



Complex Numbers Ex 13.4 Q1(i)

The polar form of a complex number $z = x + iy$, is given by $z = |z|(\cos \theta + i \sin \theta)$ where,

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

$$\arg(z) = \theta = \tan^{-1}\left(\frac{b}{a}\right)$$

$$\text{let } z = 1 + i$$

$$\begin{aligned} |z| &= \sqrt{1^2 + 1^2} \\ &= \sqrt{2} \end{aligned}$$

$\therefore x, y > 0$, so θ lies in first quadrant

Now,

$$\begin{aligned} \theta &= \tan^{-1}\left(\frac{b}{a}\right) \\ &= \tan^{-1}\left(\frac{1}{1}\right) \quad [\because a = 1 \text{ and } b = 1] \\ &= \tan^{-1}(1) \\ &= \tan^{-1}\left(\frac{\tan \pi}{4}\right) \quad \left(\because \frac{\tan \pi}{4} = 1\right) \\ &= \frac{\pi}{4} \quad (\because \tan^{-1}(\tan x) = x) \end{aligned}$$

$$\Rightarrow \arg(z) = \frac{\pi}{4}$$

$$\text{Polar form of } 1 + i \text{ is given by } z = \sqrt{2} \left(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4} \right)$$

Complex Numbers Ex 13.4 Q1(ii)

The polar form of a complex number $z = x + iy$, is given by $z = |z|(\cos \theta + i \sin \theta)$

where,

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

$$\arg(z) = \theta = \tan^{-1}\left(\frac{y}{x}\right)$$

$$\text{let } z = \sqrt{3} + i$$

$$\begin{aligned}|z| &= \sqrt{(\sqrt{3})^2 + (1)^2} \\ &= \sqrt{3+1} \\ &= \sqrt{4} \\ &= 2\end{aligned}$$

$$\because x = \sqrt{3} > 0 \text{ \& } y = 1 > 0,$$

$\therefore \theta$ lies in first quadrant

Hence

$$\begin{aligned}\theta = \arg(z) &= \tan^{-1}\left(\frac{y}{x}\right) \\ &= \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) \\ &= \tan^{-1}\left(\frac{\tan \frac{\pi}{6}}{1}\right) \\ &= \tan^{-1}\left\{\because \tan^{-1}(\tan x) = x\right\}\end{aligned}$$

polar form is given by $z = |z|(\cos \theta + i \sin \theta)$

$$\text{i.e. } z = 2\left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6}\right)$$

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