

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

## **MARK SCHEME for the May/June 2014 series**

### **0606 ADDITIONAL MATHEMATICS**

**0606/13**

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 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 May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0606	13

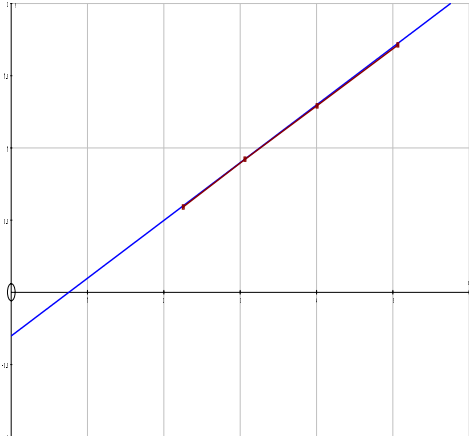
1	(i)	$y = 3(x-1)^2 + 2$ $a = 3, b = 1, c = 2$	B1, B1, B1	B1 for each, may be given in the form $y = 3(x-1)^2 + 2$
	(ii)	(1, 2)	√B1	Follow through on their answers to (i) If using differentiation, follow through on their x only.
2		$2^{4x} \times 4^y \times 8^{x-y} = 1$ Considering powers of either 2, 4 or 8 $7x - y = 0$ $3^{x+y} = \frac{1}{3}$	M1	M1 for considering powers of either 2, 4 or 8 and forming an equation using these powers
		Considering powers of 3 $x + y = -1$	B1	B1 for equation considering powers of 3
		Solving both simultaneously gives $x = -\frac{1}{8}, y = -\frac{7}{8}$	M1 A1	M1 for attempt to solve their equations A1 for both
3	(i)	$f(-3) = -27 + 9p - 3p^2 + 21$ $= 9p - 3p^2 - 6$	M1 A1	M1 for substitution of $x = -3$ A1 answer must be simplified
	(ii)	$9p - 3p^2 - 6 < 0$ $(p-1)(p-2) > 0$ Critical values 1 and 2 $p < 1, p > 2$	M1 A1 A1	M1 for attempt to factorise A1 for critical values A1 for correct range
4	(i)	$V = x(24 - 2x)^2$ $= x(576 - 96x + 4x^2)$ $= 4x^3 - 96x^2 + 576x$	M1 A1	M1 for attempt at a product of 3 lengths, 2 of which must be the same A1 for expansion to reach given answer
	(ii)	$\frac{dV}{dx} = 12x^2 - 192x + 576$ When $\frac{dV}{dx} = 0, 12x^2 - 192x + 576 = 0$ leading to $(x-4)(x-12) = 0$ with $x = 4$ the only possible solution $V = 1024$	M1 DM1 A1 A1	M1 for attempt to differentiate DM1 for equating $\frac{dV}{dx}$ to zero and attempt to solve A1 for $x = 4$ A1 for $V = 1024$

Page 3	Mark Scheme	Syllabus	Paper								
	IGCSE – May/June 2014	0606	13								
5	<p>(i) <math>64 - 960x + 6000x^2</math></p> <p>(ii) <math>(64 - 960x + 6000x^2)(a^3 + 3a^2bx)</math>,  <math>64a^3 = 512, a = 2</math>  <math>-960a^3 + 3a^2b(64) = 0</math>    leading to <math>b = 10</math></p>	<p><b>B1, B1, B1</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>M1</b></p> <p><b>A1</b></p>	<p><b>B1</b> for each correct term</p> <p><b>B1</b> for first two terms of <math>(a + bx)^3</math></p> <p><b>B1</b> for equating constant term to 512 and obtaining <math>a = 2</math></p> <p><b>M1</b> for attempt to equate coefficient of <math>x</math> to zero, must have two terms involved</p> <p><b>A1</b> for <math>b = 10</math></p>								
6	<p>When <math>x = 2, y = -4</math></p> $\frac{dy}{dx} = x \left( \frac{2x}{3} \right) (x^2 - 12)^{-\frac{2}{3}} + (x^2 - 12)^{\frac{1}{3}}$ <p>When <math>x = 2, \frac{dy}{dx} = -\frac{4}{3}</math></p> <p>Normal: <math>y + 4 = \frac{3}{4}(x - 2)</math>  <math>(4y = 3x - 22)</math></p>	<p><b>B1</b></p> <p><b>M1, B1</b> <b>A1</b></p> <p><b>M1</b></p> <p><b>A1</b></p>	<p><b>B1</b> for <math>y = -4</math></p> <p><b>M1</b> for differentiation of a product</p> <p><b>B1</b> for <math>\frac{2x}{3}(x^2 - 12)^{-\frac{2}{3}}</math></p> <p><b>M1</b> for attempt at normal equation</p> <p><b>A1</b> allow unsimplified</p>								
7	<p>(a) (i) 15120</p> <p>(ii) <math>(5 \times 4) \times (4 \times 3 \times 2)</math> 480</p> <p>(b) (i) 5456</p> <p>(ii) <math>{}^{18}C_2 \times 15</math> 2295</p> <p>(iii) 5456 – Number of ways only girls get tickets  <math>5456 - 455 = 5001</math></p> <p><b>Or</b></p> <table style="margin-left: 20px;"> <tr><td>1B 2G</td><td>1890</td></tr> <tr><td>2B 1G</td><td>2295</td></tr> <tr><td>3B</td><td>816</td></tr> <tr><td>Total</td><td>5001</td></tr> </table>	1B 2G	1890	2B 1G	2295	3B	816	Total	5001	<p><b>B1</b></p> <p><b>M1</b> <b>A1</b></p> <p><b>B1</b></p> <p><b>M1</b> <b>A1</b></p> <p><b>M1</b> <b>A1</b></p> <p><b>M1</b> <b>A1</b></p>	<p><b>M1</b> for attempt to multiply number of ways of getting 4 letters by the number of ways of getting 2 digits.</p> <p><b>M1</b> for attempt at an appropriate product, at least one term must be correct.</p> <p><b>M1</b> for a complete correct method <i>their (i)</i> – number of ways only girls get tickets</p> <p><b>M1</b> must be considering at least 2 of the cases shown</p>
1B 2G	1890										
2B 1G	2295										
3B	816										
Total	5001										

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0606	13

8	(i)	1	<b>B1</b>	
	(ii)	$a = 8e^{-2t}$	<b>M1</b>	<b>M1</b> for attempt to differentiate
		$8e^{-2t} = 6, -2t = \ln \frac{3}{4}$	<b>DM1</b>	<b>DM1</b> for correct attempt to solve equation in the form $e^{-2t} = \text{constant}$
	(iii)	$t = 0.144$	<b>A1</b>	<b>A1</b> must be at least 3 sf
$s = 5t + 2e^{-2t} (+c)$		<b>M1</b>	<b>M1</b> for attempt to integrate	
When $t = 0, s = 0, \text{ so } c = -2$		<b>DM1, A1</b>	<b>DM1</b> for attempt to find $c$ , <b>A1</b> $c$ correct	
When $t = 1.5, s = 5.60$		<b>M1, A1</b>	<b>M1</b> for substitution of $t = 1.5$	
	<b>Alternative:</b>			
	$s = [5t + 2e^{-2t}]_0^{1.5}$	<b>M1</b> <b>DM1</b> <b>A1</b> <b>M1</b>	<b>M1</b> for attempt to integrate <b>DM1</b> for attempt to use limits <b>A1</b> all correct <b>M1</b> for evaluation of square bracket notation	
	Leading to $s = 5.60$	<b>A1</b>		
(iv)	Velocity is always +ve, so no change in direction	<b>B1</b>	Allow any valid argument.	
9	(i)	$\cos x (3 \sin x - 2) = 0$	<b>B1</b>	<b>B1</b> for $90^\circ$
		$\cos x = 0, x = 90^\circ$	<b>M1</b>	<b>M1</b> for attempt to solve $\sin x = \frac{2}{3}$
		$\sin x = \frac{2}{3},$ $x = 41.8^\circ, 138.2^\circ$	<b>A1, √A1</b>	Follow through on their first answer
	(ii)	$10 \sin^2 y + \cos y = 8$	<b>M1</b>	<b>M1</b> for use of correct identity
$10(1 - \cos^2 y) + \cos y = 8$		<b>M1</b>	<b>M1</b> for attempt to reduce to a 3 term quadratic and attempt to solve quadratic	
$10 \cos^2 y - \cos y - 2 = 0$		<b>M1</b>	<b>M1</b> for attempt to solve using factors in terms of cos	
$(2 \cos y - 1)(5 \cos y + 2) = 0$ $\cos y = \frac{1}{2}, \cos y = -\frac{2}{5}$ $y = 60^\circ, 300^\circ$ and $y = 113.6^\circ, 246.4^\circ$		<b>A1, A1</b>	<b>A1</b> for any 'pair'	

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0606	13

<p><b>10 (i)</b></p> <table border="1" data-bbox="316 241 746 324"> <tr> <td><math>x^2</math></td> <td>2.25</td> <td>3.06</td> <td>4</td> <td>5.06</td> </tr> <tr> <td><math>\lg y</math></td> <td>0.59</td> <td>0.92</td> <td>1.29</td> <td>1.71</td> </tr> </table>	$x^2$	2.25	3.06	4	5.06	$\lg y$	0.59	0.92	1.29	1.71	<p><b>(ii)</b></p> 	<p><b>B1</b></p>	
$x^2$	2.25	3.06	4	5.06									
$\lg y$	0.59	0.92	1.29	1.71									
<p><b>(iii)</b></p> <p>Gradient:  <math>\lg b = 0.4</math>, <math>b = 2.5</math> (allow 2.45 to 2.55)</p> <p>Intercept :  <math>\lg A = -0.3</math>, <math>A = 0.5</math> (allow 0.4 to 0.6)</p>		<p><b>M1</b> <b>A1, 0</b></p> <p><b>M1</b> <b>A1</b></p>	<p><b>M1</b> for plotting <math>\lg y</math> against <math>x^2</math>          –1 each error, poor point plotting, poor line drawing</p> <p><b>M1</b> for correct use of gradient</p> <p><b>M1</b> for correct use intercept</p>										
<p><b>(iv)</b></p>	<p>2.1 (allow 2 to 2.2)</p>	<p><b>M1, A1</b></p>											

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0606	13

11	(i)	<p>at A <math>\sqrt{3} \sin 3x + \cos 3x = 0</math></p> <p><math>\tan 3x = -\frac{1}{\sqrt{3}}, 3x = \frac{5\pi}{6} \quad 150^\circ</math></p> <p><math>x = \frac{5\pi}{18} (0.873) \text{ (allow } 50^\circ)</math></p>	M1	M1 for equating to zero and attempt to solve using tan
			DM1	DM1 for dealing with 3x
			A1	
	(ii)	<p><math>\frac{dy}{dx} = 3\sqrt{3} \cos 3x - 3 \sin 3x</math></p> <p>When <math>\frac{dy}{dx} = 0, \tan 3x = \sqrt{3}, 3x = \frac{\pi}{3} \text{ or } 3x = 60^\circ,</math></p> <p><math>x = \frac{\pi}{9} (0.349) \text{ (allow } 20^\circ)</math></p>	B1, B1	B1 for $\frac{dy}{dx}$
			M1	M1 for attempt to solve $\frac{dy}{dx} = 0$
			A1	
	(iii)	<p>Area = <math>\left[ -\frac{\sqrt{3}}{3} \cos 3x + \frac{1}{3}x + \frac{1}{3} \sin 3x \right]_{\frac{\pi}{9}}^{\frac{5\pi}{18}}</math></p> <p><math>= \left( -\frac{\sqrt{3}}{3} \cos \frac{5\pi}{6} + \frac{1}{3} \sin \frac{5\pi}{6} \right) - \left( -\frac{\sqrt{3}}{3} \cos \frac{\pi}{3} + \frac{1}{3} \sin \frac{\pi}{3} \right)</math></p> <p><math>= \frac{2}{3} \text{ or } 0.667 \text{ or better}</math></p>	M1 A1, A1	M1 for attempt to integrate A1 for each term
			DM1	DM1 for correct application of their limits
			A1	