

1		<p>B1 Establish result true for $n = 1$ or $n = 2$</p> <p>M1 Add next term to given sum formula</p> <p>M1 Attempt to factorise or expand and simplify to correct expression</p> <p>A1 Correct expression obtained</p> <p>A1 5 Specific statement of induction conclusion</p>
5		
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2	<p>(i) (-7)</p>	<p>M1 Obtain a single value</p> <p>A1 2 Obtain correct answer as a matrix</p>
<hr style="border-top: 1px dashed black;"/>		
(ii)	<p>$BA = \begin{pmatrix} 5 & -20 \\ 3 & -12 \end{pmatrix}$</p> <p>$\begin{pmatrix} -7 & -20 \\ 11 & -20 \end{pmatrix}$</p>	<p>M1 Obtain a 2×2 matrix</p> <p>A1 All elements correct</p> <p>B1 4C seen or implied by correct answer</p> <p>B1ft 4 Obtain correct answer, ft for a slip in BA</p>
6		
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3	<p>Either</p> <p>$\frac{2}{3}n(n+1)(2n+1) - 2n(n+1) + n$</p> <p>$\frac{1}{3}n(2n-1)(2n+1)$</p> <p>Or</p> <p>$\sum_{r=1}^{2n} r^2 - 4 \sum_{r=1}^n r^2$</p> <p>$\frac{1}{6} \times 2n(2n+1)(4n+1) - 4 \times \frac{1}{6}n(n+1)(2n+1)$</p> <p>$\frac{1}{3}n(2n-1)(2n+1)$</p>	<p>M1 Express as a sum of 3 terms</p> <p>M1 Use standard sum results</p> <p>A1 Correct unsimplified answer</p> <p>M1 Attempt to factorise</p> <p>A1 Obtain at least factor of n and a quadratic</p> <p>A1 6 Obtain correct answer a.e.f.</p> <p>M1 Express as difference of 2 $\sum r^2$ series</p> <p>M1 Use standard result</p> <p>A1 Correct unsimplified answer</p> <p>M1 Attempt to factorise</p> <p>A1 Obtain at least factor of n</p> <p>A1 Obtain correct answer</p>
6		

- 4 (i) $5 + 12i$
13
 67.4° or 1.18
- B1B1 Correct real and imaginary parts
B1ft Correct modulus
B1ft 4 Correct argument

(ii)

$$-\frac{11}{85} - \frac{27}{85}i$$

- M1 Multiply by conjugate
A1 Obtain correct numerator
A1 3 Obtain correct denominator

7

- 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)
(ii)

- B1B12 Stretch, in x -direction sf 5
B1B12 Rotation, 60° clockwise

6

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

(ii)

- B1ft Inside their circle
B1ft 2 And to right of their line, if vertical

6

7

Either

$$\alpha + \beta = -2k \quad \alpha\beta = k$$

$$y^2 - 4ky + 4k = 0$$

Or

$$\alpha + \beta = -2k$$

$$\frac{-2k}{\alpha}$$

$$y = \frac{-2k}{x}$$

$$y^2 - 4ky + 4k = 0$$

Or

$$-k \pm \sqrt{k^2 - k}$$

$$\frac{\alpha + \beta}{\alpha} = \frac{2k}{k + \sqrt{k^2 - k}}, \quad \frac{\alpha + \beta}{\beta} = \frac{2k}{k - \sqrt{k^2 - k}}$$

$$y^2 - 4ky + 4k = 0$$

- B1B1 State or use correct results
 M1 Attempt to find sum of new roots
 A1 Obtain $4k$
 M1 Attempt to find product of new roots
 A1 Obtain $4k$
 B1ft 7 Correct quadratic equation a.e.f.

- B1 State or use correct result
 B1 State or imply form of new roots
 B1 State correct substitution
 M1 Rearrange and substitute for x
 A1 Correct unsimplified equation
 M1 Attempt to clear fractions
 A1 Correct quadratic equation a.e.f.

- B1 Find roots of original equation
 B1 Express both new roots in terms of k
 M1 Attempt to find sum of new roots
 A1 Obtain $4k$
 M1 Attempt to find product of new roots
 A1 Obtain $4k$
 B1ft Correct quadratic equation a.e.f.

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Mark Scheme

June 2010

8	(i)	M1 A1	Attempt to rationalise denominator or cross multiply 2 Obtain given answer correctly
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	(ii)	M1 M1 A1 A1 M1 A1	Express terms as differences using (i) Attempt this for at least 1 st three terms 1 st three terms all correct Last two terms all correct Show pairs cancelling 6 Obtain correct answer, in terms of n
			$\frac{1}{2}(\sqrt{n+2} + \sqrt{n+1} - \sqrt{2} - 1)$
<hr/>			
	(iii)	B1	1 9 Sensible statement for divergence
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9	(i)	M1 M1 A1	Show correct expansion process for 3 x 3 Correct evaluation of any 2 x 2 3 Obtain correct answer
			$\det \mathbf{A} = a^2 - a$
<hr/>			
	(ii)	M1 A1 M1 A1 B1 B1	Find a pair of inconsistent equations State inconsistent or no solutions Find a repeated equation State non unique solutions State that $\det \mathbf{A}$ is non-zero or find correct solution 6 State unique solution SC if $\det \mathbf{A}$ incorrect, can score 2 marks for correct deduction of a unique solution, but only once
	(a)		
	(b)		
	(c)		
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10	(i)	M1 A1 M1 M1 A1	Attempt to equate real and imaginary parts Obtain both results Eliminate to obtain quadratic in x^2 or y^2 Solve to obtain x or y value 5 Obtain correct answer as a complex no.
			$x^2 - y^2 = 3 \quad xy = 2$
			$z = 2 + i$
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	(ii)	B1	1 Obtain given answer correctly
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	(iii)	M1 A1 M1 M1 A1	Attempt to solve quadratic equation Obtain correct answers Choose negative sign Relate required value to conjugate of (i) 5 Obtain correct answer
			$w^3 = 2 \pm 11i$
			$w = 2 - i$
			11