

## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

## **ADDITIONAL MATHEMATICS**

0606/02

Paper 2

For Examination from 2013

SPECIMEN MARK SCHEME

2 hours

**MAXIMUM MARK: 80** 



## **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.
- The symbol √ 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:

- 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  $\sqrt{}$ " 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.

1	$\mathbf{A}^{-1} = \frac{1}{10} \begin{pmatrix} 4 & -6 \\ -7 & 13 \end{pmatrix}$	B1+B1	
	evaluate $\mathbf{A}^{-1} \begin{pmatrix} 41 \\ 24 \end{pmatrix}$	M1	
	x = 2, y = 2.5	A1	[4]
2	$k(2x-9)^2  6(2x-9)^2$	M1 A1	
	substitute $x = 7$ and $\frac{dx}{dt} = 4$ into $\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$	M1	
	600	A1	[4]
3	eliminate y use $b^2 - 4ac$ $m^2 + 10m - 39 * 0$ factorise 3 term quadratic in m or take square root -13 < m < 3	M1 DM1 A1 M1 A1	[5]
4	(a) 10, 3 and 15 multiply 3 values 450	B1 M1 A1	[6]
	<b>(b)</b> 4 × (5 × 4 × 3) 240	B1+B1 B1	[6]
5	(i) $\frac{\mathrm{d}}{\mathrm{d}x}(\ln x) = \frac{1}{x}$	B1	
	$1 + \ln x$	B1	
	(ii) $\int (1 + \ln x) dx = x \ln x (+c)$	M1	
	$\int \ln x  \mathrm{d}x = x \ln x - \int \! \mathrm{d}x (+c)$	M1	
	$x \ln x - x (+c)$	A1	[5]
6	(i) express as powers of 2 (or 4 or 8) applies rules of indices $[2x - (5 - x) = 4x - 3(x - 3)]$	M1 DM1 A1	
	(ii) $\lg (2y + 10) + \lg y = \lg \{y(2y + 10)\}\$ or $2 = \lg 100$ $2y^2 + 10y = 100$ oe 5 only	B1 B1 B1	[6]

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7	(i)	speed of travel = 4.8 or distance downstream = 14	B1	
		1.4 OR (4.8) 1.4		
		draw right angle triangle with 1.4 and (4.8) at 90° $\sqrt{1.4^2 + (4.8)^2}$ 5	B1 M1 A1	
	(ii)	$\tan^{-1} \frac{(4.8)}{1.4}$ oe 73.7 or 1.29 radians	M1 A1	[6]
8	(i)	5	B1	
	(ii)	180 or $\pi$	B1	
	(iii)	8 and -2	B1+B1	
	2 cy	The ect start and endpoints well as $0$ to $2\pi$ and min points	B1 B1 B1	[7]
9		eliminate $y$ (or $x$ ) $7x^2 - 42x + 35 = 0$ (or $7y^2 + 42y - 49 = 0$ ) oe solve 3 term quadratic $x = 1$ and 5 (or $y = -7$ and 1) find second coordinates find mid-point use $m_{AB}$ , $m_1m_2 = -1$ and coordinates of a point $y + 3 = -\frac{1}{2}(x - 3)$ or $x + 2y + 3 = 0$ or $y = -\frac{1}{2}x - \frac{3}{2}$	M1 A1 M1 A1 M1 M1 M1	[8]

10 (i) $\frac{dy}{dx} = 3x^2 - 16x + 16$ B1  equate to 0 and solve 3 term quadratic $x = 4, y = 0$ A1 AG $x = \frac{4}{3}y = 9\frac{13}{27} \text{ or } \frac{256}{27} \text{ or } 9.48 \text{ or } 9.5$ (ii) integrate	
$x = 4, y = 0$ $x = \frac{4}{3}y = 9\frac{13}{27} \text{ or } \frac{256}{27} \text{ or } 9.48 \text{ or } 9.5$ A1 AG A1  (ii) integrate	
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(ii) integrate	
(ii) integrate	
$\frac{x^4}{4} - \frac{8x^3}{3} + 8x^2$	
use limits of 4 (and 0)  DM1	
$21\frac{1}{3}$ or 21.3	[8]
11 (i) plot $xy$ against $1/x$ with linear scales M1	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	
(ii) attempt at gradient using plotted points DM1	
$5 \pm 0.2$	
intercept $2 \pm 0.1$ (or A1 if calculated from $y = mx + c$ )	
use $Y = mX + c$ in correct way	
$y = \frac{5}{x^2} + \frac{2}{x}$ or $y = \frac{5+2x}{x^2}$ or $y = \frac{1}{x} \left( \frac{5}{x} + 2 \right)$ A1 $$	
(iii) read from graph or substitute in formula to find x  M1	
$x = 2.5 \pm 0.2$ A1	[11]
$y = 1.6 \pm 0.1$ A1	[11]
12	
(i) $\frac{OC}{2} = \cos 0.6 \text{ or } OC = 2 \cos 0.6 \text{ or } \frac{OC}{\sin 0.97} = \frac{2}{\sin \frac{\pi}{2}}$ M1	
1.65 A1	
$CD = 2 \sin 0.6 \text{ or } CD = \sqrt{OD^2 - OC^2}$ M1	
1.13 A1	
(ii) 6 × 0.6	
complete plan $CD + 4 + r\theta + (6 - 1.65)$ M1	
13.1 A1	
(iii) $\frac{1}{2} \times 6^2 \times 0.6$	
complete plan $\frac{1}{2} r^2 \theta - \frac{1}{2} \times OC \times CD$	
9.87 A1	[10]

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