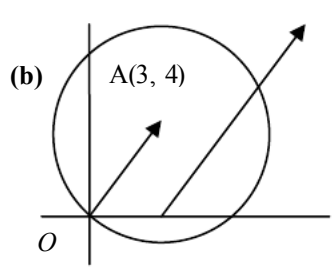


4725 Further Pure Mathematics 1

1 (i)	$\begin{pmatrix} 1 & 1 \\ 5 & -1 \end{pmatrix}$	B1 Two elements correct B1 All four elements correct 2
<hr/>		
(ii)	EITHER $\frac{1}{3} \begin{pmatrix} 2 & -1 \\ -5 & 4 \end{pmatrix}$ OR	B1 Both diagonals correct B1 Divide by determinant 2 B1 Solve sim. eqns. 1 st column correct B1 2 nd column correct
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2 (i)	5 0.927 or 53.1°	B1 Correct modulus B1 Correct argument, any equivalent form 2
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(ii)(a)	(b) 	B1 Circle centre A (3, 4) B1 Through O, allow if centre is (4, 3) 2 B1 Half line with +ve slope B1 Starting at (3, 0) B1 Parallel to OA, (implied by correct arg shown) 3
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3 (i)	$\frac{r}{(r+1)!}$	M1 Common denominator of (r + 1)! or r!(r + 1)! A1 Obtain given answer correctly 2
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(ii)	$1 - \frac{1}{(n+1)!}$	M1 Express terms as differences using (i) A1 At least 1 st two and last term correct M1 Show pairs cancelling A1 Correct answer a.e.f. 4
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4		B1 Establish result is true, for n = 1 (or 2 or 3) M1 Attempt to multiply A and A ⁿ , or vice versa M1 Correct process for matrix multiplication A1 Obtain 3 ⁿ⁺¹ , 0 and 1 A1 Obtain ½(3 ⁿ⁺¹ - 1) A1 Statement of Induction conclusion, only if 5 marks earned, but may be in body of working 6

5		M1	Express as difference of two series
		M1	Use standard results
	$\frac{1}{4}n^2(n+1)^2 - \frac{1}{6}n(n+1)(2n+1)$	A1	Correct unsimplified answer
		M1	Attempt to factorise
		A1	At least factor of $n(n+1)$
	$\frac{1}{12}n(n+1)(3n+2)(n-1)$	A1	Obtain correct answer
			6
6 (i)	$3 - i$	B1	Conjugate stated
			1
(ii)	<i>EITHER</i>	M1	Use sum of roots
		A1	Obtain correct answer
		M1	Use sum of pairs of roots
		A1	Obtain correct answer
		M1	Use product of roots
		A1	Obtain correct answers
	$a = -8, b = 22, c = -20$		6
	<i>OR</i>	M1	Attempt to find a quadratic factor
		A1	Obtain correct factor
		M1	Expand linear and quadratic factors
	$a = -8, b = 22, c = -20$	A1A1A1	Obtain correct answers
	<i>OR</i>	M1	Substitute 1 imaginary & the real root into eqn
		M1	Equate real and imaginary parts
		M1	Attempt to solve 3 eqns.
	$a = -8, b = 22, c = -20$	A1A1A1	Obtain correct answers
7 (i)		B1	Enlargement (centre O) scale factor 6
			1
(ii)		B1	Reflection
		B1	Mirror line is $y = x$
			2
(iii)		B1	Stretch in y direction
		B1	Scale factor 6, must be a stretch
			2
(iv)		B1	Rotation
		B1	36.9° clockwise or equivalent
			2

8	$\alpha + \beta = -k$ $\alpha\beta = 2k$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{1}{2}(k - 4)$ $\alpha'\beta' = 1$ $x^2 - \frac{1}{2}(k - 4)x + 1 = 0$	B1 State or use correct value B1 State or use correct value M1 Attempt to express sum of new roots in terms of $\alpha + \beta$, $\alpha\beta$ A1 Obtain correct expression A1 Obtain correct answer a.e.f. B1 Correct product of new roots seen B1ft Obtain correct answer, must be an eqn.
		$\boxed{7}$ Alternative for last 5 marks M1 Obtain expression for $u = \frac{\alpha}{\beta}$ in terms of k and α or k and β A1 Obtain a correct expression A1 rearrange to get α in terms of u M1 Substitute into given equation A1 Obtain correct answer
9 (i)	$x^2 - y^2 = 5 \text{ and } xy = 6$ $\pm(3 + 2i)$	M1 Attempt to equate real and imaginary parts of $(x + iy)^2$ and $5 + 12i$ A1 Obtain both results M1 Eliminate to obtain a quadratic in x^2 or y^2 M1 Solve a 3 term quadratic & obtain x or y A1 Obtain correct answers as complex nos.
(ii)	$5 - 12i$	B1B1 Correct real and imaginary parts
(iii)	$x^2 = 5 \pm 12i$ $x = \pm(3 \pm 2i)$	$\boxed{2}$ M1 Attempt to solve a quadratic equation A1 Obtain correct answers A1A1 Each pair of correct answers a.e.f.
		$\boxed{4}$

10 (i)

M1 Find value of det **AB****A1** Correct value 2 seen**2**

(ii)

M1 Show correct process for adjoint entries**A1** Obtain at least 4 correct entries in adjoint**B1** Divide by their determinant

$$(\mathbf{AB})^{-1} = \frac{1}{2} \begin{pmatrix} 0 & 3 & -1 \\ 0 & -1 & 1 \\ 2 & 6-3a & a-6 \end{pmatrix}$$

A1 Obtain completely correct answer**4**

(iii) EITHER

M1 State or imply $(\mathbf{AB})^{-1} = \mathbf{B}^{-1}\mathbf{A}^{-1}$ **A1** Obtain $\mathbf{B}^{-1} = (\mathbf{AB})^{-1} \times \mathbf{A}$ **M1** Correct multiplication process seen**A1** Obtain three correct elements

$$\mathbf{B}^{-1} = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 2 \\ -6 & 2 & -2 \end{pmatrix}$$

A1 All elements correct**5**

OR

M1 Attempt to find elements of **B****A1** All correct**M1** Correct process for \mathbf{B}^{-1} **A1** 3 elements correct**A1** All elements correct