Ex: Given ω = 1 M rad/sec, write inverse phasors for each of the following signals:

a) $\mathbf{I} = 6e^{j45°}$ A

b) $\mathbf{V} = j9$ V

c) $\mathbf{I} = -2$ A

d) $\mathbf{V} = 6(1+j)e^{j45°}$ V

e) $\mathbf{I} = e^{3+j45°}$ A $= e^{3}\angle 45°$ A

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

$$\mathrm{P}^{-1}\left[\mathbf{I} = 6e^{j45°}\ \mathrm{A}\right] = 6\cos(\omega t + 45°)\ \mathrm{A} = 6\cos(1\mathrm{M}t + 45°)\ \mathrm{A}$$

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

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

or

$$\mathrm{P}^{-1}\left[\mathbf{V} = j9\ \mathrm{V}\right] = 9\cos(1\mathrm{M}t + 90°)\ \mathrm{V}$$

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

c) A minus sign is equivalent to a ±180° phase shift.

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

or

$$\mathrm{P}^{-1}\left[\mathbf{I} = -2\ \mathrm{A}\right] = 2\cos(1\mathrm{M}t + 180°)\ \mathrm{A}$$

d) We multiply terms in polar form.

$$\mathrm{P}^{-1}\left[\mathbf{V} = 6(1+j)e^{j45°}\ \mathrm{V}\right] = \mathrm{P}^{-1}\left[6\sqrt{2}e^{j45°}e^{j45°}\ \mathrm{V}\right] = \mathrm{P}^{-1}\left[6\sqrt{2}e^{j90°}\ \mathrm{V}\right]$$

or

$$\mathrm{P}^{-1}\left[\mathbf{V}\right] = 6\sqrt{2}\cos(\omega t + 90°)\ \mathrm{V} = 6\sqrt{2}\cos(1\mathrm{M}t + 90°)\ \mathrm{V}$$

e) The real exponent yields the magnitude.

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

or

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