## MARK SCHEME for the October/November 2012 series

## 0606 ADDITIONAL MATHEMATICS

0606/22

Paper 2, 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 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.



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## Mark Scheme Notes

Marks are of the following three types:

- M 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.
- A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).
- B 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.
- 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:

- AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
- BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely 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 √" 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.

IGCSE – October/November 20120606221 $7x + 5 = 3x - 13$ $x = -4.5$ o.e. $7x + 5 = 3x + 13$ $x = 0.8$ o.e. OR Square and Equate $(5x - 4)(2x + 9)[= 0]$ $x = 0.8$ and $x = -4.5$ OR Plot $y =  7x + 5 $ Plot $y =  3x - 13 $ $x = -4.5$ M1 M1 M1 M1 M1 M1 M1 M1 M1 M1 M1 M1 M2 M1 M1 M1 M1 M2 M1 M1 M1 M2 M2 M2 M1 M1 M2 M2 M1 M1 M2 M2 M2 M2 M1 M2 M2 M2 M2 M2 M1 M2 M3 M2 M3 M2 M3 M4<	Paç	ge 4	Mark Scheme			Syllabus	Paper	
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(ii) Evidence of $2 \times 3$ for outside digits B1	(ii)	Evidence	of $2 \times 3$ for outside digits					
Evidence of $4 \times 3$ for inside digits B1 ${}^{4}P_{2}$ used correctly.				B1	${}^{4}P_{2}\iota$	used correctly.		
72 B1			č					
[3]				[3]				
<b>6</b> (i) Express as powers of 2 M1 At least one : $2^{6y-9}$ or $2^{4x-4y}$ o.e.	6 (1)	Everage	s nowers of 2	N/1		<b>6</b> <sup>1</sup> / <sub>2</sub> -0	4x-4y	
6 (i) Express as powers of 2 Correctly reaches $3x + 2y = 6$ M1 At least one : $2^{6y-9}$ or $2^{4x-4y}$ o.e.					At le	east one : $2^{y-y}$ or $2^{y-y}$	2 <sup></sup> o.e.	
$\begin{bmatrix} 2 \end{bmatrix}$		Concerny	$\frac{1}{2} \cos (3x + 2y) = 0$					
(ii) Express as powers of 5 $M_1^{\lfloor 2 \rfloor}$ Both correct $5^2$ and $5^{3x-6}$ o.e.	(ii)	Express a	s powers of 5		Both	correct $5^2$ and $5^{3x}$	<sup>-6</sup> o e	
$y = 3x - 4  \text{o.e.} \qquad \qquad \text{A1}  \text{Three terms}$								
Attempt to solve simultaneous equations M1 Equations must be linear							ar	
		14	2		-			~£
x = - and $y = -$		$x = \frac{1}{\alpha}$ and	$1y = \frac{1}{3}$		Acc	ept decimals that ro	ound to correct 3s	31
9 3 [4]		7	5	[4]				

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		2						
7 (i	·	$\sec^2 4x$		M1	One	term only		
	>	× 4		A1 [2]				
(i	ii) х	к +		B1				
,	,	an4x		M1	No additional terms			
	÷	÷4		A1	isw			
(iii	i) (	Correct us	se of limits	[3] M1	Expression must have 2 integrated terms			
(	., .					from <b>(ii)</b> .	C	
		$k = \frac{1}{8}$		A1	Rou	nds to 0.125. Acce	ept $\frac{\pi}{-}$ or $0.125\pi$	
		8		[2]			8	
		7 /		B1	Find	ling gradient		
8 (i	i)	$(b=)\frac{7-4}{8-2}$	$\dot{f} = \left  \frac{1}{2} \right $	M1		ling gradient ling y intercept		
		(lg a) = 3	· [4]	M1		$= c + m \lg x$ is suffic	ient	
			blgx  or  lgy - 4 = b(lgx - 2)	1 <b>VI 1</b>	igy -	$-c + mig_x$ is suffic	lent	
		or $\lg y = 3$						
		1000	1.03					
		a = 1000  or	or $10^{\circ}$ or $1000\sqrt{x}$	A1 A1				
	J	v = 1000x	of $1000\sqrt{x}$	[5]				
(i	ii) <i>r</i>	m = 1		B1				
				[1]				
(iii	i) (	c = 6		B1				
				[1]				
9 (i)			80	B1	Corr	rect triangle		
			40					
		420	OR					
		α	420					
			<u>40</u> 80					
		$\sin \alpha$ s	sin 40	M1	Use	of sine or cosine ru	ale in any triangle	
		80 =-	420				heir v and an angle.	
		$\alpha = 7.03$	or 7	A1 A1√				
			223 $(230 - \alpha)$	[4]				
				L J				
(ii)	)	$\frac{v}{\sin t h \sin t}$	$\frac{122}{122} = \frac{420}{\sin 40}$	M1	Use of sine or cosine rule in any triangle			
		sin their	133 sin 40		with	80 or 420 or both.		
		v = 478		A1				
		Use time	, 1000	M1	v ca	lculated from a tria	ngle	
			V					
		2.09 hou	rs or 2 hours 5minutes	A1 [4]	Units required			
				[7]				

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10 (i)		e to find v	M1	Increase of powe	rs seen	at least once
	v = 4t - t		A1			
	Use $t = 0$ v = 4t - 1	v = 12 to find $c = 12$	B1			
	v = 4t - t $t = 6$	t + 12	M1 A1	Solve three term Do not penalize <i>t</i>		10
	l = 0		[5]		- <i>-</i> 2.	
(ii)	Integrate	e to find <i>s</i>	M1	Increase of powe	rs on at	least 2 terms
	-		A1√	3 terms		
	$s = 2t^2 - $	$\frac{1}{3} + 12t$	Al			
	s = 72	5	[3]	cao		
	~		[-]			
11 (a)	$\tan x = -$	2.25	B1			
	114		B1	Rounds to 114.0		
	294		B1√^	Their $114 + 180$	from tai	n function isw
<b>A</b> .)		1	[3]	_		
<b>(b)</b>	Uses co	$\sec y = \frac{1}{\sin y}$	B1	Seen anywhere		
		uadratic in $\sin y : 12\sin^2 y + \sin y - 1$	M1	Must be 3 terms		
	[=0]	1)(2-1) + 1)[-0]	N ( 1		1 6 7	1.
	$(4\sin y - 14.5 \text{ and})$	$1)(2\sin y + 1)[= 0]$	M1 A1	Factorise or form Any 2 values isw		e term quadratic.
	165.5 an		A1 A1	The other 2 value		
	100.0 un		[5]	The other 2 value	0 10 10	
(c)	$\cos\left(\frac{z}{3}\right)$	$=\frac{3}{5}$	B1			
	$\frac{z}{3} = 0.92$		M1	Solves their equa	tion in	radians
	5	to 2.79 inc	A1	isw		
	z = 2.78	0 2.75 me	A1 A1	Rounds to isw		
			[4]			
10 EITI						
12 EITH				Integrate : $e^{-\frac{x}{4}}$ so		
(f)	$y A e^{-\frac{1}{4}x}$	+c	M1	Integrate : e <sup>4</sup> se	een	
(1)	$y A e^{-4}$	т <i>с</i> ј	A1 DM1			
	A = -4 Substitute	(0, 10)	DM1			
	y=14-4	e <sup>4</sup> .	A1			
	14 - 4e		A1			
			[5]			
(ii)	Tangent a	$t A  ext{ is } y - 10 = x$	B1			
		tangent at B is e	B1			
	-	t B is $y+4e-14=ex+4e$	B1√^	With their gradie		inswer to (i)
	-	ations of tangents	M1	Two linear equat	ions	
	$x = \frac{4}{1-e}$	).e.	A1			
	1-e		[5]			
			[3]			

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12 OR				r	
(i)	$\frac{\mathrm{d}y}{\mathrm{d}x} = -\frac{1}{3}$		M1	$Ae^{-\frac{x}{3}}$ only one term	
	at (0, 9)	$\frac{\mathrm{d}y}{\mathrm{d}x} = -\frac{1}{3}$	A1		
	Grad not	rmal = 3	M1	Use of $m_1 m_2 = -1$	
	Point Q	is (-3, 0)	A1	Condone $x = -3$	
			[4]		
(ii)	Area rec	tangle 24 + 3e (32.1)	M1	Their $3 \times \text{their}(8+e)$	
	$\int_{-3}^{0} 8 + e^{-3}$	$-\frac{x}{3}$ dx	M1	Integrate: $8x$ and $e^{-\frac{x}{3}}$ so	een
	$=\left[8x-3\right]$	$e^{-\frac{x}{3}} \bigg]_{-3}^{0}$	A1		
	21+3e (2	29.1)	M1	Correct use of limits th	heir $-3$ and $0$
	Shaded a		A1		
			A1		
			[6]		