

## Convert the complex number $1 + i$ into polar form then exponential form

To convert the complex number  $1 + i$  into polar form and then exponential form, we follow these steps:

### 1. Polar Form

The polar form of a complex number  $a + bi$  is given by:

$$r(\cos(\theta) + i\sin(\theta))$$

Where:

- $r$  is the magnitude of the complex number
- $\theta$  is the argument (or angle) of the complex number

#### Magnitude $r$ :

$$r = \sqrt{a^2 + b^2}$$

For  $1 + i$ ,  $a = 1$  and  $b = 1$ :

$$r = \sqrt{1^2 + 1^2} = \sqrt{1 + 1} = \sqrt{2}$$

#### Argument $\theta$ :

$$\theta = \tan^{-1}(b/a)$$

For  $1 + i$ :

$$\theta = \tan^{-1}(1) = \pi/4$$

Thus, the polar form is:

$$\sqrt{2} (\cos(\pi/4) + i\sin(\pi/4))$$

### 2. Exponential Form

The exponential form of a complex number is given by:

$$re^{i\theta}$$

Using the values of  $r$  and  $\theta$  calculated:

$$\sqrt{2} e^{i\pi/4}$$

### Summary

Polar Form:  $\sqrt{2} (\cos(\pi/4) + i\sin(\pi/4))$

Exponential Form:  $\sqrt{2} e^{i\pi/4}$