Question Number	Scheme	Marks
7(a)	$z=\dfrac{3+\left(k\sqrt{3}\right)\mathrm{i}}{2+\left(\sqrt{3}\right)\mathrm{i}}\times\dfrac{2-\left(\sqrt{3}\right)\mathrm{i}}{2-\left(\sqrt{3}\right)\mathrm{i}}$	M1
	$=\dfrac{6+\left(2k\sqrt{3}\right)\mathrm{i}-\left(3\sqrt{3}\right)\mathrm{i}+3k}{7}$	dM1
	$=\dfrac{6+3k}{7}+\dfrac{\sqrt{3}\left(2k-3\right)}{7}\mathrm{i}$	A1
		(3)
(b)		
	$\dfrac{\sqrt{3}\left(2k-3\right)}{6+3k}=\dfrac{\sqrt{3}}{3}$	M1
	$6k-9=6+3k\Rightarrow k=5$	M1A1
	$\Rightarrow z=3+\left(\sqrt{3}\right)\mathrm{i}\ \Rightarrow\left\|z\right\|=\sqrt{3^2+\left(\sqrt{3}\right)^2}\ =\ldots$	M1
	$\sqrt{12}\quad\text{or}\quad 2\sqrt{3}$	A1
		(5)
Alt	$z=r\left(\cos\dfrac{\pi}{6}+\mathrm{i}\sin\dfrac{\pi}{6}\right)=r\dfrac{\sqrt{3}}{2}+\dfrac{1}{2}r\,\mathrm{i}$	M1
	$\Rightarrow 6+3k=\dfrac{7r}{2}\sqrt{3},\quad\sqrt{3}(2k-3)=\dfrac{7r}{2}$	M1A1
	$\Rightarrow k=\dfrac{1}{3}\left(\dfrac{7r}{2}\sqrt{3}-6\right)\Rightarrow r=\dfrac{2}{7}\left(\sqrt{3}\left(\dfrac{2}{3}\left(\dfrac{7r}{2}\sqrt{3}-6\right)-3\right)\right)\Rightarrow r=\ldots$	M1
	$r=2\sqrt{3}$	A1
		(5)
		Total 8

Notes

(a)

M1: A correct rationalising multiplier seen or implied

dM1: Obtains denominator of 7 (need not be fully simplified) **and** numerator of the correct form with the i^2 processed to give two real terms and two imaginary terms.

A1: Any correct expression in $a + bi$ form (with single i term) or expressions for a and b. Terms in i must be factored out.

(b)

M1: Uses their $\dfrac{b}{a}=\dfrac{\sqrt{3}}{3}$ or $\dfrac{1}{\sqrt{3}}$ to form an equation in k. Condone if by error only one component of z contained a k. M0 if they leave i in the equation and never recover but allow if the later realise it should not be there and drop the i.

M1: Solves for k from an equation that had at least two k's in (both components of z must have been in terms of k). Must achieve a real value, but accept any real value following a suitable equation having been set up..

A1: Correct k Allow from an incorrect denominator in (a) if all else was correct.

M1: Correct method to find a value for $|z|$ using their real k. E.g. uses k to find z and applies modulus, or via use of the numerator and denominator of original z and taking ratio of moduli, or may find $|z|$ in

terms of k first and then substitute for k. Must be correct application of the modulus in whichever method.

A1: Either correct exact value

Alt:

M1: Attempts to evaluate the polar form using $\arg z = \frac{\pi}{6}$ with evaluated trig terms.

M1: Equates coefficients to produce two equations in r and k.

A1: Correct equations.

M1: Solves the equations to find the value for r (if k is found first they must proceed to find r to score this mark.

A1: Correct answer, either form as per main scheme.