HOMEWORK #13 solution prob 5

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

a) $\mathbf{I} = 12e^{j30°}$ A

b) $\mathbf{V} = -j$ V

c) $\mathbf{I} = -7$ A

d) $\mathbf{V} = 4(\sqrt{3} + j)e^{j60°}$ V

e) $\mathbf{I} = e^{-\pi - j30°}$ 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.

$$\mathrm{P}^{-1}\left[\mathbf{I} = 12e^{j30°} \text{ A}\right] = 12\cos(\omega t + 30°) \text{ A}$$

b) One way to proceed is to first put the phasor in pure polar form.

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

NOTE: We could also say $\mathrm{P}^{-1}[-j \text{ V}] = \sin(\omega t) \text{ V}$ since $\cos(\omega t - 90°) = \sin(\omega t)$

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

$$\mathrm{P}^{-1}\left[\mathbf{I} = -7 \text{ A}\right] = \mathrm{P}^{-1}\left[e^{j180°} 7 \text{ A}\right] = \mathrm{P}^{-1}\left[7e^{j180°} \text{ A}\right] = 7\cos(\omega t + 180°) \text{ A}$$

d) We multiply terms after converting them to polar form.

$$\mathrm{P}^{-1}\left[\mathbf{V} = 4(\sqrt{3} + j)e^{j60°} \text{ V}\right] = \mathrm{P}^{-1}\left[4 \cdot 2e^{j30°} e^{j60°} \text{ V}\right] = \mathrm{P}^{-1}\left[8e^{j90°} \text{ V}\right]$$

or

$$\mathrm{P}^{-1}\left[\mathbf{V}\right] = \mathrm{P}^{-1}\left[8e^{j90°} \text{ V}\right] = 8\cos(\omega t + 90°) \text{ V}$$

NOTE: We could also say $\mathrm{P}^{-1}[\mathbf{V}] = -8\sin(\omega t) \text{ V}$ since $\cos(\omega t + 90°) = -\sin(\omega t)$

e) The real exponent yields the magnitude.

$$\mathrm{P}^{-1}\left[\mathbf{I} = e^{-\pi - j30^\circ}\ \mathrm{A} = e^{-\pi}\angle -30^\circ\ \mathrm{A}\right] = e^{-\pi}\cos(\omega t - 30^\circ)\ \mathrm{A}$$