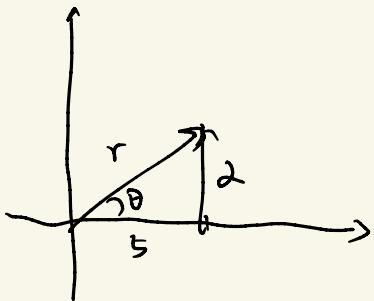


## LAB EXERCISE 11

$$1) \underline{5+2j}$$



$$r = \sqrt{5^2 + 2^2} = \sqrt{29}$$

$$\tan^{-1} \frac{2}{5} = \theta$$

$$\theta = 0.3805$$

$$\text{Polar form} = \sqrt{29} (\cos(0.3805) + j \sin(0.3805))$$

$$\text{Exponential form} = \sqrt{29} e^{j0.3805}$$

$$\underline{5-2j} \quad r = \sqrt{29}.$$

$$\tan^{-1} \left( \frac{-2}{5} \right) = -0.3805$$

$$\text{Polar form} = \sqrt{29} (\cos(-0.3805) + j \sin(-0.3805))$$

$$\text{Exponential form} = \sqrt{29} e^{j(-0.3805)}$$

$$\underline{6+4j} \quad r = \sqrt{6^2 + 4^2} = \sqrt{36+16} = \sqrt{52}$$

$$\theta = \tan^{-1} \left( \frac{4}{6} \right) = 0.588$$

$$\text{Polar form} = \sqrt{52} (\cos(0.588) + j \sin(0.588))$$

$$\text{Exponential form} = \sqrt{52} e^{j0.588}$$

$$\underline{5-5j} \quad r = \sqrt{50}$$

$$\theta = \tan^{-1}(-1) = -0.785$$

$$\text{Polar form} : \sqrt{50} (\cos(-0.785) + j \sin(-0.785))$$

$$\text{Exponential form} : \sqrt{50} e^{j(-0.785)}$$

$$\underline{2+3j} \quad r = \sqrt{4+9} = \sqrt{13}.$$

$$\theta = \tan^{-1}\left(\frac{3}{2}\right) = 0.983.$$

$$\text{Polar form} : \sqrt{13} (\cos(0.983) + j \sin(0.983))$$

$$\text{Exponential form} : \sqrt{13} e^{j0.983}$$

$$\begin{aligned} 2) 2 e^{\frac{\pi}{3}j} &= 2\left(\cos\frac{\pi}{3} + j \sin\frac{\pi}{3}\right) \\ &= 2\left(0.5 + j\frac{\sqrt{3}}{2}\right) \\ &= 1 + \sqrt{3}j \end{aligned}$$

$$\begin{aligned} -4 e^{\frac{\pi}{6}j} &= 4\left(\cos\frac{\pi}{6} + j \sin\frac{\pi}{6}\right) \\ &= 4\left(\frac{\sqrt{3}}{2} + \frac{1}{2}j\right) \\ &= \sqrt{3} + 2j \end{aligned}$$

$$5 \left( \cos \frac{\pi}{3} + j \sin \frac{\pi}{3} \right)$$

$$= 5 \left( \frac{1}{2} + j \frac{\sqrt{3}}{2} \right)$$

$$= \frac{5}{2} + \frac{5\sqrt{3}}{2} j$$

$$2 \left( \cos \frac{\pi}{4} + j \sin \frac{\pi}{4} \right)$$

$$= 2 \left( \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} j \right)$$

$$= \sqrt{2} + \sqrt{2} j$$

$$4) \frac{z_1}{z_2}$$

Rectangular form.

$$= \frac{2+3j}{-1+4j}$$

$$= \frac{(-2+12) + (-3-8)j}{1+16}$$

$$= \frac{10-11j}{17}$$

Polar form.

$$\frac{\sqrt{13}}{\sqrt{17}} \left( \cos(0.983 + 1.326) + j \sin(0.983 + 1.326) \right)$$

$$= \frac{\sqrt{13}}{\sqrt{17}} \left( \cos(2.309) + j \sin(2.309) \right)$$

$$= \frac{10}{17} - j \frac{11}{17}$$

Exponential form.

$$\frac{\sqrt{13}}{\sqrt{17}} e^{j(2.309)}$$

$$= \frac{\sqrt{13}}{\sqrt{17}} \left( \cos 2.309 + j \sin 2.309 \right)$$

$$3) z_1 = 2+3j \quad z_2 = -1+4j$$

1) Z1 Polar form

$$\sqrt{13} \left( \cos 0.983 + j \sin 0.983 \right)$$

Exponential form

$$= \sqrt{13} e^{j0.983}$$

2) Z2 Polar form.

$$\sqrt{17} \left( \cos(-1.326) + j \sin(-1.326) \right)$$

Exponential form.

$$= \sqrt{17} e^{j(-1.326)}$$

3)  $z_1 z_2$  Rectangular form.

$$z_1 z_2 = (2+3j)(-1+4j)$$

$$= (-2-12) + (8+(-3))j$$

$$= -14 + 5j$$

Polar form.

$$\sqrt{13} \times \sqrt{17} \left( \cos(0.983 - 1.326) + j \sin(0.983 - 1.326) \right)$$

$$= \sqrt{221} \left( \cos(-0.343) + j \sin(-0.343) \right)$$

$$= (14 + (-5))j$$

Exponential form

$$\sqrt{13}\sqrt{17} e^{j(0.983 - 1.326)}$$

$$= \sqrt{221} \left( \cos(-0.343) + j \sin(-0.343) \right)$$

They are equal.

They can be shown equal