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Question number		Scheme	Marks
1.	(a)	$f'(x) = 3x^2 - 6x + 5$	M1A1 (2)
	(b)	f(1.4) = –0.136	B1
		$f'(1.4) = 2.48$	B1ft
		$x_0 = 1.4, x_1 = 1.4 - \frac{-0.136}{2.48}$	M1
		= 1.455 (3 dpl)	A1 (4)
			(6 marks)
2.	(a)	$\begin{pmatrix} a & 4 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} 0 & 1 & 1 \\ 2 & 0 & 2 \end{pmatrix} = \begin{pmatrix} 8 & a & a+8 \\ 2 & -1 & 1 \end{pmatrix}$	M1 A1 A1 (3)
	(b)	det **A** = $a - (-4) = a + 4$	B1 (1)
	(c)	Area of R = 2	B1
		Area of R' = 18	
		Area scale factor is $9 = a + 4$	M1
		$\therefore a = 5$	A1 (3)
			(7 marks)
3.	(a)	$\mathbf{R}^2 = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	M1 A1 (2)
	(b)	Rotation of 90°, clockwise (about (0,0))	B1, B1 (2)
	(c)	Rotation of 45° clockwise	B1ft (1)
			(5 marks)
4.		End points: (4, –8) and (5, 2)	B1
		$\frac{\alpha - 4}{8} = \frac{5 - \alpha}{2}$ (or equiv.)	M1
		$\alpha = 4.8$	A1 (3)
			(3 marks)

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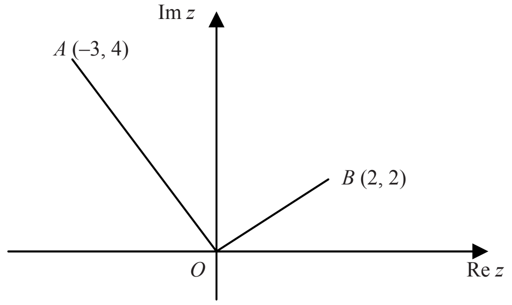
5. (a)	$\sum_{r=1}^{n}\left(r^2-r-1\right)=\sum_{r=1}^{n}r^2-\sum_{r=1}^{n}r-\sum_{r=1}^{n}1$	M1
	$\sum_{r=1}^{n}1=n$	B1
	$\sum_{r=1}^{n}\left(r^2-r-1\right)=\frac{n}{6}(n+1)(2n+1)-\frac{1}{2}n(n+1)-n$	M1
	$=\frac{n}{6}\left(2n^2-8\right)$	M1 A1
	$= =\frac{1}{3}(n-2)n(n+2)$ (✱)	A1 (6)
(b)	$\sum_{r=10}^{40}\left(r^2-r-1\right)=\sum_{r=1}^{40}\left(r^2-r-1\right)-\sum_{r=1}^{9}\left(r^2-r-1\right)$	M1
	$=\frac{1}{3}\times 38\times 40\times 42-\frac{1}{3}\times 7\times 9\times 11=$ ~~1449~~ 21049	M1 A1 (3)
		(9 marks)
6. (a)	$\lvert z\rvert=\sqrt{\left(3^2+4^2\right)}=5$	M1 A1 (2)
(b)	$\arg z=\pi$ - $\arctan\frac{4}{3}=2.21$	M1 A1 (2)
(c)	$w=\frac{-14+2\mathrm{i}}{-3+4\mathrm{i}}=\frac{(-14+2\mathrm{i})(-3-4\mathrm{i})}{(-3+4\mathrm{i})(-3-4\mathrm{i})}$	M1
	$=\frac{(42+8)+\mathrm{i}(-6+56)}{9+16}$	A1 A1
	$=\frac{50+50\mathrm{i}}{25}=2+2\mathrm{i}$	A1 (4)
(d)		B1 B1 (2)
		(10 marks)

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Question number		Scheme		Marks
7.	(a)	$a = 4$		B1 (1)
	(b)	$y = 2a^{\frac{1}{2}}x^{\frac{1}{2}} \quad \Rightarrow \quad y' = a^{\frac{1}{2}}x^{-\frac{1}{2}}$	$y =$ and attempt y'	M1
		$y' = \frac{1}{t}$	sub $x = 4t^2$	M1
		Tangent is $\quad y - 8t = \frac{1}{t}\left(x - 4t^2\right)$		M1
		$yt = x + 4t^2 \qquad$ (✱)		A1cso (4)
	(c)	$x = -4$		B1ft
		$15t = -4 + 4t^2$	Substitute (–4, 15)	M1
		$4t^2 - 15t - 4 = 0$		
		$(4t+1)(t-4) = 0$	Attempt to solve	M1
		$t = 4$ or $-\frac{1}{4}$		A1
		$A = (64, 32) \quad B = (\frac{1}{4}, -2)$	M for attempt A or B	M1 A1 A1 (7)
				(12 marks)
8.	(a)	$1 + 2\text{i}$		B1 (1)
	(b)	$(x - 1 + 2\text{i})(x - 1 - 2\text{i})$ are factors of f(x)		M1
		so $x^2 - 2x + 5$ is a factor of f (x)		M1 A1
		f(x) = $(x^2 - 2x + 5)(2x - 1)$		M1 A1ft
		Third root is $\frac{1}{2}$		A1 (6)
	(c)	$p = 10 + 2$		M1
		$= 12$		A1 (2)
				(9 marks)

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Question number	Scheme	Marks
9. (a)	$\begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix}^1 = \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix}$, for $n = 1$, $\begin{pmatrix} n+1 & n \\ -n & 1-n \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix}$	B1
	$\therefore$ true for $n = 1$	
	Assume true for $n = k$,	
	$\begin{pmatrix} k+1 & k \\ -k & 1-k \end{pmatrix}\begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} 2k+2-k & k+1-0 \\ -2k-1+k & -k+0 \end{pmatrix}$	M1 A2/1/0
	$= \begin{pmatrix} (k+1)+1 & k+1 \\ -(k+1) & 1-(k+1) \end{pmatrix}$	M1 A1
	$\therefore$ true for $n = k + 1$ if true for $n = k$	
	$\therefore$ true for $n \in \mathbb{Z}^+$ by induction	A1 (7)
(b)	$f(1) = 4 + 6 - 1 = 9 = 3 \times 3$	B1
	$\therefore$ true for $n = 1$	
	Assume true for $n = k$, $f(k) = 4^k + 6k - 1$ is divisible by 3	
	$f(k + 1) = 4^{k+1} + 6(k + 1) - 1$	M1 A1
	$= 4\times4^k + 6(k + 1) - 1$	A1
	$f(k + 1) - f(k) = 3\times4^k + 6$	M1
	$\therefore$ $f(k + 1) = 3(4^k + 2) - f(k)$ which is divisible by 3	A1
	$\therefore$ true for $n = k + 1$ if true for $n = k$	
	$\therefore$ true for $n \in \mathbb{Z}^+$ by induction	A1 (7)
		(14 marks)

