

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

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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
- 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 $92 \div (1 \text{ and } 25 \text{ mins})$ or $92/85 \times 60$ o.e. or $92 \div (1.41 \text{ to } 1.42)$
		(iii) 11.76...or 11.8	1	
		(iv) 80	3	M2 for $92 \div 1.15$ o.e. or M1 for 115% associated with 92
	(b)	(i) $(150 \div (11+16+ 3))$ or 150×3 o.e. then $\times 3$ or $\div 30$	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, $(3, 2), (\text{factor}) - 1$	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 $1080 \div (12 \times 10)$ 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 $4 \times \pi \times (\text{their (c)(i)})^2$
	(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 $[R^2 =] (2 \times \text{their c(ii)})/4\pi$ or $[R^2 =] 2 \times (\text{their (c)(i)})^2$
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 Smooth curve through at least 12 points Two separate branches	P3FT C1 B1	P2FT for 10 or 11, P1FT for 8 or 9 In absence of plot[s], allow curve to imply plot[s]. No ruled sections Not touching y-axis
	(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	

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	(ii)	$y = -3.5x + 1.5$ o.e. final answer	3	<p>B2 for $y = kx + 1.5$ [$k \neq 0$] $y = -3.5x + d$ o.e.</p> <p>B1 for gradient = -3.5 o.e. acc integer/integer $y = kx + [1.4 \text{ to } 1.6]$ o.e.</p> <p>SC2 for answer $-3.5x + 1.5$ [no 'y =']</p>
	(iii)	Tangent	1	
6	(a)	0.57	B4	<p>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 $cl = d$</p> <p>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</p>
	(b) (i)	$\frac{5}{x} + \frac{6}{x+2} = 1 \text{ o.e.}$ $5(x+2) + 6x = x(x+2) \text{ o.e.}$ $5x + 10 + 6x = x^2 + 2x$ $0 = x^2 - 9x - 10$	M2	<p>e.g. $\left(1 - \frac{5}{x}\right)(x+2) = 6$</p> <p>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. $(x-5)(x+2) = 6x$</p>
	(ii)	$(x-10)(x+1)$	A1	<p>Allow $5x + 10 + 6x = x^2 + 2x$ and allow all over correct denominator but must see this line E1 No errors or omissions</p>
	(iii)	21	2	SC1 for $(x+a)(x+b)$ where $ab = -10$ or $a+b = -9$
			2FT	<p>FT a positive x into $2\left(x + \frac{5}{x}\right)$ M1 for 0.5 seen or 5 / their positive root</p>

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	(c) (i)	$(2x+3)^2 = (x+3)^2 + 5^2$ o.e. $4x^2 + 6x + 6x + 9 = x^2 + 3x + 3x + 9 + 25$ o.e. $3x^2 + 6x - 25 = 0$	M1 B1 B1 E1	for $4x^2 + 6x + 6x + 9$ or $4x^2 + 12x + 9$ for $x^2 + 3x + 3x + 9$ or $x^2 + 6x + 9$ 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 $x + 3$) $\times 2.5$ SC1 for $0.5 \times$ <i>their</i> positive value $\times 5$ written
7	(a)	$\sin [] = \frac{130}{0.5 \times 16 \times 25}$ o.e. 40.54... = 40.5	M2 E1	M1 for $0.5 \times 16 \times 25 \times \sin [] = 130$ o.e. but if 40.54... reached from implicit method then M2 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 $0.5 \times 25 \times \text{distance} = 130$ or $\frac{\text{dist}}{16} = \sin[40.5]$ 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 and 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 $OLM 90^\circ$ (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 0.5×8 \times their LM or $0.5 \times 8 \times (\text{their } OM) \sin 44$ 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 $(9 \times 35 + \text{their } 11 \times 45 + 16 \times 55 + 28 \times 65 + 108 \times 75 + 28 \times 85)$ [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 so i $\sum fx$ 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, $13 - 2n$	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

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	(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	