

MARK SCHEME for the October/November 2013 series

0444 MATHEMATICS (US)

0444/41

Paper 4 (Extended), maximum raw mark 130

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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
soi	seen or implied

	Correct answer		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) (i) 204 or 204.2 to 204.23	2	M1 for $\pi \times 5 \times 13$ implied by answer in range 204.1 to 204.3
	(ii) 12 cao	3	M2 for $\sqrt{13^2 - 5^2}$ or states 5, 12, 13 triangle or M1 for $13^2 = 5^2 + h^2$ or better
	(iii) 314 or 314.1 to 314.2	2	M1 for $\frac{1}{3} \times \pi \times 5^2 \times$ <i>their (a)(ii)</i> implied by answer in range 314 to 314.3
	(iv) 3.14×10^{-4} or 3.141 to 3.142×10^{-4}	2FT	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 (iii)</i> $\div 100^3$ or SC1 for conversion of <i>their</i> m^3 into standard form only if negative power
	(b) 138 or 138.3 to 138.5	4	M3 for $\frac{10\pi}{26\pi} \times 360$ oe or $\frac{\pi \times 5 \times 13}{\pi \times 13^2}$ or <i>their (a)(i)</i> $\times 360$ oe or M2 for a correct fraction without $\times 360$ or M1 for $\pi \times 2 \times 13$ [81.6 to 81.8] seen or $\pi \times 13^2$ [530.6 to 531.2] seen

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3	(a)	45.[0] or 45.01 to 45.02 nfw	4	M2 for $55^2 + 70^2 - 2.55.70 \cos 40$ or M1 for correct implicit equation A1 for 2026.
	(b)	84.9 or 84.90 to 84.92	4	B1 for angle $BDC = 40$ soi M2 for $\frac{70 \sin(\text{their } 40)}{\sin 32}$ or M1 for correct implicit equation
	(c) (i)	4060 or 4063 to 4064 nfw	3	M2 for $\frac{1}{2}(55 \times 70 \sin 40) +$ oe $\frac{1}{2}(70 \times \text{their (b)} \sin (180 - \text{their } 40 - 32))$
	(ii)	1020 or 1015 to 1016	2FT	FT $\text{their (c)(i)} \div 4$ oe correctly evaluated or M1 $\text{their (c)(i)} \div \text{figs } 4$ oe
(d)	35.4 or 35.35... nfw	2	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	
4	(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)	Enlargement to (2, 4) (10, 4) (10, 8)	2	SC1 for enlargement factor 4 correct orientation Ignore additional triangles
	(iv)	Stretch, y -axis invariant, [factor] 2	3	B1 each (independent)
	(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	

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5	(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 $1 - 2(3x) [= 2x]$
6	(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 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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7	<p>(a) $\sqrt{(-11)^2 - 4(8)(-11)}$ or better $p = -(-11), r = 2(8)$ 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 or answers 0.67 and – 2.05</p> <p>M1 for $y = k\sqrt{x}$ oe or $\sqrt{x} = ky$ oe A1 for $k = 6$ oe or better or for $k = 0.1666$ to 0.167 [$k = 6$ implies M1A1] oe</p> <p>B2 for $\frac{x}{2.5} + \frac{x - 14.5}{0.5} = 19$ oe or B1 for $\frac{x}{2.5}$ or $\frac{x - 14.5}{0.5}$</p> <p>M1dep on B2 for first completed correct move to clear both fractions M1 for second completed correct move to collect terms in x to a single term 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>
8	<p>(a) $y = 2$ oe $y = 2x$ oe $y = -\frac{1}{2}x + 5$ oe</p> <p>(b) $y \geq 2$ oe $y \geq 2x$ oe $y \leq -\frac{1}{2}x + 5$ 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 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 After 0 scored, SC1 for all inequalities reversed</p> <p>M1 for any correct trial using integer coordinates in region or $30x + 200y = 720$ seen</p> <p>M1 for any correct trial using integer coordinates in region</p>

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9	(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. $\frac{2(2+1)}{k}$ 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
10	(a)	4724	3	M2 for 8000×0.9^5 oe (implied by 4723.92) M1 for 8000×0.9^n $n > 1$
	(b)	$100 \times 1.005^2 + 100 \times 1.005$ oe	M2	M1 for 100×1.005^2 seen
	(c)	$2^n - 1$	2	M1 for use of $a(r^n - 1)/(r - 1)$ oe