Question	Scheme	Marks	AOs
7	$z_2 = 2 - 3\text{i}$	B1	1.1b
	$(z_3 =)\ p - 3\text{i}$ and $(z_4 =)\ p + 3\text{i}$ May be seen in an Argand diagram	M1	3.1a
	$(z_3 =) -4 - 3\text{i}$ and $(z_4 =) -4 + 3\text{i}$ May be seen in an Argand diagram, but the complex numbers used in their method takes precedence	A1	1.1b
	$(z^2 - 4z + 13)(z^2 + 8z + 25)$ or $(z - (2 - 3\text{i}))(z - (2 + 3\text{i}))(z - (-4 - 3\text{i}))(z - (-4 + 3\text{i}))$ or $a = -[(2 - 3\text{i}) + (2 + 3\text{i}) + (-4 - 3\text{i}) + (-4 + 3\text{i})]$ and $b = (2 - 3\text{i})(2 + 3\text{i}) + (2 - 3\text{i})(-4 - 3\text{i}) + (2 - 3\text{i})(-4 + 3\text{i}) + (2 + 3\text{i})(-4 - 3\text{i}) + (2 + 3\text{i})(-4 + 3\text{i}) + (-4 - 3\text{i})(-4 + 3\text{i})$ and $c = -\left[(2 - 3\text{i})(2 + 3\text{i})(-4 - 3\text{i}) + (2 - 3\text{i})(2 + 3\text{i})(-4 + 3\text{i}) + (2 - 3\text{i})(-4 - 3\text{i})(-4 + 3\text{i}) + (2 + 3\text{i})(-4 - 3\text{i})(-4 + 3\text{i})\right]$ and $d = (2 - 3\text{i})(2 + 3\text{i})(-4 - 3\text{i})(-4 + 3\text{i})$ or Substitutes in one root from each conjugate pair and equates real and imaginary parts and solves simultaneously $(2 \pm 3\text{i})^4 + a(2 \pm 3\text{i})^3 + b(2 \pm 3\text{i})^2 + c(2 \pm 3\text{i}) + d = 0$ $(-4 \pm 3\text{i})^4 + a(-4 \pm 3\text{i})^3 + b(-4 \pm 3\text{i})^2 + c(-4 \pm 3\text{i}) + d = 0$	dM1	3.1a
	$a = 4, b = 6, c = 4, d = 325$ $\text{f}(z) = z^4 + 4z^3 + 6z^2 + 4z + 325$	A1 A1	1.1b 1.1b
		(6)	

(6 marks)

Notes:

B1: Seen $2 - 3\text{i}$

M1: Finds the third and fourth roots of the form $p \pm 3\text{i}$. May be seen in an Argand diagram

A1: Third and fourth roots are $-4 \pm 3\text{i}$. May be seen in an Argand diagram

dM1: Uses an appropriate method to find $\text{f}(z)$. If using roots of a polynomial at least 3 coefficients must be attempted.

A1: At least two of *a*, *b*, *c*, *d* correct

A1: All *a*, *b*, *c* and *d* correct

Note: Using roots $2 \pm 3\text{i}$ and $-2 \pm 3\text{i}$ leads to $z^4 + 10z^2 + 169$ Maximum score **B1 M1 A0 M1 A0 A0**