Contents

0.1 Polar co-ordinates

0.1.1 All complex numbers can be shown in polar form

Consider a complex number

$z = a + bi$

We can write this as:

$z = r\cos(\theta) + ir\sin(\theta)$

0.1.2 Polar forms are not unique

Because the functions loop:

$ae^{i\theta} = a(\cos(\theta) + i\sin(\theta))$

$ae^{i\theta} = a(\cos(\theta + n\tau) + i\sin(\theta + n\tau))$

$ae^{i\theta} = ae^{i\theta + n\tau}$

Additionally:

$ae^{i\theta} = a(\cos(\theta) + i\sin(\theta))$

$ae^{i\theta} = a(\cos(\theta) + i\sin(\theta))$

$ae^{i\theta} = -a(\cos(\theta) - i\sin(\theta))$

$ae^{i\theta} = -a(\cos(\theta + \frac{\pi}{2}) + i\sin(\theta + \frac{\pi}{2}))$

0.1.3 Real and imaginary parts of a complex number in polar form

We can extract the real and imaginary parts of this number.

$Re(z) := r\cos(\theta)$

$Im(z) := r\sin(\theta)$

Alternatively:

$Re(z) = r\frac{e^{i\theta} + e^{-i\theta}}{2}$

$Im(z) = r\frac{e^{i\theta} - e^{-i\theta}}{2i}$