CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0444 MATHEMATICS (US)

0444/41 Paper 4, 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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CAMBRIDGE
International Examinations

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

1	**(a)**	8	**2**	**M1** for 12 ÷ 1.5 oe
	(b)	Distance = 36 *their* 36 ÷ 3 [= 12]	**B1** **M1**	
	(c)	200	**2**	**M1** for 12 × 1000 ÷ 60 oe e.g. 36000 ÷ 180
	(d)	Horizontal line at 36 to 13 45 (*their* 13 45, 36) joined to (16 42, 0)	**1** **1FT**	
2	**(a)**	62705	**2**	**M1** for 75246 ÷ 6 soi by 12541 or 75246 × 5
	(b)	10.9 or 10.88…	**3**	**M2** for $\frac{(150675-135890)}{135890} \times 100$ oe **or** **M1** for correct fraction soi by 0.1088… **or** $\frac{150675}{135890} \times 100$ soi by 110.88…
	(c)	127000	**3**	**M2** for 135890 ÷ 1.07 oe **or** **M1** for 135890 associated with 107%
	(d) (i)	59112 to 59113 or 59100 or 59110 or 59119 to 59120 or 59100 nfww	**3**	**M2** for $\pi \times 21 \times (30^2 - 2^2)$ oe **or** **M1** for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$
	(ii) (a)	0.0125	**1**	
	(b)	7580 or 7582 or 7581 or 7583 nfww	**4**	**M1** for 21 × 29.7 × *their* 0.0125 [=7.796 or 7.8[0]] **and** **M1** for *their* **(d)(i)** ÷ (21 × 29.7 × *their* 0.0125) **A1** for 7580 to 7583.2 (non integer) If 0 then **SC1** for *their* **(d)(i)** ÷ (21 × 29.7 × 0.125)

		(iii)	0.63	3	**M2** for $36 \div \left(\frac{240}{60} \times \frac{180}{60}\right)$ oe **M1** for $\frac{240}{60}$ oe or $\frac{180}{60}$ oe
3	(a)	(i)	120	1	
		(ii)	151	4	**B1** for $\angle ECB = 32$ **M1** for $\angle ECD = 90 -$ *their* $\angle ECB$ **M1** for $\angle CED = 0.5(180 -$ *their* $\angle ECD)$ **or M1** for $360 -$ *their* $\angle CED - 148$
	(b)		Two of $AP = PB$ [given] CP is common $\angle CPA = \angle CPB$ [= 90] Reason with one of the above SAS or in words	 1 1 1	 dep on three correct statements (reasons not needed)
	(c)	(i)	Any two of $\angle D = \angle C$ with reason $\angle A = \angle B$ with reason $AXD = BXC$ with reason Equiangular oe	 1 1 1	 Circumference, same segment Opposite angles Dep on 2 pairs of angles identified
		(ii)	6	2	**M1** for $\frac{8}{12} = \frac{4}{DX}$ oe
		(iii)	$8k$	2	**M1** for $\left(\frac{2}{3}\right)^2$ or $\left(\frac{3}{2}\right)^2$ seen or $\frac{1}{2} \times 4 \times 4k$
4	(a)		91.6 or 91.59 to 91.60	2	**M1** for $0.5 \times 15 \times 19 \times \sin 40$
	(b)		12.2 or 12.22… nfww	 3	**M1** for $15^2 + 19^2 - 2 \times 15 \times 19 \times \cos 40$ **A1** for 149 or 149.3 to 149.4
	(c)		97.8 or 97.81… nfww	4	**M2** for $\frac{19 \sin 35}{11}$ implied by 0.991 or 0.9907… or 82.2 or 82.18 to 82.19 or **M1** for $\frac{11}{\sin 35} = \frac{19}{\sin ADC}$ oe **M1** for 180 – an acute angle from sine rule

5	**(a)** **(i)**	0.6 oe	**2**	**M1** for $0.2 + 0.4$
	(ii)	1500	**1**	
	(iii)	0.03 oe	**2**	**M1** for 0.1×0.3
	(b)	$\frac{112}{132}$ oe $\frac{28}{33} = 0.848[4\ldots]$	**3**	**M2** for $1 - \frac{5}{12} \times \frac{4}{11}$ or $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{6}{11}$ or $\frac{7}{12} + \frac{5}{12} \times \frac{7}{11}$ **or** **M1** for addition of any two of $\frac{7}{12} \times \frac{5}{11}$, $\frac{5}{12} \times \frac{7}{11}$, $\frac{7}{12} \times \frac{6}{11}$ or sum of 3 products with an error in the numerator of one product or for $\frac{5}{12} \times \frac{4}{11}$ identified
6	**(a)** **(i)**	Image: (–5, –1), (–4, –1), (–5, –3)	**2**	**SC1** for translation $\begin{pmatrix} -6 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -4 \end{pmatrix}$
	(ii)	Image: (1, –1), (3, –1), (3, –2)	**2**	**SC1** for rotation about the origin but 90º anticlockwise
	(b) **(i)**	Enlargement	**1**	Accept dilation
		[factor] 3	**1**	
		[centre] (3, 3)	**1**	Do not allow column vector for coordinates of centre
	(ii)	Stretch	**1**	
		[factor] 3	**1**	
		Invariant line y-axis oe	**1**	Accept $x = 0$, stays the same
7	**(a)**	2.125 and 2.375	**2**	**B1** for one correct value
	(b)	Correct curve	**B4**	**B3FT** for 11 correct plots **or** **B2FT** for 9 or 10 correct plots **or** **B1FT** for 7 or 8 correct plots

	(c)	Ruled tangent at $x = 2$	**B1**	No daylight at $x = 2$. Consider point of contact as midpoint between two vertices of daylight, this must be between $x = 1.8$ and 2.2
		Gradient from 7.8 to 10.2	**2**	**Dep** on B1 awarded Allow integer/integer or a mixed number if within range **or** **M1 dep** for (change in y) ÷ (change in x) Dependent on any tangent drawn or close attempt at a tangent at <u>any</u> point Must see correct or implied calculation from a drawn tangent
	(d)	0 and –1.75 to –1.65 and 1.65 to 1.75	**2**	**B1** for two correct values
	(e)	–1.2 to –0.8 $< k <$ 2.8 to 3.2	**2**	**B1** for each correct or **SC1** for reversed answers
8	**(a) (i)**	34 to 34.5	**1**	
	(ii)	18	**2**	**B1** for [UQ =] 43 or [LQ =] 25
	(iii)	41 to 42	**2**	**B1** for 56 seen or horizontal line drawn at cf = 56
	(b) (i)	31.8[4…] nfww	**4**	**M1** for midpoints soi (condone 1 error or omission) and **M1** for use of $\sum ft$ with t in correct interval including both boundaries (condone 1 further error or omission) and **M1** (**dep** on 2nd M1) for $\sum ft \div 80$ ($2547.5 \div 80$)
	(ii)	Correct histogram	**4**	**B1** for each correct block with correct width and height If **B0** then **SC1** for four correct f.d.s or four correct widths
9	**(a) (i)**	5	**1**	
	(ii)	$-2\frac{1}{3}$ oe	**2**	**B1** for [h(– 1) =] $\frac{1}{3}$ soi or **M1** for $2(3^x) - 3$
	(iii)	$\frac{x+3}{2}$ or $\frac{x}{2} + 1.5$ as final ans	**2**	**M1** for $y + 3 = 2x$ or $x = 2y - 3$ or $\frac{y}{2} = x - 1.5$ or better or correct reverse flowchart

	(iv)	$4x - 9$ as final answer nfww	**2**	**M1** for $2(2x - 3) - 3$
	(v)	$(2x - 3)(x + 1) = 1 + 2(x + 1)$	**M1**	$(2x - 5)(x + 1) = 1$ (eliminate fractions)
		$2x^2 - 3x + 2x - 3$ or better seen	**B1**	$2x^2 - 5x + 2x - 5$ or better seen
		$2x^2 - 3x - 6 = 0$	**A1**	No errors or omissions seen
	(vi)	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 2 \times -6}}{2 \times 2}$	**B2**	**B1** for $\sqrt{(-3)^2 - 4 \times 2 \times -6}$ or better [$\sqrt{57}$] and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$
		2.64 and – 1.14 cao	**B1B1**	**B1** for $p = -(-3)$ and $r = 2 \times 2$ or better **SC1** for 2.64 **and** –1.14 seen in working or 2.6 **and** –1.1 as final ans or 2.637.. **and** –1.137.. as final ans or –2.64 **and** 1.14 as final ans
	(b)	$\frac{x-1}{x+5}$ as final answer nfww	**4**	**B3** for $(x - 1)(x - 2)$ and $(x + 5)(x - 2)$ **or B2** for $(x - 1)(x - 2)$ or $(x + 5)(x - 2)$ **or SC1** for $(x + a)(x + b)$ where $a + b = 3$ or -3 or $ab = 2$ or -10
10	**(a) (i)**	(– 5, 7)	**1**	
	(ii)	5	**2**	**M1** for $\sqrt{(-3)^2 + 4^2}$ or better
	(b) (i) (a)	$\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ or $\frac{1}{5}(3\mathbf{a} + 2\mathbf{b})$ final answer	**2**	**M1** for any correct vector path for $\overrightarrow{ON}$
	(i) (b)	$\frac{2}{5}\mathbf{a}$	**2**	**M1** for any correct vector path for $\overrightarrow{NY}$
	(b) (ii)	$NY = \frac{2}{5}BC$ oe [NY] parallel to [BC]	**1dep** **1dep**	**dep** on **(b)(i)(b)** correct **dep** on $\overrightarrow{NY} = k\mathbf{a}$, $k \neq 1$
11	**(a) (i)**	$(x - 1.5)^2 - 1.25$ oe	**2**	**M1** for $(x - 1.5)^2$
	(ii)	(1.5, – 1.25)	**2FT**	**1FT** each **FT** only if in completed square form

(b)	$[p =] -2$ $[q =] -6$ nfww	**4**	**M1** for $1 - p + q = -3$ **M1** for $4^2 + 4p + q = 2$ **A1** for correct p or q