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**	Acceptable 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 $\sqrt[3]{\dfrac{1080}{\frac{4}{3}\pi}}$ o.e. or **M1** for $\dfrac{1080}{\frac{4}{3}\pi}$ 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 $[R^2 =]$ $(2 \times$ *their* **c(ii)**$)/4\,\pi$ **or** $[R^2 =]$ $2 \times$ (*their* **(c)(i)**)^2
4	(a)		$\dfrac{2}{20}$ o.e.	2	**M1** for $\dfrac{2}{5} \times \dfrac{1}{4}$
	(b)		$\dfrac{6}{20}$ o.e.	3	**M2** for $2 \times \dfrac{1}{5} \times \dfrac{1}{4} + 2 \times \dfrac{2}{5} \times \dfrac{1}{4}$ o.e. **M1** for pairs 1, 4 **and** 2, 3 clearly identified and no other incorrect pairings **or** for one appropriate product isw
	(c)		$\dfrac{14}{20}$ 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)		$\dfrac{1}{3}$	2	Accept 0.333[3….] or $0.\dot{3}$ **M1** for $\dfrac{2}{x^2} - 3x = 3x$ 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 $y = kx + 1.5 [k \neq 0]$ o.e. or $y = -3.5x + d$ o.e. **B1** for gradient = -3.5 o.e. accept integer/integer or $y = kx + [1.4\ to\ 1.6]$ 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)	$\dfrac{5}{x} + \dfrac{6}{x+2} = 1$ o.e.	M2	e.g. $\left(1 - \dfrac{5}{x}\right)(x + 2) = 6$ **M1** for $\dfrac{5}{x}$ seen or $\dfrac{6}{x+2}$ 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 One correctly expanded line seen
		$5x + 10 + 6x = x^2 + 2x$ $0 = x^2 - 9x - 10$	E1	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 $2\left(x + \dfrac{5}{x}\right)$ **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	for $4x^2 + 6x + 6x + 9$ or $4x^2 + 12x + 9$	
		B1	for $x^2 + 3x + 3x + 9$ or $x^2 + 6x + 9$	
	$3x^2 + 6x - 25 = 0$	E1	No errors or omissions	
(ii)	$\dfrac{-6 \pm \sqrt{6^2 - 4(3)(-25)}}{2(3)}$	2	B1 for $\sqrt{6^2 - 4(3)(-25)}$ or better seen If in form $\dfrac{p + \sqrt{q}}{r}$ or $\dfrac{p - \sqrt{q}}{r}$ 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 $-4.055\ldots$ 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 $x + 3$) $\times 2.5$ SC1 for $0.5 \times$ *their* positive value $\times 5$ written	
7 (a)	$\sin [\ ] = \dfrac{130}{0.5 \times 16 \times 25}$ o.e.	M2	M1 for $0.5 \times 16 \times 25 \times \sin [\ ] = 130$ o.e. but if $40.54\ldots$ 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 $40.54\ldots$] (M1 for $\cos 40.5 = \dfrac{16^2 + 25^2 - AC^2}{2 \times 16 \times 25}$) [allow $40.54...$] A1 for 272.6 to 273.0…(which implies M2)	
(c)	**10.39 to 10.4[0]**	2	M1 for $0.5 \times 25 \times$ distance $= 130$ or $\dfrac{dist}{16} = \sin[40.5]$ o.e. [allow $40.54\ldots$.]	
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* **and** 28 at *D*. 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 $LM = 8\tan44$ [7.7255…] or $OM = 8 \div \cos44$ [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 $\dfrac{44}{360} \times \pi \times 8^2$ 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	**M1**	At least 5 correct mid-values soi
		($9 \times 35 +$ *their* $11 \times 45 + 16 \times 55 + 28 \times 65 + 108 \times 75 + 28 \times 85$) [13990]	**M1**	$\sum fx$ where *x* is in the correct interval allow one further slip
		$\div 200$ or *their* $\sum f$	**M1dep**	Depend on second method
		69.95 or 69.9 or 70[.0] cao	**A1**	**must be from 13990** isw conversion to mins/secs & reference to classes **SC2** for correct answer without working
11	(a)	*A* 1, $13 - 2n$	3	**B1, B2** (**M1** for $k - 2n$) o.e.
		B 36, n^2	2	**B1, B1**
		C 42, $n(n + 1)$	3	**B1, B2** (**B1** for a quadratic in *n*)
		D 729, 3^n	2	**B1, B1**
		E 687 , $3^n - n(n + 1)$	2FT	**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**	