Some basic equations for complex numbers

1. Multiplication of complex numbers

$$z = cos heta + i sin heta \ w = cos lpha + i sin lpha \ zw = (cos lpha + i sin lpha)(cos heta + sin heta) \ = cos heta cos lpha + i sin lpha cos lpha - sin heta sin lpha \ = cos(heta + lpha) + i sin(lpha + heta) \ arg(zw) = arg(z) + arg(w) \ z_1 z_2 = r_1 r_2 [cos(heta_1 + heta_2) + i sin(heta_1 heta_2)]$$

2. Division of complex numbers

$$egin{aligned} |rac{1}{z}|&=rac{1}{|z|}\ rac{1}{z}&=rac{x-iy}{x+iy}\ arg(rac{1}{z})&=-arg(z)\ rac{z_1}{z_2}&=rac{r_1}{r_2}[cos(heta_1- heta_2)+isin(heta_1- heta_2)] \end{aligned}$$

3. De Moivre's theorem

$$z^n = r^n(cosn\theta + isin\theta)$$

4.nth root of a complex number

$$z^{rac{1}{n}}=[r(cos heta+isin heta)]^{rac{1}{n}}=r^{rac{1}{n}}[cos(rac{ heta+2k\pi}{n})+isin(rac{ heta+2k\pi}{n})]$$