

1) Phasor Addition

$$V_1 = a_1 + j b_1 \quad V_2 = a_2 + j b_2$$

$$\begin{aligned} V_1 + V_2 &= a_1 + j b_1 + a_2 + j b_2 \\ &= (a_1 + a_2) + j (b_1 + b_2) \end{aligned}$$

$$\text{Ex: } 3 + j4 + 5 + j7 = 8 + j11$$

$$V_1 = |V_1| \angle \theta_1 \quad V_2 = |V_2| \angle \theta_2$$

$$V_1 + V_2 = |V_1| \angle \theta_1 + |V_2| \angle \theta_2$$

$$\text{Ex: } 10 \angle 0^\circ + 20 \angle 60^\circ$$

$$= 10 (\cos 0 + j \sin 0) + 20 (\cos 60^\circ + j \sin 60^\circ)$$

$$= 10 (1 + j0) + 20 \left(\frac{1}{2} + j \frac{\sqrt{3}}{2} \right)$$

$$= 20 + j 10\sqrt{3}$$

$$= 26.46 \angle 40.9^\circ$$

(II) Phasor Subtraction

$$V_1 = a_1 + j b_1 \quad V_2 = a_2 + j b_2$$

$$\begin{aligned} V_1 - V_2 &= (a_1 + j b_1) - (a_2 + j b_2) \\ &= (a_1 - a_2) + j (b_1 - b_2) \end{aligned}$$

$$V_1 = |V_1| \angle \theta_1 \quad V_2 = |V_2| \angle \theta_2$$

$$V_1 - V_2 = |V_1| \angle \theta_1 - |V_2| \angle \theta_2$$

(III) Phasor Multiplication

$$V_1 = |V_1| \angle \theta_1 \quad V_2 = |V_2| \angle \theta_2$$

$$V_1 \times V_2 = |V_1| |V_2| \angle \theta_1 + \theta_2$$

$$3 \angle 50^\circ \times 6 \angle 10^\circ = 18 \angle 60^\circ$$

$$j^2 = -1$$

$$(3 + j4) \times (5 + j6) = \frac{15 + j18}{+ j20 - 24} = \underline{\underline{-9 + j38}}$$

(IV)

Division

$$V_1 = |V_1| \angle \theta_1$$

$$V_2 = |V_2| \angle \theta_2$$

$$\frac{V_1}{V_2} = \left| \frac{V_1}{V_2} \right| \angle \theta_1 - \theta_2$$

$$\frac{3 \angle 50^\circ}{2 \angle 20^\circ} = 1.5 \angle 30^\circ$$

$$(a+ib)(a-ib) = a^2 + b^2$$

$$j4 \times -j2 = 8$$

$$\frac{3+j4}{1+j2} = \frac{-5+j10}{1+j2}$$

$$= \frac{(3+j4)(1-j2)}{(1+j2)(1-j2)} = \frac{3(1-j2) + j4(1-j2)}{1^2 + 2^2}$$

$$= \frac{3 - j6 + j4 + 8}{5}$$

$$= \frac{11 - j2}{5}$$

$$= \frac{11}{5} - j\frac{2}{5}$$

$$= 2.2 - j0.4$$

$$\underline{\underline{|V_1| \angle \theta_1}}$$

Q.1

$$i_1 = \frac{10 \sqrt{2} \angle 45^\circ}{10 \sqrt{2} \angle 45^\circ + 10 \angle 0^\circ} = 20 \angle 10^\circ$$

Q. 1

$$i_1 = \underbrace{20\sqrt{2} \sin(\omega t + 60^\circ)} = 20 \angle 60^\circ$$

find the constant current rms value.

$$\begin{aligned} \vec{C} = \vec{i}_1 + \vec{i}_2 &= 10 \angle 0^\circ + 20 \angle 60^\circ \\ &= 37.42 \angle 40.9^\circ \end{aligned}$$

Q. 2

$$A = \underbrace{5 + j5}_{\downarrow 5\sqrt{2} \angle 45^\circ} \quad B = 50 \angle 40^\circ \quad C = \underbrace{4 + j0}_{\downarrow 4 \angle 0^\circ}$$

$$\frac{AB}{C} = \frac{5\sqrt{2} \angle 45^\circ \times 50 \angle 40^\circ}{4 \angle 0^\circ}$$

$$= \frac{250\sqrt{2} \angle 85^\circ}{4 \angle 0^\circ}$$

$$= 88.37 \angle 85^\circ$$