HOMEWORK #16 prob 5 solution

EX: Given ω = 200 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) $\mathbf{I} = e^{3+j45°}\text{ A} = e^{3}\angle 45°$ 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.

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

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

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

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

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

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

d) We multiply terms in polar form.

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

or

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

e) The real exponent yields the magnitude.

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