Assignment-2

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Q) if a+ib = $\frac{x+iy}{x-iy}$
prove that $a^2 + b^2$ = 1 and $\frac{b}{a} = \frac{2xy}{x^2-y^2}$

SOLUTION

let us solve the equation
The equation is given by

$$a + ib = \frac{x + iy}{x - iy} \tag{1}$$

multiplying x+iy on both numerator and denominator

$$a + ib = \frac{x^2 - y^2 + 2ixy}{x^2 + y^2} \tag{2}$$

$$a + ib = \frac{x^2 - y^2}{x^2 + y^2} + i\frac{2xy}{x^2 + y^2} \tag{3}$$

$$\tag{4}$$

so from the above we get a = $\frac{x^2-y^2}{x^2+y^2}$ and b =$\frac{2xy}{x^2+y^2}$

$$\implies so\frac{b}{a} = \frac{2xy}{x^2 - y^2} \tag{5}$$

$$a^2 = \frac{x^4 + y^4 - 2x^2y^2}{x^4 + y^4 + 2x^2y^2} \tag{6}$$

$$b^2 = \frac{4x^2y^2}{x^4 + y^4 + 2x^2y^2} \tag{7}$$

$$a^2 + b^2 = \frac{x^4 + y^4 - 2x^2y^2}{x^4 + y^4 + 2x^2y^2} + \frac{2x^2y^2}{x^4 + y^4 + 2x^2y^2} \tag{8}$$

$$\tag{9}$$

$\implies$ a$^2 + b^2 = \frac{x^4+y^4+2x^2y^2}{x^4+y^4+2x^2y^2} = 1$