UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS **4037/02**

Paper 2 **For Examination from 2013**

SPECIMEN MARK SCHEME

2 hours

MAXIMUM MARK: 80

This document consists of **6** printed pages.

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.

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.

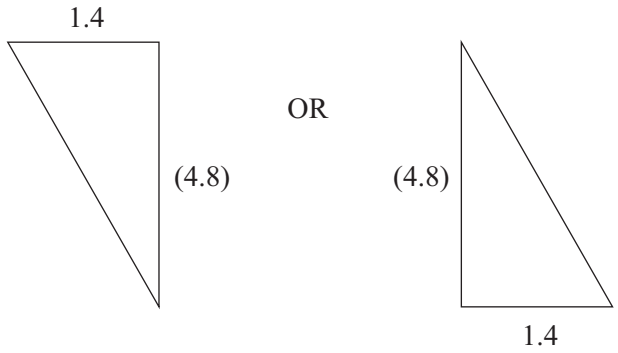
OW –1,2 This is deducted from A or B marks when essential working is omitted.

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.

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	$k(2x-9)^2$	M1	
	$6(2x-9)^2$	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	M1	
	use $b^2 - 4ac$	DM1	
	$m^2 + 10m - 39 * 0$	A1	
	factorise 3 term quadratic in m or take square root	M1	
	$-13 < m < 3$	A1	**[5]**
4	**(a)** 10, 3 and 15	B1	
	multiply 3 values	M1	
	450	A1	
	(b) $4 \times (5 \times 4 \times 3)$	B1+B1	
	240	B1	**[6]**
5	**(i)** $\frac{d}{dx}(\ln x) = \frac{1}{x}$	B1	
	$1 + \ln x$	B1	
	(ii) $\int (1 + \ln x)dx = x \ln x (+c)$	M1	
	$\int \ln x \, dx = x \ln x - \int dx (+c)$	M1	
	$x \ln x - x \, (+c)$	A1	**[5]**
6	**(i)** express as powers of 2 (or 4 or 8)	M1	
	applies rules of indices $[2x - (5 - x) = 4x - 3(x - 3)]$	DM1	
	7	A1	
	(ii) $\lg(2y + 10) + \lg y = 1\text{g}\ \{y(2y + 10)\}$ or $2 = \lg 100$	B1	
	$2y^2 + 10y = 100$ oe	B1	
	5 only	B1	**[6]**

7	**(i)**	speed of travel = 4.8 or distance downstream = 14	B1	
				
		draw right angle triangle with 1.4 and (4.8) at 90°	B1	
		$\sqrt{1.4^2 + (4.8)^2}$	M1	
		5	A1	
	(ii)	$\tan^{-1}\frac{(4.8)}{1.4}$ oe	M1	
		73.7 or 1.29 radians	A1	**[6]**
8	**(i)**	5	B1	
	(ii)	180 or π	B1	
	(iii)	8 and –2	B1+B1	
		correct start and endpoints	B1	
		2 cycles in 0 to 2π	B1	
		correct max and min points	B1	**[7]**
9		eliminate y (or x)	M1	
		$7x^2 - 42x + 35 = 0$ (or $7y^2 + 42y - 49 = 0$) oe	A1	
		solve 3 term quadratic	M1	
		$x = 1$ and 5 (or $y = -7$ and 1)	A1	
		find second coordinates	M1	
		find mid-point	M1	
		use m_{AB}, $m_1 m_2 = -1$ and coordinates of a point	M1	
		$y + 3 = -\frac{1}{2}(x - 3)$ or $x + 2y + 3 = 0$ or $y = -\frac{1}{2}x - \frac{3}{2}$	A1	**[8]**

10	**(i)** $\frac{dy}{dx} = 3x^2 - 16x + 16$	B1	
	equate to 0 and solve 3 term quadratic	M1	
	$x = 4$, $y = 0$	A1 AG	
	$x = \frac{4}{3}$ $y = 9\frac{13}{27}$ or $\frac{256}{27}$ or 9.48 or 9.5	A1	
	(ii) integrate	M1	
	$\frac{x^4}{4} - \frac{8x^3}{3} + 8x^2$	A1	
	use limits of 4 (and 0)	DM1	
	$21\frac{1}{3}$ or 21.3	A1	**[8]**
11	**(i)** plot xy against $1/x$ with linear scales	M1	
	xy 4.5 3.24 2.82 2.64 $1/x$ 0.5 0.25 0.17 0.125	A2, 1, 0	
	(ii) attempt at gradient using plotted points	DM1	
	5 ± 0.2	A1	
	intercept 2 ± 0.1	B1	
	(or A1 if calculated from $y = mx + c$)		
	use $Y = mX + c$ in correct way	M1	
	$y = \frac{5}{x^2} + \frac{2}{x}$ 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	
	$y = 1.6 \pm 0.1$	A1	**[11]**
12			
	(i) $\frac{OC}{2} = \cos 0.6$ or $OC = 2 \cos 0.6$ or $\frac{OC}{\sin 0.97} = \frac{2}{\sin\frac{\pi}{2}}$	M1	
	1.65	A1	
	$CD = 2 \sin 0.6$ or $CD = \sqrt{OD^2 - OC^2}$	M1	
	1.13	A1	
	(ii) 6×0.6	B1	
	complete plan $CD + 4 + r\theta + (6 - 1.65)$	M1	
	13.1	A1	
	(iii) $\frac{1}{2} \times 6^2 \times 0.6$	B1	
	complete plan $\frac{1}{2} r^2\theta - \frac{1}{2} \times OC \times CD$	M1	
	9.87	A1	**[10]**