

14. (a) Find real numbers  $a$  and  $b$  such that  $(a + bi)^2 = -3 - 4i$ .  
(b) Hence solve the equation:  $z^2 + i\sqrt{3}z + i = 0$  [6 marks]

15. Given that  $|z| = \sqrt{3}$ , solve the equation  $2z^* + \frac{3}{iz} = \sqrt{15}$ .  
[5 marks]

16. Given that  $|z| = 3$ , solve the equation  $z - \frac{12i}{z^*} = 5$ . [5 marks]

18. If  $z = x + iy$ , find the real and the imaginary parts of  $\frac{z}{z+1}$  in terms of  $x$  and  $y$ , simplifying your answers as far as possible. [6 marks]

19.  $w = \frac{kz}{z^2 + 1}$  where  $z^2 \neq -1$ . If  $\text{Im}(w) = \text{Im}(k) = 0$  and  $\text{Im}(z) \neq 0$   
prove that  $|z| = 1$ . [6 marks]