

**Ex:** Given  $\omega = 200$  rad/sec, write inverse phasors for each of the following signals:

- a)  $\mathbf{I} = 6e^{j45^\circ}$  A
- b)  $\mathbf{V} = j9$  V
- c)  $\mathbf{I} = -2$  A
- d)  $\mathbf{V} = 6(1 + j)e^{j45^\circ}$  V
- e)  $\mathbf{I} = e^{3+j45^\circ}$  A =  $e^3 \angle 45^\circ$  A

**SOL'N:** a) The magnitude is the magnitude of  $\cos(\omega t)$ , and the angle in the exponent is the phase shift of the time-domain waveform.

$$P^{-1}[\mathbf{I} = 6e^{j45^\circ} \text{ A}] = 6 \cos(\omega t + 45^\circ) \text{ A}$$

b) We first put the phasor in pure polar form.

$$P^{-1}[\mathbf{V} = j9 \text{ V}] = P^{-1}[e^{j90^\circ} 9 \text{ V}] = P^{-1}[9e^{j90^\circ} \text{ V}] = 9 \cos(\omega t + 90^\circ) \text{ V}$$

**NOTE:**  $P^{-1}[j] = \cos(\omega t + 90^\circ) = -\sin(\omega t)$

c) A minus sign is equivalent to a  $\pm 180^\circ$  phase shift.

$$P^{-1}[\mathbf{I} = -2 \text{ A}] = P^{-1}[e^{j180^\circ} 2 \text{ A}] = P^{-1}[2e^{j180^\circ} \text{ A}] = 2 \cos(\omega t + 180^\circ) \text{ A}$$

d) We multiply terms in polar form.

$$P^{-1}[\mathbf{V} = 6(1 + j)e^{j45^\circ} \text{ V}] = P^{-1}[6\sqrt{2}e^{j45^\circ} e^{j45^\circ} \text{ V}] = P^{-1}[6\sqrt{2}e^{j90^\circ} \text{ V}]$$

or

$$P^{-1}[\mathbf{V}] = P^{-1}[6\sqrt{2}e^{j45^\circ} e^{j45^\circ} \text{ V}] = 6\sqrt{2} \cos(\omega t + 90^\circ) \text{ V}$$

e) The real exponent yields the magnitude.

$$P^{-1}[\mathbf{I} = e^{3+j45^\circ} \text{ A} = e^3 \angle 45^\circ \text{ A}] = e^3 \cos(\omega t + 45^\circ) \text{ A}$$