CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0444 MATHEMATICS (US)

0444/43 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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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.	Part	Answers	Mark	Part Marks
1	**(a) (i)**	[0]9 15 [am]	**1**	Accepable form of time
	(ii)	64.9 or 65.[0] or 64.92 to 64.98	**2**	**M1** for 92 ÷ (1 and 25 mins) or 92/85 × 60 o.e. or 92 ÷ (1.41 to 1.42)
	(iii)	11.76…or 11.8	**1**	
	(iv)	80	**3**	**M2** for 92 ÷ 1.15 o.e. or **M1** for 115% associated with 92
	(b) (i)	(150 ÷ (11+16+ 3) or 150 × 3 o.e. then × 3 or ÷ 30	**M1** **E1**	Correct first step Correct conclusion
	(ii)	11 : 9 final answer	**2**	**M1** for 8.25 : (15 – 8.25) o.e. For **M1** e.g. allow 1 : 0.818 [0.8181 to 0.8182] or 1.22 : 1 [1.222…] **After M0**, **SC1** for 9 : 11 as final answer
2	**(a) (i)**	Image at (– 3, 1), (– 7, 7), (– 3, 7)	**2**	**SC1** for translation $\begin{pmatrix}-11\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-1\end{pmatrix}$
	(ii)	Image at (– 4, – 1), (– 4, – 4), (– 2, – 4)	**2**	**SC1** for enlargement factor 0.5 and correct orientation In each part of **(b)** must be one transformation only – if more then lose all marks for that part.
	(b) (i)	Reflection, $y = 1$	**2**	**B1 B1** independent
	(ii)	Rotation, (3, 2), 180 o.e. or enlargement, (3, 2), (factor) – 1	**3**	**B1 B1 B1** independent
	(iii)	Stretch, (factor) 0.5, Invariant line y-axis or $x = 0$	**3**	**B1 B1 B1** independent – must be clear on **invariant** line
3	**(a)**	7.407….. or 7.41	**1**	
	(b)	9	**2**	**M1** for 1080 ÷ (12 × 10) o.e.

	(c) (i)	6.36 to 6.37 www	**3**	**M2** for $\sqrt[3]{\frac{1080}{\frac{4}{3}\pi}}$ o.e. or **M1** for $\frac{1080}{\frac{4}{3}\pi}$ o.e. [257.7 to 258.7] Accept 4.18 to 4.19 for $4/3\,\pi$
	(ii)	508 to 510	**2**	**M1** for $4 \times \pi \times$ (*their* **(c)(i)**)^2
	(d)	$\sqrt{2}$ or 1.41 [1.414…] www	**2**	Allow over 1 or $\sqrt{2}$: 1 etc. **M1** for $(R / r)^2 = 2$ o.e. or $[R^2 =]$ (2 × *their* **c(ii)**)/$4\,\pi$ **or** $[R^2 =]$ 2 × (*their* **(c)(i)**)^2
4	**(a)**	$\frac{2}{20}$ o.e.	**2**	**M1** for $\frac{2}{5}\times\frac{1}{4}$
	(b)	$\frac{6}{20}$ o.e.	**3**	**M2** for $2\times\frac{1}{5}\times\frac{1}{4}+2\times\frac{2}{5}\times\frac{1}{4}$ o.e. **M1** for pairs 1, 4 **and** 2, 3 clearly identified and no other incorrect pairings **or** for one appropriate product isw
	(c)	$\frac{14}{20}$ o.e.	**1FT**	FT 1 – *their* **(b)** or recovery to correct ans
5	**(a)**	5, –1	**2**	**B1 B1**
	(b)	12 points plotted	**P3FT**	**P2FT** for 10 or 11, **P1FT** for 8 or 9
		Smooth curve through at least 12 points	**C1**	In absence of plot[s], allow curve to imply plot[s]. No ruled sections Not touching *y*-axis
		Two separate branches	**B1**	
	(c) (i)	0.55 to 0.65	**1**	
	(ii)	0.65 to 0.75	**2**	**M1** for $y = 3x$ drawn ruled to cross curve
	(d)	$\frac{1}{3}$	**2**	Accept 0.333[3….] or $0.\dot{3}$ **M1** for $\frac{2}{x^2} - 3x = 3x$ or better
	(e) (i)	**Ruled** line through (– 1, 5) and (3, – 9)	**1**	

	(ii)	$y = -3.5x + 1.5$ o.e. final answer	**3**	**B2** for $y = kx + 1.5$ [$k \neq 0$] $y = -3.5x + d$ o.e. **B1** for gradient = – 3.5 o.e. acc integer/integer o $y = kx + [1.4 \text{ to } 1.6]$ o.e. **SC2** for answer $-3.5x + 1.5$ [no '$y =$']
	(iii)	Tangent	**1**	
6	**(a)**	0.57	**B4**	Condone use of other variables **M1** for $2w + 3l = 3.6$ o.e. **and M1** for $l = w + 0.25$ o.e. **A1** for correct $aw = b$ or $cl = d$ **or M2** for $2w + 3(w + 0.25) = 3.6$ o.e. or $2(l - 0.25) + 3l = 3.6$ o.e. or **M1** for $w + 0.25$ or $l - 0.25$ seen **A1** for $2w + 3w = 3.6 - 0.75$ or better or $2l + 3l = 3.6 + 0.5$ or better $l = 0.82$ implies **M2A1** trial & error scores **B4 or zero** accept answer 57 if written **57 cents after M0, SC3** if answer 57
	(b) (i)	$\frac{5}{x} + \frac{6}{x+2} = 1$ o.e.	**M2**	e.g. $\left(1 - \frac{5}{x}\right)(x+2) = 6$ **M1** for $\frac{5}{x}$ seen or $\frac{6}{x+2}$ seen or $xy = 5$ **and** $(x+2)Y = 6$ o.e. or $xy = 5$ **and** $(x+2)(1-y) = 6$ o.e. e.g. $(x-5)(x+2) = 6x$
		$5(x+2) + 6x = x(x+2)$ o.e.	**A1**	Allow $5x + 10 + 6x = x^2 + 2x$ and allow **all** over correct denominator but must see this line
		$5x + 10 + 6x = x^2 + 2x$ $0 = x^2 - 9x - 10$	**E1**	One correctly expanded line seen No errors or omissions
	(ii)	$(x-10)(x+1)$	**2**	**SC1** for $(x+a)(x+b)$ where ab = -10 or $a + b$ = -9
	(iii)	21	**2FT**	FT a positive x into $2(x + \frac{5}{x})$ **M1** for 0.5 seen or 5 / *their* positive root

	(c) (i)	$(2x+3)^2 = (x+3)^2 + 5^2$ o.e.	**M1**	
		$4x^2 + 6x + 6x + 9 = x^2 + 3x + 3x + 9 + 25$ o.e.	**B1** **B1**	for $4x^2 + 6x + 6x + 9$ or $4x^2 + 12x$ for $x^2 + 3x + 3x + 9$ or $x^2 + 6x + 9$
		$3x^2 + 6x - 25 = 0$	**E1**	No errors or omissions
	(ii)	$\frac{-6 \pm \sqrt{6^2 - 4(3)(-25)}}{2(3)}$	**2**	**B1** for $\sqrt{6^2 - 4(3)(-25)}$ or better seen If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ o.e. **B1** for $p = -6$ and $r = 2(3)$ or better
		– 4.06, 2.06 final answer	**B1B1**	**B1 B1** After B0 B0 **SC1** for – 4.1 **and** 2.1 or – 4.055… **and** 2.055... or –4.06 and 2.06 seen
	(iii)	12.63 to 12.65 or 12.6 or 12.7	**2FT**	FT (a positive $x + 3$) × 2.5 **SC1** for 0.5 × *their* positive value × 5 written
7	**(a)**	$\sin[\ ] = \frac{130}{0.5 \times 16 \times 25}$ o.e.	**M2**	**M1** for 0.5 × 16 × 25 × sin [ ] = 130 o.e. but if 40.54… reached from implicit method then **M2**
		40.54**...** = 40.5	**E1**	Must see 40.54.. and conclusion Use of 40.5 alone in implicit expression scores **M1**.
	(b)	16.51 to 16.53… or 16.5 www 4	**4**	**M2** for $16^2 + 25^2 - 2 \times 16 \times 25 \times \cos(40.5)$ o.e. [allow 40.54…] (**M1** for $\cos 40.5 = \frac{16^2 + 25^2 - AC^2}{2 \times 16 \times 25}$) [allow 40.54...] **A1** for 272.6 to 273.0…(which implies **M2**)
	(c)	**10.39 to 10.4[0]**	**2**	**M1** for 0.5 × 25 × distance = 130 or $\frac{dist}{16} = \sin[40.5]$ o.e. [allow 40.54….]
8	**(a) (i)**	4 2	**1** **1**	
	(ii)	$4\cos(2x - 60)$ o.e.	**2**	**B1** for $4\cos(kx + c)$, $k \neq 0$ Or **B1** for $\cos(2x - 60)$ o.e.
	(b)	Correct sketch by eye	**2**	**B1** for correct shape but missing intercepts with x-axis or for graph through both intercepts with x-axis

9	**(a)**	**24**	**3**	**M2** for 24 at *B* **or** 128 at *X* **an** or **M1** for 28 at *D* **or** 128 at *X* allow on diagram
	(b)	**5** www	**3**	**M2** for $360 - 22x = 2 \times 25x$ o.e. or better or $22x = 2(180 - 25x)$ o.e. or better or $11x + 25x = 180$ o.e. or better or **M1** for $P = 11x$ or reflex $O = 360 - 22x$ or reflex $O = 50x$ allow on diagram
	(c)	6.32 to 6.34 www	**5**	**B1** for *OLM* 90° (seen or implied) allow on diagram and **M1** for $LM = 8\tan 44$ [7.7255…] or $OM = 8 \div \cos 44$ [11.1213…] and **M1dep** on previous **M** for $0.5 \times 8 \times$ *their LM* or $0.5 \times 8 \times$ (*their OM*) sin44 and **M1** for $\frac{44}{360} \times \pi \times 8^2$ o.e. [24.5 to 24.6]
10	**(a) (i)**	72	**1**	
	(ii)	68	**1**	
	(iii)	8	**1**	
	(iv)	164	**2**	**M1** for 36 seen may be on graph
	(b) (i)	11	**1**	
	(ii)	35, 45, 55, 65, 75, 85 $(9 \times 35 +$ *their* $11 \times 45 + 16 \times 55 + 28 \times 65 + 108 \times 75 + 28 \times 85)$ [13990] $\div 200$ or *their* $\sum f$ 69.95 or 69.9 or 70[.0] cao	**M1** **M1** **M1dep** **A1**	At least 5 correct mid-values soi $\sum fx$ where x is in the correct interval allow one further slip Depend on second method **must be from 13990** isw conversion to mins/secs & reference to classes **SC2** for correct answer without working
11	**(a)**	*A* 1, $13 - 2n$ *B* 36, n^2 *C* 42, $n(n + 1)$ *D* 729, 3^n *E* 687 , $3^n - n(n + 1)$	**3** **2** **3** **2** **2FT**	**B1, B2** (**M1** for $k - 2n$) o.e. **B1, B1** **B1, B2** (**B1** for a quadratic in n) **B1, B1** **B1FT** *their D – their C* **, B1FT** *their D – their C* only if both in terms of n

	(b) (i)	–187	**1FT**	FT if A is linear
	(ii)	10100	**1FT**	FT if C is quadratic
	(c)	8	**1FT**	
	(d)	58 939 cao	**1**	