



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 \surd 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 $\sqrt{\quad}$ " 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.

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

<p>10 (i) $\frac{dy}{dx} = 3x^2 - 16x + 16$ equate to 0 and solve 3 term quadratic $x = 4, y = 0$ $x = \frac{4}{3}, y = 9\frac{13}{27}$ or $\frac{256}{27}$ or 9.48 or 9.5</p> <p>(ii) integrate $\frac{x^4}{4} - \frac{8x^3}{3} + 8x^2$ use limits of 4 (and 0) $21\frac{1}{3}$ or 21.3</p>	B1 M1 A1 AG A1 M1 A1 DM1 A1	<p style="text-align: right;">[8]</p>										
<p>11 (i) plot xy against $1/x$ with linear scales <table style="margin-left: 20px;"> <tr> <td>xy</td> <td>4.5</td> <td>3.24</td> <td>2.82</td> <td>2.64</td> </tr> <tr> <td>$1/x$</td> <td>0.5</td> <td>0.25</td> <td>0.17</td> <td>0.125</td> </tr> </table></p> <p>(ii) attempt at gradient using plotted points 5 ± 0.2 intercept 2 ± 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 $y = \frac{1}{x}\left(\frac{5}{x} + 2\right)$</p> <p>(iii) read from graph or substitute in formula to find x $x = 2.5 \pm 0.2$ $y = 1.6 \pm 0.1$</p>	xy	4.5	3.24	2.82	2.64	$1/x$	0.5	0.25	0.17	0.125	M1 A2, 1, 0 DM1 A1 B1 M1 A1√ M1 A1 A1	<p style="text-align: right;">[11]</p>
xy	4.5	3.24	2.82	2.64								
$1/x$	0.5	0.25	0.17	0.125								
<p>12</p> <p>(i) $\frac{OC}{2} = \cos 0.6$ or $OC = 2 \cos 0.6$ or $\frac{OC}{\sin 0.97} = \frac{2}{\sin \frac{\pi}{2}}$ 1.65 $CD = 2 \sin 0.6$ or $CD = \sqrt{OD^2 - OC^2}$ 1.13</p> <p>(ii) 6×0.6 complete plan $CD + 4 + r\theta + (6 - 1.65)$ 13.1</p> <p>(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</p>	M1 A1 M1 A1 B1 M1 A1 B1 M1 A1	<p style="text-align: right;">[10]</p>										