	<b>2</b>	<b>M1</b> for $\frac{1}{8} \times \frac{1}{8}$
<b>(b)</b>	$\frac{63}{64}$	<b>1FT</b>	<b>FT 1 – their (a)</b>
<b>(c)</b>	$\frac{30}{64}$ oe	<b>2</b>	<b>M1</b> for $[2 \times] \frac{3}{8} \times \frac{5}{8}$ oe
<b>(d)</b>	$\frac{7}{64}$	<b>3</b>	<b>M2</b> for $\frac{1}{8} \times \frac{1}{8} + \frac{1}{8} \times \frac{3}{8} + \frac{3}{8} \times \frac{1}{8}$ oe or <b>M1</b> for identifying combinations required, (8, 8) and (8, 6) and (8, 5) or identifying 6 out of the 7 possible outcomes
<b>(e)</b>	$\frac{24}{64}$ oe	<b>3</b>	<b>M2</b> for $\frac{1}{8} \times \frac{7}{8} + \frac{3}{8} \times \frac{4}{8} + \frac{2}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{1}{8}$ oe or $\frac{7}{8} \times \frac{1}{8} + \frac{6}{8} \times \frac{1}{8} + \frac{4}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{3}{8}$ oe or <b>M1</b> for the sum of any two correct products from above oe isw
<b>6 (a)</b>	$[\cos ABL =] \frac{40^2 + 61.1^2 - 92.1^2}{2 \times 40 \times 61.1}$  130.11...	<b>M2</b>  <b>A2</b>	<b>M1</b> for correct implicit version  <b>A1</b> for $[\cos ABL =] -0.644\dots$ or $-\frac{7873}{12220}$ or $-\frac{3149.2}{4888}$
<b>(b)</b>	[0]59.5 or 59.50 to 59.511	<b>4</b>	<b>M2</b> for $\frac{40 \sin 130.1}{92.1}$ or $\frac{61.1 \sin 130.1}{92.1}$ or <b>M1</b> for $\frac{\sin A}{40} = \frac{\sin 130.1}{92.1}$ or $\frac{\sin L}{61.1} = \frac{\sin 130.1}{92.1}$ <b>and</b> <b>A1</b> for 19.39 to 19.4... or 30.48 to 30.49...

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Question	Answer	Mark	Part marks
(c)	1h 50min	5	<p><b>M2</b> for <math>[BC =] 2 \times 40 \times \cos(180 - 130.1)</math> oe  or <b>M1</b> for <math>\frac{x}{40} = \cos(180 - 130.1)</math> oe</p> <p>OR <b>M2</b> for  <math>[BC =] \sqrt{40^2 + 40^2 - 2 \times 40 \times 40 \cos(\text{their } 80.2)}</math>  or <b>M1</b> for correct implicit version</p> <p>OR <b>M2</b> for <math>[BC =] \frac{40 \sin(\text{their } 80.2)}{\sin 49.9}</math>  or <b>M1</b> for correct implicit version</p> <p><b>and</b>  <b>M1</b> for <math>\frac{\text{their } BC}{28}</math>  <b>A1</b> for 1.84[0...] to 1.841</p>
7 (a) (i)	6000 [7600] 10200 4200	2	<b>B1</b> for 6000 or 10200 If <b>B0</b> then <b>B1FT</b> for <i>their</i> (UQ – LQ)
(ii)(a)	True, median price is lower	1	No inclusion of other statistic
(ii)(b)	False, A's UQ < 13 600 oe	<b>1FT</b>	<b>FT</b> <i>their</i> UQ in (a)(i)
(b)	11 025	4	Listed values are in thousands <b>M1</b> for 3, 7, 9, 11, 13, 18 soi <b>M1</b> for $\Sigma fm$ [1323] <b>M1</b> (dep on second <b>M1</b> ) for <i>their</i> $\Sigma fm \div 120$
(c)	323.25 nfw	3	<b>M2</b> for $9948 - 0.25 \times 8760$ or <b>M1</b> for $0.25 \times 8760$
8 (a)	Attempt to use $18 - r$ in Pythagoras' $144 = r^2 - 324 + 18r + 18r - r^2$ oe $468 = 36r$ oe	<b>M1</b>	
(b)	$[2 \times] \sin^{-1}\left(\frac{12}{13}\right)$ oe  134.76...	<b>B2</b> <b>A1</b> <b>M1</b> <b>A1</b>	or <b>B1</b> for $324 - 18r - 18r + r^2$ Correct simplification with no errors or $\cos = \left(\frac{13^2 + 13^2 - 24^2}{2 \times 13 \times 13}\right)$ or better or $[180 - ] 2 \times \sin^{-1}\left(\frac{5}{13}\right)$ Not $67.4 \times 2$

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Question	Answer	Mark	Part marks
(c) (i)	332 or 332.1 to 332.2...	3	M2 for $\frac{(360-134.8)}{360} \times \pi \times 13^2$ or M1 for $\frac{134.8}{360} \times \pi \times 13^2$
(ii)	392 or 392.0 to 392.2...	3	M2 for $\frac{1}{2} \times 24 \times 5 + \text{their (c)(i)}$ or $\frac{1}{2} \times 13^2 \times \sin 134.8 + \text{their (c)(i)}$ or M1 for $\frac{1}{2} \times 24 \times 5$ or $\frac{1}{2} \times 13^2 \times \sin 134.8$
(iii)	15 700 or 15 670 to 15 690	1FT	FT for answer to $40 \times \text{their (c)(ii)}$
(d)	29.5 or 29.6 or 29.51 to 29.57...	2FT	M1 for $\pi \times 13^2 \times h = \text{their (c)(iii)}$ or better
9 (a) (i)	$\begin{pmatrix} 12 \\ -5 \end{pmatrix}$	2	M1 for $\begin{pmatrix} 12 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$
(ii)	13 nfw	2FT	M1FT for $\sqrt{\text{their } 12^2 + \text{their } (-5)^2}$ FT dep on <i>their (a)</i> being $\begin{pmatrix} a \\ b \end{pmatrix}$ where <i>a, b</i> are both non-zero
(b)(i)(a)	<b>b – a</b>	1	
(i)(b)	$\frac{3}{5}(\mathbf{b} - \mathbf{a})$ or $\frac{3}{5}\mathbf{b} - \frac{3}{5}\mathbf{a}$ final answer	1FT	FT $\frac{3}{5}$ <i>their</i> vector, in terms of <b>a</b> and <b>b</b> , in (b)(i)(a)
(i)(c)	$\frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$ or $\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ final answer	2	M1 for <b>a</b> + <i>their</i> vector in (b)(i)(b) or any correct route
(ii)	$\frac{3}{2}$ oe	1	

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Question	Answer	Mark	Part marks
<b>10 (a)</b>	A: 14 $3n - 1$ oe	<b>3</b>	<b>B1</b> for 14 <b>B2</b> for $3n - 1$ oe or <b>M1</b> for $3n + k$ , for any $k$ oe
	B: -4 $26 - 6n$ oe	<b>3</b>	<b>B1</b> for -4 <b>B2</b> for $26 - 6n$ oe or <b>M1</b> for $k - 6n$ , for any $k$ oe
	C: 25 $n^2$ oe	<b>2</b>	<b>B1</b> for 25 <b>B1</b> for $n^2$ oe
	D: 20 $n^2 - n$ oe	<b>2</b>	<b>B1</b> for 20 <b>B1</b> for $n^2 - n$ oe
<b>(b) (i)</b>	$\frac{n(3n+1)}{2} = 155$	<b>M1</b>	Accept $\frac{3n^2 + n}{2} = 155$
	$3n^2 + n = 310$		Intermediate step must include elimination of fraction eg $n(3n + 1) = 310$
	$3n^2 + n - 310 = 0$	<b>A1</b>	With no errors or omissions
<b>(ii)</b>	$10, -\frac{31}{3}$ oe	<b>3</b>	<b>M2</b> for $(3n + 31)(n - 10) [= 0]$ or <b>M1</b> for $3n(n - 10) + 31(n - 10)$ or $n(3n + 31) - 10(3n + 31)$ or $(3n + a)(n + b)$ where $ab = -310$ or $a + 3b = 1$
<b>(iii)</b>	10	<b>1FT</b>	<b>FT</b> their <b>b(ii)</b> if only one positive integer solution

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Question	Answer	Mark	Part marks
11	5 and $-\frac{27}{2}$ oe	7	<p><b>M2</b> for <math>12 \times 2(2x - 1) + (x + 3)(2x - 1) = 12 \times 3(x + 3)</math> oe or <b>M1</b> for a common denominator with 2 or more of the terms</p> <p>and <b>B2</b> for <math>2x^2 + 17x - 135 [= 0]</math> oe or <b>B1</b> for <math>48x - 24</math> or <math>2x^2 - x + 6x - 3</math> or <math>36x + 108</math> or <math>2x^2 - x + 54x - 27</math> or <math>132 - 12x</math> or <math>37x + 111 - 2x^2 - 6x</math></p> <p>and <b>M2</b> for <math>(2x + 27)(x - 5)</math> or <i>their</i> correct factors or formula or <b>M1</b> for <math>2x(x - 5) + 27(x - 5)</math> or <math>x(2x + 27) - 5(2x + 27)</math> or <math>(2x + a)(x + b)</math> where <math>ab = -135</math> or <math>a + 2b = 17</math></p>