

MATH425 Lecture 2

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1 Complex numbers - Plotting

imaginary numbers can be plotted on an extension of \mathbb{R} analagous to the cartesian plane in which an imaginary axis extends out from \mathbb{R} .

Complex numbers can also be plotted using polar coordinates with the length of r as the absolute value of some complex number Z

$$r = |z| = \sqrt{x^2 + y^2}$$

Also represented as :

$$z = x + iy = r(\cos(\theta) + i\sin(\theta)) = re^{i\theta}$$

1.1 Example

Convert $1+i$ to a polar form

Convert $z = e^{i\pi/2}$ to $z=a+bi$

Find $e^{\pi i} + 1$

$$\begin{aligned} 1 + i &= \sqrt{2}e^{i\pi/4} = (\sqrt{2}, \frac{\pi}{4}) \\ z = e^{i\pi/2} &= \cos(\frac{\pi}{2}) + \sin(\frac{\pi}{2})i \\ e^{\pi i} + 1 &= 0 \end{aligned}$$

2 Rotating a complex numbers by τ radians

Let f be the function that rotates $z = re^{i\theta}$ by τ counter clockwise.

$$f(z) = re^{i(\theta+\tau)} = ze^{i\tau}$$