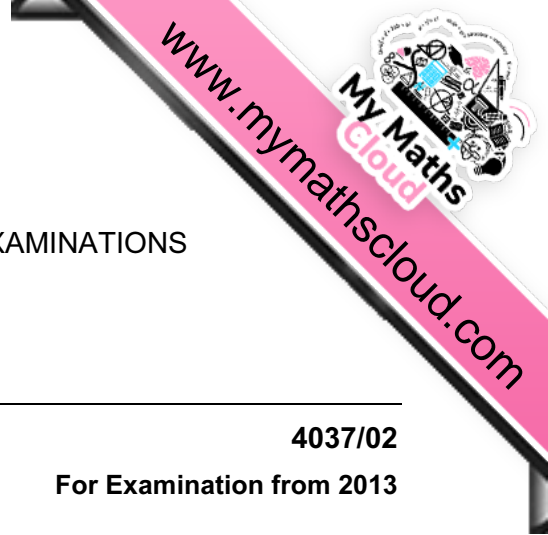




UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level



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**ADDITIONAL MATHEMATICS**

**4037/02**

Paper 2

**For Examination from 2013**

SPECIMEN MARK SCHEME

**2 hours**

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**MAXIMUM MARK: 80**

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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 numeric 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.

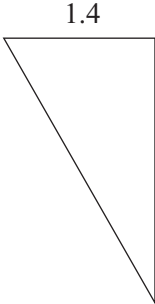
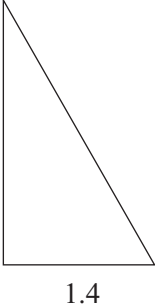
The following abbreviations may be used in a mark scheme or used on the scripts:

- AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed 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><b>1</b> <math>\mathbf{A}^{-1} = \frac{1}{10} \begin{pmatrix} 4 &amp; -6 \\ -7 &amp; 13 \end{pmatrix}</math></p> <p>evaluate <math>\mathbf{A}^{-1} \begin{pmatrix} 41 \\ 24 \end{pmatrix}</math></p> <p><math>x = 2, y = 2.5</math></p>	<p>B1+B1</p> <p>M1</p> <p>A1</p>	<p>[4]</p>
<p><b>2</b> <math>\frac{k(2x-9)^2}{6(2x-9)^2}</math></p> <p>substitute <math>x = 7</math> and <math>\frac{dx}{dt} = 4</math> into <math>\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}</math></p> <p>600</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>[4]</p>
<p><b>3</b> eliminate <math>y</math> use <math>b^2 - 4ac</math> <math>m^2 + 10m - 39 = 0</math> factorise 3 term quadratic in <math>m</math> or take square root <math>-13 &lt; m &lt; 3</math></p>	<p>M1</p> <p>DM1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>[5]</p>
<p><b>4</b> (a) 10, 3 and 15 multiply 3 values 450</p> <p>(b) <math>4 \times (5 \times 4 \times 3)</math> 240</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1+B1</p> <p>B1</p>	<p>[6]</p>
<p><b>5</b> (i) <math>\frac{d}{dx}(\ln x) = \frac{1}{x}</math> <math>1 + \ln x</math></p> <p>(ii) <math>\int (1 + \ln x) dx = x \ln x + x + c</math> <math>\int \ln x dx = x \ln x - \int dx + c</math> <math>x \ln x - x + c</math></p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>[5]</p>
<p><b>6</b> (i) express as powers of 2 (or 4 or 8) applies rules of indices <math>[2x - (5 - x) = 4x - 3(x - 3)]</math> 7</p> <p>(ii) <math>\lg(2y + 10) + \lg y = \lg \{y(2y + 10)\}</math> or <math>2 = \lg 100</math> <math>2y^2 + 10y = 100</math> oe 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>7 (i) speed of travel = 4.8 or distance downstream = 14</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div>OR</div> <div style="text-align: center;">  </div> </div> <p style="margin-top: 20px;">draw right angle triangle with 1.4 and (4.8) at <math>90^\circ</math></p> $\sqrt{1.4^2 + (4.8)^2}$ <p>5</p> <p>(ii) <math>\tan^{-1} \frac{(4.8)}{1.4}</math> oe 73.7 or 1.29 radians</p>	<p>B1</p> <p>B1 M1 A1</p> <p>M1 A1</p>	<p>[6]</p>
<p>8 (i) 5</p> <p>(ii) 180 or <math>\pi</math></p> <p>(iii) 8 and <math>-2</math></p> <p>correct start and endpoints 2 cycles in 0 to <math>2\pi</math> correct max and min points</p>	<p>B1</p> <p>B1</p> <p>B1+B1</p> <p>B1 B1 B1</p>	<p>[7]</p>
<p>9</p> <p>eliminate <math>y</math> (or <math>x</math>)  <math>7x^2 - 42x + 35 = 0</math> (or <math>7y^2 + 42y - 49 = 0</math>) oe        solve 3 term quadratic  <math>x = 1</math> and <math>5</math> (or <math>y = -7</math> and <math>1</math>)        find second coordinates        find mid-point        use <math>m_{AB}</math>, <math>m_1 m_2 = -1</math> and coordinates of a point  <math>y + 3 = -\frac{1}{2}(x - 3)</math> or <math>x + 2y + 3 = 0</math> or <math>y = -\frac{1}{2}x - \frac{3}{2}</math></p>	<p>M1 A1 M1 A1 M1 M1 M1 A1</p>	<p>[8]</p>

<p><b>10 (i)</b> <math>\frac{dy}{dx} = 3x^2 - 16x + 16</math>          equate to 0 and solve 3 term quadratic  <math>x = 4, y = 0</math>  <math>x = \frac{4}{3} y = 9\frac{13}{27}</math> or <math>\frac{256}{27}</math> or 9.48 or 9.5</p> <p><b>(ii)</b> integrate  <math>\frac{x^4}{4} - \frac{8x^3}{3} + 8x^2</math>          use limits of 4 (and 0)  <math>21\frac{1}{3}</math> or 21.3</p>	B1 M1 A1 AG A1 M1 A1 DM1 A1	[8]
<p><b>11 (i)</b> plot <math>xy</math> against <math>1/x</math> with linear scales  <math>xy</math> 4.5 3.24 2.82 2.64  <math>1/x</math> 0.5 0.25 0.17 0.125</p> <p><b>(ii)</b> attempt at gradient using plotted points  <math>5 \pm 0.2</math>          intercept <math>2 \pm 0.1</math>          (or A1 if calculated from <math>y = mx + c</math>)          use <math>Y = mX + c</math> in correct way  <math>y = \frac{5}{x^2} + \frac{2}{x}</math> or <math>y = \frac{5+2x}{x^2}</math> or <math>y = \frac{1}{x}\left(\frac{5}{x} + 2\right)</math></p> <p><b>(iii)</b> read from graph or substitute in formula to find <math>x</math>  <math>x = 2.5 \pm 0.2</math>  <math>y = 1.6 \pm 0.1</math></p>	M1 A2, 1, 0 DM1 A1 B1 M1 A1√ M1 A1 A1	[11]
<p><b>12</b></p> <p><b>(i)</b> <math>\frac{OC}{2} = \cos 0.6</math> or <math>OC = 2 \cos 0.6</math> or <math>\frac{OC}{\sin 0.97} = \frac{2}{\sin \frac{\pi}{2}}</math>            1.65  <math>CD = 2 \sin 0.6</math> or <math>CD = \sqrt{OD^2 - OC^2}</math>          1.13</p> <p><b>(ii)</b> <math>6 \times 0.6</math>          complete plan <math>CD + 4 + r\theta + (6 - 1.65)</math>          13.1</p> <p><b>(iii)</b> <math>\frac{1}{2} \times 6^2 \times 0.6</math>            complete plan <math>\frac{1}{2} r^2\theta - \frac{1}{2} \times OC \times CD</math>          9.87</p>	M1 A1 M1 A1 B1 M1 A1 B1 M1 A1	[10]