OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today’s society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners’ meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates’ scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2010

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk
1

- B1 Establish result true for $n = 1$ or $n = 2$
- M1 Add next term to given sum formula
- M1 Attempt to factorise or expand and simplify to correct expression
- A1 Correct expression obtained
- A1 5 Specific statement of induction conclusion

2 (i) (-7)  

- M1 Obtain a single value
- A1 2 Obtain correct answer as a matrix

(ii) $BA = \begin{pmatrix} 5 & -20 \\ 3 & -12 \end{pmatrix}$

- M1 Obtain a $2 \times 2$ matrix
- A1 All elements correct
- B1 4C seen or implied by correct answer
- B1ft 4 Obtain correct answer, ft for a slip in BA

3

- Either
  
  $\frac{2}{3} n(n+1)(2n+1) - 2n(n+1) + n$

  $\frac{1}{3} n(2n-1)(2n+1)$

  Or

  $\sum_{i=1}^{2n} r^2 - 4 \sum_{i=1}^{n} r^2$

  $\frac{1}{6} \times 2n(2n+1)(4n+1) - 4 \times \frac{1}{6} n(n+1)(2n+1)$

  $\frac{1}{3} n(2n-1)(2n+1)$

- M1 Express as sum of 3 terms
- M1 Use standard sum results
- A1 Correct unsimplified answer
- M1 Attempt to factorise
- A1 Obtain at least factor of $n$ and a quadratic
- A1 6 Obtain correct answer a.e.f.

- M1 Express as difference of $2 \sum r^2$ series
- M1 Use standard result
- A1 Correct unsimplified answer
- M1 Attempt to factorise
- A1 Obtain at least factor of $n$
- A1 Obtain correct answer
4 (i) \[ 5 + 12i \]
\[ \frac{13}{67.4^\circ} \text{ or } 1.18 \]
B1B1 Correct real and imaginary parts
B1ft Correct modulus
B1ft 4 Correct argument

(ii) M1 Multiply by conjugate
A1 Obtain correct numerator
A1 3 Obtain correct denominator

\[ \frac{-11}{85} - \frac{27}{85}i \]

5 (a) \[ \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \]
B1B12 Each column correct
SC B2 use correct matrix from MF1
Can be trig form

(b) (i) B1B12 Stretch, in x-direction sf 5
(ii) B1B12 Rotation, \(60^\circ\) clockwise

6 (i) (a) B1B12 Circle centre (3, –4), through origin
(b) B1B12 Vertical line, clearly \(x = 3\)

(ii) B1ft Inside their circle
B1ft 2 And to right of their line, if vertical
Either
\[ \alpha + \beta = -2k \quad \alpha \beta = k \]

\[ y^2 - 4ky + 4k = 0 \]

Or
\[ \alpha + \beta = -2k \]
\[ \frac{-2k}{\alpha} \]
\[ y = \frac{-2k}{k} \]

\[ y^2 - 4ky + 4k = 0 \]

Or
\[ -k \pm \sqrt{k^2 - k} \]
\[ \frac{\alpha + \beta}{\alpha} = \frac{2k}{k + \sqrt{k^2 - k}}, \quad \frac{\alpha + \beta}{\beta} = \frac{2k}{k - \sqrt{k^2 - k}} \]

\[ y^2 - 4ky + 4k = 0 \]
<table>
<thead>
<tr>
<th>Question</th>
<th>Mark Scheme</th>
<th>June 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (i)</td>
<td>M1 Attempt to rationalise denominator or cross multiply</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 2 Obtain <strong>given</strong> answer correctly</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>M1 Express terms as differences using (i)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Attempt this for at least 1&lt;sup&gt;st&lt;/sup&gt; three terms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 1&lt;sup&gt;st&lt;/sup&gt; three terms all correct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 Last two terms all correct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Show pairs cancelling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 6 Obtain correct answer, in terms of n</td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>B1 1 Sensible statement for divergence</td>
<td></td>
</tr>
<tr>
<td>9 (i)</td>
<td>M1 Show correct expansion process for 3 x 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Correct evaluation of any 2 x 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 3 Obtain correct answer</td>
<td></td>
</tr>
<tr>
<td>(ii) (a)</td>
<td>M1 Find a pair of inconsistent equations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 State inconsistent or no solutions</td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>M1 Find a repeated equation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 State non unique solutions</td>
<td></td>
</tr>
<tr>
<td>(c)</td>
<td>B1 State that det A is non-zero or find correct solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B1 6 State unique solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>SC if detA incorrect, can score 2 marks for correct deduction of a unique solution, but only once</strong></td>
<td></td>
</tr>
<tr>
<td>10 (i)</td>
<td>M1 Attempt to equate real and imaginary parts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 Obtain both results</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Eliminate to obtain quadratic in x&lt;sup&gt;2&lt;/sup&gt; or y&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Solve to obtain x or y value</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 5 Obtain correct answer as a complex no.</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>B1 1 Obtain <strong>given</strong> answer correctly</td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>M1 Attempt to solve quadratic equation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 Obtain correct answers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Choose negative sign</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Relate required value to conjugate of (i)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 5 Obtain correct answer</td>
<td></td>
</tr>
</tbody>
</table>