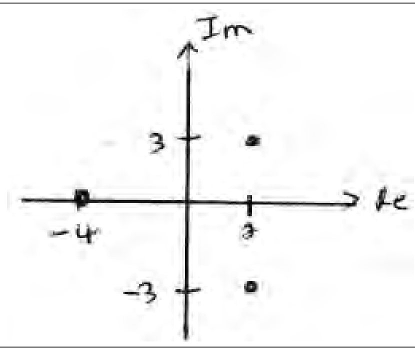
Question	Scheme	Marks	AOs
1(a)	$2+3i$	B1	1.1b
		(1)	
(b) (i)	$z*=2+3i$ so $z+z*=4$, $zz*=13$ $z+z*+\alpha=0 \Rightarrow \alpha=\ldots$ or $\alpha zz*=-52 \Rightarrow \alpha=-\frac{52}{"13"}=\ldots$ or $z^2-(\text{sum roots})z+(\text{product roots})=0$ or $\left(z-(2+3i)\right)\left(z-(2-3i)\right)=\ldots$ $\Rightarrow (z^2-4z+13)\underline{(z+4)} \Rightarrow z=\ldots$	M1	3.1a
	$z=2\pm 3\text{i},\ -4$	A1	1.1b
(ii)	$(z^2-4z+13)(z+4)$ expands the brackets to find value for a Or a = pair sum $=-4(2+3i+2-3i)+13=\ldots$ Or $f(-4)/f(2\pm 3i)=0 \Rightarrow\ldots\Rightarrow a=\ldots$	M1	1.1b
	$a=-3$	A1	2.2a
		(4)	
(c)		B1ft	1.1b
		(1)	
			(6 marks)

Notes:
(a) **B1:** $2 + 3i$
(b) **(i)** **M1:** A complete method to find the third root. E.g. forms the quadratic factor and uses this to find the linear factor leading to roots. Alternatively uses sum of roots = 0 or product of roots = ±52 (condone sign error) with their complex roots to find the third. Note they may have used the factor theorem to find *a* first, which is fine. If they have found *a* first, then the correct third root seen implies this mark. The method may be implied by the third root seen on the diagram. **A1:** Correct roots, all three must be clearly stated somewhere in (b), not just seen on a diagram in part (c). **(ii)** **M1:** Complete method to find a value for *a* e.g. multiplies out their quadratic and linear factors to find the coefficient of *z*, or uses pair sum, or uses factor theorem with one of the roots (may be done before finding the third root) but must reach a value for *a*. **A1:** Deduces the correct value of *a*. May be seen as the *z* coefficient in the cubic (need not be extracted, but if it is it must be correct).
(c) **B1ft:** Correctly plots all three roots following through their third root in part (b). Must be labelled with the "−4" further from *O* than 2, but don't be concerned about *x* and *y* scale. If correct look for one root on the negative real axis, with the other two symmetric about real axis in quadrants 1 and 4, but follow through their real root if positive. Accept (0,−4) labelled on the real axis in correct place as a label.