Qn No	Scheme	Notes	Marks
2. (a)	$\frac{z_2 z_3}{z_1} = \frac{(p-\mathrm{i})(p+\mathrm{i})(2+\mathrm{i})}{(2-\mathrm{i})(2+\mathrm{i})}$	Multiply top and bottom by complex conjugate of their denominator. (The two M's may be scored if the given numbers are wrongly placed.)	M1
	$= \frac{(p^2+1)(2+\mathrm{i})}{5}$	Simplifies numerator with evidence that $\mathrm{i}^2 = -1$ and denominator real. Accept any equivalent form in the numerator as long as there are not i^2 terms if expanded.	M1
	$= \frac{2(p^2+1)}{5} + \frac{(p^2+1)}{5}\mathrm{i}$	Correct real +imaginary form with i factored out. Accept as single fraction with numerator in correct form. Accept '$a =$' and '$b =$'.	A1
			(3)
ALT	$\frac{z_2 z_3}{z_1} = \frac{(p-\mathrm{i})(p+\mathrm{i})}{(2-\mathrm{i})} = a + b\mathrm{i}$ $p^2+1 = (a+b\mathrm{i})(2-\mathrm{i})$ $\left.\begin{array}{l} 2a+b = p^2+1 \\ 2b-a = 0 \end{array}\right\}$	Cross multiplies by $2-\mathrm{i}$ (or their denominator), expands and equates real and imaginary parts. (The two M's may be scored if the given numbers are wrongly placed.)	M1
	$\left.\begin{array}{l} 2a+b = p^2+1 \\ 2b-a = 0 \end{array}\right\} \Rightarrow a = ..., b = ...$	Attempt to solve their equations.	M1
	$a + b\mathrm{i} = \frac{2(p^2+1)}{5} + \frac{(p^2+1)}{5}\mathrm{i}$	Correct real +imaginary form with i factored out. Accept as single fraction with numerator in correct form. Accept '$a =$' and '$b =$'.	A1
			(3)
2(b)	$\left\|\frac{z_2 z_3}{z_1}\right\|^2 = \frac{4(p^2+1)^2}{25} + \frac{(p^2+1)^2}{25}$	Correct attempt at the modulus or modulus squared. Accept with their answers to part (a). Any erroneous i or i^2 is M0.	M1
	$\frac{4(p^2+1)^2}{25} + \frac{(p^2+1)^2}{25} = \left(2\sqrt{5}\right)^2$	Their $\left\|\frac{z_2 z_3}{z_1}\right\|^2 = \left(2\sqrt{5}\right)^2$	dM1
	$(p^2+1)^2 = 100 \Rightarrow p = \pm 3$	Attempt to solve and achieves $p = ...$ (may be scored from use of $\|..\|^2 = 2\sqrt{5}$) $p = \pm 3$	M1 A1
			(4)
ALT 1	$\left\|\frac{z_2 z_3}{z_1}\right\| = 2\sqrt{5} \Rightarrow \|z_2 z_3\| = \sqrt{4+1} \times 2\sqrt{5}$	Cross multiplies and attempts $\|z_1\|$	M1
	$\Rightarrow \|z_2\|^2 = \sqrt{4+1} \times 2\sqrt{5} \Rightarrow p^2+1 = ...$	Attempts $\|z_2 z_3\|$ either directly or using $\left\|z_2 z_2^*\right\| = \|z_2\|^2$ to get an equation in p.	dM1
	$(p^2+1) = 10 \Rightarrow p = \pm 3$	Attempt to solve and achieves $p = ...$ $p = \pm 3$	M1 A1
			(4)
			Total 7