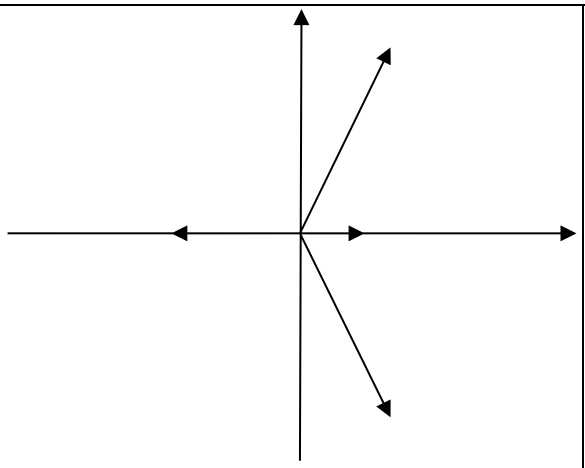
Question Number	Scheme	Notes	Marks
6	$f(z) = 12z^4 + Az^3 + Bz^2 + Cz - 306$ Allow work in x		
(a)	$(z =) 1 - 4i$	Correct conjugate seen anywhere	**B1**
			(1)
(b)	$z = 1 \pm 4i \Rightarrow (z - (1+4i))(z - (1-4i)) = \ldots \quad \{z^2 - 2z + 17\}$ or e.g., sum of roots $= \ldots \{2\}$, product of roots $= (1+4i)(1-4i) = \ldots \{17\} \Rightarrow \ldots \{z^2 - 2z + 17\}$ M1: Applies an appropriate strategy and finds a 3 term quadratic factor with real coefficients. Condone poor algebra provided there is a completed attempt using $1+4i$ and $1-4i$ A1: A correct 3 term quadratic factor. Could be just written down. Ignore if "= 0" or f(z) =...		**M1 A1**
			(2)
	Mark parts (c) and (d) together		
(c)	The other factor is $(4z \pm k)$	Sight of $(4z \pm k)$ as the other linear factor. See note below. No requirement to find k but do not award for just $4z$	**B1**
	e.g., $k \times -2 \times "17" = -306 \Rightarrow k = \ldots (9)$ $(Dz + E)("3z^3 - 8z^2 + 55z - 34") = f(z) \Rightarrow D = 4,\ E = \ldots$ Any appropriate method using $(4z \pm k)$ to obtain k seen. See note below		**M1**
	Note: If $(z \pm \frac{j}{4})$ is used then a multiplier of 4 must be recovered later to score marks		
	$\{f(z) =\}(z^2 - 2z + 17)(3z - 2)(4z + 9)$ oe e.g., $(z - (1+4i))(z - (1-4i))(3z - 2)(4z + 9)$ $12(z^2 - 2z + 17)(z - \frac{2}{3})(z + \frac{9}{4})$	All correct on one line. Factors in any order. Ignore irrelevant errors. Answer could just be written down.	**A1**
			(3)
(d)	$f(z) = (z^2 - 2z + 17)(3z - 2)(4z + 9) = \ldots$	Expands and collects terms or obtains values for all 3 constants via any credible method. If method unclear look for one of the correct values below	**M1**
	$f(z) = (12z^4) - 5z^3 + 148z^2 + 359z (-306)$ or $A = -5,\ B = 148,\ C = 359$	A1: 2 correct (with 3 found) A1: All 3 correct	**A1** **A1**
			(3)
(e)		B1: Conjugate pair (broadly symmetrical but anywhere in Q1 and Q4) **or** real pair (positive root closer to origin). **d**B1: All plotted such that the distance to the origin for the real positive root < the shortest distance to the y-axis for the complex roots **and** the positive real root positioned closer to the origin than the real negative root. Points or vectors/lines. Ignore root/axes labelling. These are not ft marks so do not award if their work clearly indicates they are using any roots which are not $1 \pm 4i$, $\frac{2}{3}$, $-\frac{9}{4}$ but ignore the labelling on the diagram	**B1** **dB1**
			(2)
			(Total 11 marks)