CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0444 MATHEMATICS (US)

0444/41 Paper 4 (Extended), maximum raw mark 130

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.

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 × 1.56
	(ii)	1.3[0] nfww	3	**M2** for 1.56 ÷ 1.2 oe **or M1** for 1.56 = 120% soi
	(c)	33.6[0]	2	**M1** for (667 – 314.2) ÷ 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 $\frac{1}{3} \times \pi \times 5^2 \times$ *their* **(a)(ii)** implied by answer in range 314 to 314.3
	(iv)	3.14×10^{-4} or 3.141 to 3.142 × 10^{-4}	2FT	**FT** *their* **(a)(iii)** ÷ 100^3 correctly evaluated and given in standard form to 3 sig figs or better or **M1 FT** for *their* **(iii)** ÷ 100^3 **or SC1** for conversion of *their* 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 $\frac{\pi \times 5 \times 13 \text{ or their (a)(i)}}{\pi \times 13^2} \times 360$ oe **or M2** for a correct fraction without × 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

3	(a)	45.[0] or 45.01 to 45.02 nfww	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 $\frac{70\sin(their 40)}{\sin 32}$ **or M1** for correct implicit equation
	(c) (i)	4060 or 4063 to 4064 nfww	3	**M2** for $\frac{1}{2}(55\times 70\sin 40)+\frac{1}{2}(70\times their\ \textbf{(b)}\sin(180-their\ 40-32))$ oe **or M1** for correct method for one of the triangle areas
	(ii)	1020 or 1015 to 1016	2FT	**FT** *their* **(c)(i)** ÷ 4 oe correctly evaluated **or M1** *their* **(c)(i)** ÷ figs 4 oe
	(d)	35.4 or 35.35… nfww	2	**M1** for $\sin 40 = \frac{\text{distance}}{55}$ or better or for $\frac{1}{2}$ (55 × 70 sin 40) = (70 × distance) ÷ 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)	**p** + 2**s** final answer	2	**M1** for recognising $\overrightarrow{OQ}$ as position vector soi
	(ii)	**s** + $\frac{1}{2}$ **p** final answer	2	**B1** for **s** + *k***p** or *k***s** + $\frac{1}{2}$ **p** or correct route ($k \neq 0$)
	(c)	parallel **and** $OQ = 2SR$ oe	1	

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 *their* 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 *their* 50 ÷ 20 and **B1FT** for block of height 1 or *their* 30 ÷ 30

7	(a)	$\sqrt{(-11)^2 - 4(8)(-11)}$ or better	B1	Seen anywhere **or** for $\left(x - \frac{11}{16}\right)^2$
		$p = -(-11)$, $r = 2(8)$ or better	B1	Must be in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ **or B1** for $\sqrt{\frac{11}{8} + \left(\frac{11}{16}\right)^2} + \frac{11}{16}$
		– 0.67, 2.05 final answers	B1B1	**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
	(b)	132	3	**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
	(c)	20 with supporting algebraic working	6	**B2** for $\frac{x}{2.5} + \frac{x - 14.5}{0.5} = 19$ oe **or B1** for $\frac{x}{2.5}$ or $\frac{x - 14.5}{0.5}$ **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 $ax = b$ **SC1** for 20 with no algebraic working
8	(a)	$y = 2$ oe	1	
		$y = 2x$ oe	2	**M1** for $y = kx$, $k \neq 0$ or gradient 2 soi
		$y = -\frac{1}{2}x + 5$ oe	2	**M1** for gradient $-\frac{1}{2}$ soi or $y = kx + 5$ oe or $x + 2y = k$ $k \neq 0$ oe If L_2 and L_3 both correct but interchanged then **SC3**
	(b)	y 2 oe y $2x$ oe y $-\frac{1}{2}x + 5$ oe	3	**B1** for each correct inequality, allow in any order After **0** scored, **SC1** for all inequalities reversed
	(c) (i)	4 [bushes], 3 [trees]	2	**M1** for any correct trial using integer coordinates in region **or** $30x + 200y = 720$ seen
	(ii)	2 [bushes], 4 [trees]	2	**M1** for any correct trial using integer coordinates in region
		860	1	

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