

Mark Scheme 4725 January 2007

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1.	(i) $a = -3$ (ii) $2a - 3 = 7$ or $3a - 6 = 9$ $a = 5$	B1 M1 A1	1 2 3	State correct value Sensible attempt at multiplication Obtain correct answer
2.	$x^2 - y^2 = 15$ and $xy = 4$ $\pm(4 + i)$	M1 A1 A1 M1 DM1 A1	 6 6	Attempt to equate real and imaginary parts of $(x + iy)^2$ and $15 + 8i$ Obtain each result Eliminate to obtain a quadratic in x^2 or y^2 Solve to obtain $x = (\pm)4$, or $y = (\pm)1$ Obtain only correct two answers as complex numbers
3.	$\frac{1}{4}n^2(n+1)^2 - \frac{1}{2}n(n+1)$ $\frac{1}{4}n(n-1)(n+1)(n+2)$	M1 M1 A1 M1 A1 A1	 6 6	Expand to obtain $r^3 - r$ Consider difference of two standard results Obtain correct unfactorised answer Attempt to factorise Obtain factor of $\frac{1}{4}n(n+1)$ Obtain correct answer
4.	(i) (ii)	B1 B1 B1 B1 B1 B1	 3 3	Circle Centre (1, -1) Passing through (0, 0) Sketch a concentric circle Inside (i) and touching axes Shade between the circles
5.	(i)	B1	1	Show given answer correctly

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	(ii) $-1 \pm i\sqrt{3}$ (iii)	M1 A1 A1 B1 B1 B1	3 3 7	Attempt to solve quadratic equation or substitute $x + iy$ and equate real and imaginary parts Obtain answers as complex numbers Obtain correct answers, simplified Correct root on x axis, co-ords. shown Other roots in 2 nd and 3 rd quadrants Correct lengths and angles or co-ordinates or complex numbers shown
6.	(i) $u_{n+1} - u_n = 2n + 4$ (ii)	B1 M1 A1 B1 M1 M1 A1 A1	3 3 5 8	Correct expression for u_{n+1} Attempt to expand and simplify Obtain given answer correctly State $u_1 = 4$ (or $u_2 = 10$) and is divisible by 2 State induction hypothesis true for u_n Attempt to use result in (ii) Correct conclusion reached for u_{n+1} Clear, explicit statement of induction conclusion
7.	(i) $\alpha + \beta = -5$ $\alpha\beta = 10$ (ii) $\alpha^2 + \beta^2 = 5$ (iii) $x^2 - \frac{1}{2}x + 1 = 0$	B1 B1 M1 A1 B1 M1 A1 B1ft	2 2 4 8	State correct values Use $(\alpha + \beta)^2 - 2\alpha\beta$ Obtain given answer correctly, using value of -5 Product of roots = 1 Attempt to find sum of roots Obtain $\frac{5}{10}$ or equivalent Write down required quadratic equation, or any multiple.

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8.	<p>(i)</p> $(r + 1)^2 r!$ <p>(ii)</p> $(n + 2)! - 2!$ <p>(iii)</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>B1ft</p>	<p></p> <p>3</p> <p></p> <p>4</p> <p>1</p> <p>8</p>	<p>Factor of $r!$ or $(r + 1)!$ seen</p> <p>Factor of $(r + 1)$ found</p> <p>Obtain given answer correctly</p> <p>Express terms as differences using (i)</p> <p>At least 1st two and last term correct</p> <p>Show that pairs of terms cancel</p> <p>Obtain correct answer in any form</p> <p>Convincing statement for non-converging, ft their (ii)</p>
9.	<p>(i)</p> $\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} 0 \\ -1 \end{pmatrix} \begin{pmatrix} 3 \\ 0 \end{pmatrix} \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ <p>(ii) 90° clockwise, centre origin</p> $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ <p>(iii) Stretch parallel to x-axis, s.f. 3</p> $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$	<p>M1</p> <p>A1</p> <p>B1 B1</p> <p>B1</p> <p>B1 B1</p> <p>B1 B1</p>	<p></p> <p>2</p> <p></p> <p>3</p> <p>4</p> <p>9</p>	<p>For at least two correct images</p> <p>For correct diagram, co-ords. clearly written down</p> <p>Or equivalent correct description</p> <p>Correct matrix, not in trig form</p> <p>Or equivalent correct description, but must be a stretch for 2nd B1</p> <p>Each correct column</p>

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10.	<p>(i)</p> $\Delta = \det \mathbf{D} = 3a - 6$ $\mathbf{D}^{-1} = \frac{1}{\Delta} \begin{pmatrix} 3 & -2 & 4 \\ -3 & a & -2a \\ -3 & a & a-6 \end{pmatrix}$ <p>(ii) $\frac{1}{\Delta} \begin{pmatrix} 5 \\ 2a-9 \\ 5a-15 \end{pmatrix}$</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>A1</p> <p>M1</p> <p>A1A1A1 ft all 3</p>	<p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p>7</p> <p></p> <p>4</p> <p>11</p>	<p>Show correct expansion process for 3 x 3</p> <p>Correct evaluation of any 2 x 2 det</p> <p>Obtain correct answer</p> <p>Show correct process for adjoint entries</p> <p>Obtain at least 4 correct entries in adjoint</p> <p>Divide by their determinant</p> <p>Obtain completely correct answer</p> <p>Attempt product of form $\mathbf{D}^{-1}\mathbf{C}$, or eliminate to get 2 equations and solve</p> <p>Obtain correct answers, ft their inverse</p>
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