Question Number	Scheme	Notes	Marks
4.	$(z-2\mathrm{i})(z^*-2\mathrm{i})=21-12\mathrm{i}$		
	$z^*=x-\mathrm{i}y$		B1
	$(x+\mathrm{i}y-2\mathrm{i})(x-\mathrm{i}y-2\mathrm{i})=....$ $=x^2-x(y+2)\mathrm{i}+x(y-2)\mathrm{i}+y^2-4$ $=x^2+y^2-4-4x\mathrm{i}$		M1
	$x^2+y^2-4=21$ and $4x=12$		M1
	$4x=12\Rightarrow x=....$		M1
	$x=3$		A1
	$y=\pm4$		A1
			(6)
			Total 6
Alternative 1			
	$(z-2\mathrm{i})(z^*-2\mathrm{i})=zz^*-2\mathrm{i}(z+z^*)-4$		M1
	$=(x+\mathrm{i}y)(x-\mathrm{i}y)-2\mathrm{i}(x+\mathrm{i}y+x-\mathrm{i}y)-4$		B1
	$=x^2+y^2-4x\mathrm{i}-4$ $x^2+y^2-4=21$ and $4x=12$		M1
	$4x=12\Rightarrow x=....$		M1
	$x=3$		A1
	$y=\pm4$		A1
Alternative 2			
	$(z-2\mathrm{i})(z^*-2\mathrm{i})=zz^*-2\mathrm{i}(z+z^*)-4$ $zz^*-2\mathrm{i}(z+z^*)-4=21-12\mathrm{i}$		M1
	$zz^*-4=21,\quad 2(z+z^*)=12$		M1
	$z^2-6z+25=0\left(\text{or}\left(z^*\right)^2-6z^*+25=0\right)$		B1
	$z^2-6z+25=0\left(\text{or}\left(z^*\right)^2-6z^*+25=0\right)$ $\Rightarrow z=\dfrac{6\pm\sqrt{36-100}}{2}\Rightarrow z=\cdots$ or $(z-3)^2+16=0\Rightarrow z=\cdots$		M1
	$x=3$		A1
	$y=\pm4$		A1

	Alternative 3	
	$(z-2\mathrm{i})(z^*-2\mathrm{i}) = zz^*-2\mathrm{i}(z+z^*)-4$ $zz^*-2\mathrm{i}(z+z^*)-4 = 21-12\mathrm{i}$	M1
	$zz^*-4 = 21, \quad 2(z+z^*) = 12$	M1
	$x^2+y^2-4 = 21$ and $4x = 12$	B1
	$4x = 12 \Rightarrow x = ...$	M1
	$x = 3$	A1
	$y = \pm 4$	A1

Notes

(a)

B1: Correct complex conjugate.

M1: Substitutes for z and their z^* and attempts to expand. No need to check individual terms, but look for any attempt to multiply out the brackets

M1: Compares real **and** imaginary parts.

M1: Solves to obtain at least one value of x or y. There must be no clear use of a calculator.

A1: $x = 3$

A1: $y = \pm 4$ (accept e.g. $z = 3 \pm 4\mathrm{i}$)

Alternative 1:

M1: Attempts to expand. No need to check individual terms, but look for any attempt to multiply out the brackets

B1: $z^* = x - \mathrm{i}y$ (may be implied).

M1: Compares real **and** imaginary parts.

M1: Solves to obtain at least one value of x or y. There must be no clear use of a calculator.

A1: $x = 3$

A1: $y = \pm 4$ (accept e.g. $z = 3 \pm 4\mathrm{i}$)

Alternative 2:

M1: Attempts to expand. No need to check individual terms, but look for any attempt to multiply out the brackets

M1: Compares real and imaginary parts.

B1: Correct quadratic.

M1: Solves (must see a method as strict calculator warning-see general rules on solving a 3TQ) to obtain at least one value of z or z^*

A1: $x = 3$

A1: $y = \pm 4$ (accept e.g. $z = 3 \pm 4\mathrm{i}$)

Alternative 3:

M1: Attempts to expand. No need to check individual terms, but look for any attempt to multiply out the brackets

M1: Compares real **and** imaginary parts.

B1: Use of $z^* = x - \mathrm{i}y$ Implied by use of $zz^* = x^2 + y^2$ or $2(z + z^*) = 4x$

M1: Solves to obtain at least one value of x or y. There must be no clear use of a calculator.

A1: $x = 3$

A1: $y = \pm 4$ (accept e.g. $z = 3 \pm 4\mathrm{i}$)