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for the guidance of teachers

4037 ADDITIONAL MATHEMATICS

4037/11

Paper 1, maximum raw mark 80

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 must be read in conjunction with the question papers and the report on the examination.

Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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Mark Scheme Notes

Marks are of the following three types:

- ambridge.com Μ Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.
- Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. А Accuracy marks cannot be given unless the associated method mark is earned (or implied).
- В Accuracy mark for a correct result or statement independent of method marks.
- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- The symbol $\sqrt{}$ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.
- Note: B2 or A2 means that the candidate can earn 2 or 0. B2, 1, 0 means that the candidate can earn anything from 0 to 2.

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The following abbreviations may be used in a mark scheme or used on the scripts:

- Cambridge.com AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
- Benefit of Doubt (allowed when the validity of a solution may not be absolutely BOD clear)
- CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
- ISW Ignore Subsequent Working
- MR Misread
- PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)
- SOS See Other Solution (the candidate makes a better attempt at the same question)

Penalties

- MR –1 A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through $\sqrt{}$ " marks. MR is not applied when the candidate misreads his own figures - this is regarded as an error in accuracy.
- OW –1,2 This is deducted from A or B marks when essential working is omitted.
- PA –1 This is deducted from A or B marks in the case of premature approximation.
- S –1 Occasionally used for persistent slackness – usually discussed at a meeting.
- EX –1 Applied to A or B marks when extra solutions are offered to a particular equation. Again, this is usually discussed at the meeting.

	Page 4Mark Scheme: Teachers' versionSyllabusGCE O LEVEL - October/November 20114037(a) (i) 7 and 0B2B1 for each.(ii) 22 and 15B2B1 for each.(b) 3 'sets' enclosed in a rectangleB1B1 for set P and set Q separate									
	i ag		GCE O LEVEL – O				1	4037	Sp.	2
1	(a)	(i) 7 and	0	Bź	2		B1 for e	each.		and
		(ii) 22 an	d 15	Bź		[4]	B1 for e	each.		102
	(b) 3	3 'sets' end	closed in a rectangle	B B	1	[2]		set <i>P</i> and set g set <i>R</i> containe	Q separate ed within set	t P
2		f (-2):-2	a + b = 84	M			M1 for	substitution of	of a correct v	value of <i>x</i>
		$f\left(\frac{1}{2}\right):\frac{1}{2}a$	$a+b=\frac{3}{2}$	А	1		A1 for eunsimp	each correct e lified)	equation (all	ow
		a = -33, b	=18	М	[1, A1	l	M1 for	solution to ol	btain <i>a</i> and <i>b</i>	6
		f(1) = -19)	$\sqrt{1}$	B1	[6]	$\sqrt{B1}$ on	their <i>a</i> and <i>b</i>	1	
3	· ·	Gradient n lg $c = -0.6$		B M M	[1			a valid attem attempt to de	-	lg <i>c</i>
		<i>c</i> = 0.251		А		[4]				
	(ii)	N = 0.251	t^4	\sqrt{I}	B1	[1]	$\sqrt{B1}$ on	their <i>m</i> and <i>c</i>		
4	(i)	6! = 720		В		543				
	(ii)	$2 \times 5! = 2$	40	В	1	[1]				
	(iii) -	$4 \times 5! = 4$	80	В		[1]				
	(iv)]	Even first Odd first a	and last: 4! (24) and even last: 4 x 4! (144		1 1	[1]				
	,	Total: 7 ×	4! = 168	В		[3]				

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		GCE O LEVEL – Octo	ober/Novembe	er 20'	11	4037 232
5	(i) v =	= 2 cos 2 <i>t</i>	M1		M1 fo	Syllabus 4037 For attempt to differentiate
		en $t = 0, v = 2$	A1	[2]		
		$s2t = 0, 2t = \frac{\pi}{2}$	M1		M1 fo	for attempt to solve and deal with $2t$
	t =	$\frac{\pi}{4}$ (0.785)	A1	[2]		
		en $t = \frac{\pi}{4}, x = 4$ en $t = 0, x = 3$	B1			
		tance moved = 1	√B1	[2]	√B1 1	for 'their 4' -3
		$=-4\sin 2t$	M1			
	whe	$en t = \frac{3\pi}{4}, a = 4$	A1	[2]		
5	(a) -5	$b = p + 3 \tan\left(-\frac{\pi}{4}\right)$	M1 A1		M1 fo	for use of $\left(-\frac{\pi}{12}, -5\right)$
	-	$p = -2$ $p'+3\tan 3q$	M1		M1fo	or use of their p and $(q, 1)$
	tan $q =$	3q = 1 = $\frac{\pi}{2}$	A1			
	4 –	12		[4]		
	(b) amj	plitude $a = 4$ b = 5	B1 B1			
		then $f = 11, x = 0$, so $c = 7$	M1			for use of either max and $x = 0$,
	Or	when $f = 3$, $x = \frac{\pi}{3}$, so $c = 7$	A1	[4]	or mi	in and $x = \frac{\pi}{3}$

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	Pa	ige 6	Mark Scheme: Teachers		Syllabus 7. Syllabus
			GCE O LEVEL – October/No	vember 20 [°]	4037 ²⁰ 20
7	(i)	$\frac{n(n-1)}{2\times 25} =$	$=\frac{3}{5}$	B1	Syllabus Syllabus 911 4037 B1 for correct term M1 equating 3^{rd} term to $\frac{3}{5}$
		$n^2 - n - 3$	$30 = 0$ or $\binom{n}{2} = 15$	M1 M1	M1 equating 3 rd term to $\frac{3}{5}$ M1 attempt to solve quadratic or realising that $\binom{n}{2} = 15$ when $n = 6$
		<i>n</i> = 6		A1 [4]	
	(ii)	$\left(1 + nx + \frac{1}{2}\right)$ term : 4	$\frac{3}{5}x^2\left(4-\frac{12}{x}+\frac{9}{x^2}\right)$	B1	B1 for 4
		$-\frac{12n}{5}$ ((14.4)	M1	M1 for 2 nd term
		$0.18(n^2 -$	(5.4)	M1	M1 for 3 rd term
		= - 5		A1 [4]	
8	(a)	$\int_0^2 e^{2x} + 2$	$e^x + 1 dx$	M1	M1 for expansion
		$\left[\frac{e^{2x}}{2} + 2e^{2x}\right]$	$\left[x^{x}+x\right]_{0}^{2}$	B1 B1 B1	B1 for each correct term
		= 41.6		M1, A1 [6]	M1 for correct use of limits
	(b)	$y = \frac{1}{2} (4)$	$(x+1)^{\frac{1}{2}}(+c)$	M1	M1 for attempt to integrate
				A1	A1 for $(4x+1)^{\frac{1}{2}}$
				A1	A1 for $(4x+1)^{\frac{1}{2}}$ A1 for $\frac{1}{2}(4x+1)^{\frac{1}{2}}$
		when $y =$	4.5, x = 2, c = 3	M1	M1 for attempt to find c , must be from integration
		$y = \frac{1}{2} \left(4x \right)$	$(t+1)^{\frac{1}{2}}+3$	A1 [5]	A1 for $c = 3$

	Page 7		Mark Scheme: Teachers' version GCE O LEVEL – October/November 2011		Syllabus 4037 for use of correct identity or valent for dealing with cosec or equivalent	
						4037 803
9	(i)	$\csc^2 x =$	8sin x	M1		for use of correct identity or valent
		$\sin^3 x = \frac{1}{8}$		M1	M1 f	for dealing with cosec or equivalent
		$\sin x = \frac{1}{2}$		M1	M1 f	for attempt to solve
		$x = 30^{\circ}, 1$	50°	A1, A1 [5]	With	nhold last A1 if extra solutions
	(ii)	$\tan(2y-$	$(0.3) = -\frac{5}{4}$	M1, A1	M1 f	for attempt to get in terms of tan
		2y - 0.3 =	2.2455, 5.387	M1	M1 f	for dealing with order correctly
		<i>y</i> = 1.27, 2	2.84 (allow 1.28 and 2.85)	A1, A1 [5]		

Page 8		Mark Scheme: Teachers' version E O LEVEL – October/November 2011		Syllabus Syllabus	
	GCE O LEVEL - Oción	Jen/November	2011	4037 736	
0 EITHER (i) $\frac{1}{2}(2r)^2$	$3\theta\big) - 2\frac{1}{2}r^2\theta = 5$	M1 M1		Syllabus 4037 for use of sector area for attempt to equate area to 5	
$\theta = \frac{1}{r^2}$		A1			
P = 2r(3)	$\theta + 2r + 2r + 2r\theta$	M1	M1 :	for use of arc length	
leading to	$P = \frac{8}{r} + 4r$	M1	M1 :	for attempt to get P in terms of r and θ	
(answer g	given)	A1	[6]		
(ii) $\frac{\mathrm{d}P}{\mathrm{d}r} = -\frac{8}{r}$	$\frac{3}{2} + 4$	M1	M1 to ze	for attempt to differentiate and equate ero.	
when $\frac{\mathrm{d}P}{\mathrm{d}r}$	$r=0, r=\sqrt{2}$	A1			
$P = 8\sqrt{2}$		M1 A1	[4]	for attempt to obtain <i>P</i>	
(iii) $\frac{\mathrm{d}^2 P}{\mathrm{d}r^2} = \frac{16}{r^3}$, + ve ∴ minimum	B1	B1 f	or correct method and conclusion	
when $r =$	$e\sqrt{2}, \theta = \frac{1}{2}$	B1	[2]		

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OR (i) $OC = 10$	- <i>r</i>	B1 [1]	Syllabus 11 4037 Photometry M1 for attempt to use sinθ
(ii) $\sin\theta = -\frac{1}{C}$	$r = \frac{r}{10 - r}$, $\sin \theta = \frac{r}{10 - r}$	M1	M1 for attempt to use $\sin\theta$
leading t	o $r = \frac{10\sin\theta}{1+\sin\theta}$	A1 [2]	A1 for correct attempt to simplify to given answer
(iii) $\frac{\mathrm{d}r}{\mathrm{d}\theta} = \frac{1}{(1+1)^2}$	$\frac{0\cos\theta}{+\sin\theta}^2$	M1	M1 for correct attempt to differentiate a quotient
X	,	A2, 1, 0	– 1 each error
when $r =$	$=\frac{10}{3}, \sin\theta = \frac{1}{2}, \cos\theta = \frac{\sqrt{3}}{2}$	M1 M1	M1 for attempt to find sin or cos M1 for substitution
$\therefore \frac{\mathrm{d}r}{\mathrm{d}\theta} = \frac{1}{2}$	$\frac{20\sqrt{3}}{9}$ (3.85)	A1 [6]	
$(iv) \frac{\mathrm{d}r}{\mathrm{d}t} = 2 ,$		B1	
when θ	$=\frac{\pi}{6}, \ \frac{\mathrm{d}\theta}{\mathrm{d}r}=\frac{3\sqrt{3}}{20}$		
$\frac{\mathrm{d}\theta}{\mathrm{d}t} = \frac{\mathrm{d}r}{\mathrm{d}t}$	$+\times \frac{\mathrm{d}\theta}{\mathrm{d}r}$	M1	M1 for correct use of rates of change
leading t	o $\frac{\mathrm{d}\theta}{\mathrm{d}t} = \frac{3\sqrt{3}}{10}$ (0.520)	A1 [3]	