

MARK SCHEME for the October/November 2013 series

0580 MATHEMATICS

0580/41

Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao	correct answer only
cso	correct solution only
dep	dependent
ft	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
www	without wrong working
art	anything rounding to
soi	seen or implied

Qu	Answers	Mark	Part Marks
1	(a) (i) $\frac{2}{5}$ cao	1	
	(ii) 3 : 2 cao	1	
	(b) (i) 1.22	2	M1 for $86.38 - 28 \times 1.56$
	(ii) 1.3 [0] nfw	3	M2 for $1.56 \div 1.2$ oe or M1 for $1.56 = 120\%$ soi
	(c) 33.6[0]	2	M1 for $(667 - 314.2) \div 10.5$ oe
2	(a) 3 correct lines on grid (0, 0) to (40, 5) (40, 5) to (100, 5) (100, 5) to (120, 0)	2	Allow good freehand SC1FT for 2 lines correct, FT from an incorrect line
	(b) $\frac{5}{40}$ oe	1	
	(c) 3.75	4	M2 for $0.5 \times 40 \times 5 + 60 \times 5 + 0.5 \times 20 \times 5$ oe [450] or M1 for evidence of a relevant area = distance and M1dep <i>their</i> area (or distance) $\div 120$

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Qu	Answers	Mark	Part Marks
3	<p>(a) (i) 204 or 204.2 to 204.23</p> <p>(ii) 12 cao</p> <p>(iii) 314 or 314.1 to 314.2</p> <p>(iv) 3.14×10^{-4} or 3.141 to 3.142×10^{-4}</p> <p>(b) 138 or 138.3 to 138.5</p>	<p>2</p> <p>3</p> <p>2</p> <p>2FT</p> <p>4</p>	<p>M1 for $\pi \times 5 \times 13$ implied by answer in range 204.1 to 204.3</p> <p>M2 for $\sqrt{13^2 - 5^2}$ or states 5, 12, 13 triangle or M1 for $13^2 = 5^2 + h^2$ or better</p> <p>M1 for $\frac{1}{3} \times \pi \times 5^2 \times \text{their (a) (ii)}$ implied by answer in range 314 to 314.3</p> <p>FT <i>their (a) (iii)</i> $\div 100^3$ correctly evaluated and given in standard form to 3 sig figs or better or M1 FT for <i>their (a) (iii)</i> $\div 100^3$ or SC1 for conversion of <i>their</i> m^3 into standard form only if negative power</p> <p>M3 for $\frac{10\pi}{26\pi} \times 360$ oe or $\frac{\pi \times 5 \times 13 \text{ or } \text{their (a) (i)}}{\pi \times 13^2} \times 360$ oe or M2 for a correct fraction without $\times 360$ or M1 for $\pi \times 2 \times 13$ oe [81.6 to 81.8] seen or $\pi \times 13^2$ oe [530.6 to 531.2] seen</p>
4	<p>(a) 45.[0] or 45.01 to 45.02 nfw</p> <p>(b) 84.9 or 84.90 to 84.92</p> <p>(c) (i) 4060 or 4063 to 4064 nfw</p> <p>(ii) 1020 or 1015 to 1016</p> <p>(d) 35.4 or 35.35... nfw</p>	<p>4</p> <p>4</p> <p>3</p> <p>2FT</p> <p>2</p>	<p>M2 for $55^2 + 70^2 - 2.55.70 \cos 40$ or M1 for correct implicit equation A1 for 2026.</p> <p>B1 for angle BDC = 40 soi M2 for $\frac{70 \sin(\text{their } 40)}{\sin 32}$ or M1 for correct implicit equation</p> <p>M2 for $\frac{1}{2} (55 \times 70 \sin 40) + \frac{1}{2} (70 \times \text{their (b)} \sin(180 - \text{their } 40 - 32))$ oe or M1 for correct method for one of the triangle areas</p> <p>FT <i>their (c) (i)</i> $\div 4$ oe correctly evaluated or M1 <i>their (c) (i)</i> \div figs 4 oe</p> <p>M1 for $\sin 40 = \frac{\text{distance}}{55}$ or better or for $\frac{1}{2} (55 \times 70 \sin 40) = (70 \times \text{distance}) \div 2$ or better</p>

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Qu	Answers	Mark	Part Marks
5	(a) (i) Correct reflection to (4, 8) (2, 9) (4, 9)	2	SC1 for reflection in line $x = 5$ or reflection in $y = k$ Ignore additional triangles
	(ii) Correct rotation to (4, 2), (4, 3) (6, 3)	2	SC1 for rotation 180° with incorrect centre Ignore additional triangles
	(iii) Shear, x-axis oe invariant, [factor] 2	3	B1 each (independent)
	(iv) $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	2FT	FT <i>their</i> shear factor B1FT for one correct column or row in 2 by 2 matrix but not identity matrix or SC1FT for $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$
	(b) (i) $\mathbf{p} + 2\mathbf{s}$ final answer	2	M1 for recognising \overrightarrow{OQ} as position vector soi
	(ii) $\mathbf{s} + \frac{1}{2}\mathbf{p}$ final answer	2	B1 for $\mathbf{s} + k\mathbf{p}$ or $k\mathbf{s} + \frac{1}{2}\mathbf{p}$ or correct route ($k \neq 0$)
	(c) parallel and $OQ = 2SR$ oe	1	
6	(a) (i) 1.4 to 1.6	1	
	(ii) 1.15 to 1.25	1	
	(iii) - 1	1	
	(iv) - 2.25 to - 2.1 - 0.9 to - 0.75 2.2 to 2.35	3	B2 for 2 correct or B1 for one correct or B1 for $y = x$ drawn ruled to cut curve 3 times
	(b) (i) - 15	2	B1 for $[h(3) =] 8$ seen or M1 for $1 - 2(x^2 - 1)$ or better
	(ii) $\frac{1-x}{2}$ or $\frac{1}{2} - \frac{x}{2}$ oe final answer	2	M1 for $2x = 1 - y$ or $x = 1 - 2y$ or better
	(iii) - 2, 2	3	M1 for $x^2 - 1 = 3$ or better B1 for one answer
	(iv) $\frac{1}{8}$ oe nfww	3	M2 for $8x = 1$ or $8x - 1 = 0$ or M1 for $1 - 2(3x) [= 2x]$

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Qu	Answers	Mark	Part Marks
7	(a) 24.7 or 24.66 to 24.67	4	M1 for midpoints soi (condone 1 error or omission) (5, 15, 25, 35, 45, 55) and M1 for use of $\sum fx$ with x in correct interval including both boundaries (condone 1 further error or omission) and M1 (dependent on second M) for $\sum fx \div 120$
	(b) (i) 50, 90, 114	2	B1 for 2 correct
	(ii) Correct curve or ruled polygon	3	Ignore section to left of $t = 10$ B1 for 6 correct horizontal plots and B1FT for 6 correct vertical plots If 0 scored SC1 for 5 out of 6 correct plots and B1FT for curve or polygon through at least 5 of <i>their</i> points dep on an increasing curve/polygon that reaches 120 vertically
	(iii) 21.5 to 23 15 to 16.5 24 to 26	4	B1 B1 B2 or B1 for 72 or 72.6 seen
	(c) (i) 50, 30	2	B1 each
	(ii) Correct histogram	3FT	B1 for blocks of widths 0 – 20, 30 – 60 (no gaps) B1FT for block of height 2.5 or <i>their</i> $50 \div 20$ and B1FT for block of height 1 or <i>their</i> $30 \div 30$

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Qu	Answers	Mark	Part Marks
8	<p>(a) $\sqrt{(-11)^2 - 4(8)(-11)}$ or better</p> <p>$p = -(-11), r = 2(8)$ or better</p> <p>– 0.67, 2.05 final answers</p> <p>(b) 132</p> <p>(c) 20 with supporting algebraic working</p>	<p>B1</p> <p>B1</p> <p>B1B1</p> <p>3</p> <p>6</p>	<p>Seen anywhere or for $\left(x - \frac{11}{16}\right)^2$</p> <p>Must be in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$</p> <p>or B1 for $\sqrt{\frac{11}{8} + \left(\frac{11}{16}\right)^2} + \frac{11}{16}$</p> <p>SC1 for – 0.7 or – 0.672 to – 0.671 and 2.0 or 2.046 to 2.047</p> <p>or answers 0.67 and – 2.05</p> <p>M1 for $y = k\sqrt{x}$ oe or $\sqrt{x} = ky$ oe</p> <p>A1 for $k = 6$ oe or better or for $k = 0.1666$ to 0.167</p> <p>[$k = 6$ implies M1A1] oe</p> <p>B2 for $\frac{x}{2.5} + \frac{x - 14.5}{0.5} = 19$ oe</p> <p>or B1 for $\frac{x}{2.5}$ or $\frac{x - 14.5}{.5}$</p> <p>M1dep on B2 for first completed correct move to clear both fractions</p> <p>M1 for second completed correct move to collect terms in x to a single term</p> <p>M1 for third completed correct move to collect numeric term[s] leading to $ax = b$</p> <p>SC1 for 20 with no algebraic working</p>
9	<p>(a) $y = 2$ oe</p> <p>$y = 2x$ oe</p> <p>$y = -\frac{1}{2}x + 5$ oe</p> <p>(b) $y \geq 2$ oe</p> <p>$y \leq 2x$ oe</p> <p>$y \leq -\frac{1}{2}x + 5$ oe</p> <p>(c) (i) 4 [bushes], 3 [trees]</p> <p>(ii) 2 [bushes], 4 [trees]</p> <p>860</p>	<p>1</p> <p>2</p> <p>2</p> <p>3</p> <p>2</p> <p>2</p> <p>1</p>	<p>M1 for $y = kx, k \neq 0$ or gradient 2 soi</p> <p>M1 for gradient $-\frac{1}{2}$ soi or $y = kx + 5$oe</p> <p>or $x + 2y = k, k \neq 0$ oe</p> <p>If L^2 and L^3 both correct but interchanged then SC3</p> <p>B1 for each correct inequality, allow in any order</p> <p>After 0 scored, SC1 for all inequalities reversed</p> <p>M1 for any correct trial using integer coordinates in region</p> <p>or $30x + 200y = 720$ seen</p> <p>M1 for any correct trial using integer coordinates in region</p>

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Qu	Answers	Mark	Part Marks
10	(a) (i) $1 + 2 + 3 + 4 + 5 = 15$	1	
	(ii) Correct substitution equating to sum e.g. $\frac{2(2+1)}{k} = 3$ and $k = 2$ stated with no errors seen	2	M1 for using a value of n in $\frac{n(n+1)}{k}$ e.g. $\frac{2(2+1)}{k} = 3$ or for a verification using $k = 2$ e.g. $\frac{2(2+1)}{2} = 3$
	(iii) 1830	1	
	(iv) 30	2	M1 for $\frac{n(n+1)}{2} = 465$ or better
	(v) $n - 8$	1	
	(b) (i) 225, 15	2	B1 either
	(ii) $\frac{n^2(n+1)^2}{4}$ oe	1	
	(iii) 36100	2	M1 for $\frac{19^2(19+1)^2}{4}$ oe or 190^2