HOMEWORK #16 solution

Ex: Give numerical answers to each of the following questions:

a) Rationalize $\dfrac{-65 + j3}{-52 - j39}$. Express your answer in rectangular form.

b) Find the rectangular form of $\left(\dfrac{2}{e^{-j45°}}\right)^*$. (Note: the asterisk means "conjugate".)

c) Given ω = 9 rad/sec, find the following inverse phasor:

$P^{-1}[6\cos(40°)(1 + j)]$

d) Find the magnitude of $\left(\dfrac{j}{4 + j}\right)\left(\dfrac{e^{j15°}}{4 - j}\right)$.

e) Find the real part of $\dfrac{10e^{j360°}}{j^2}$.

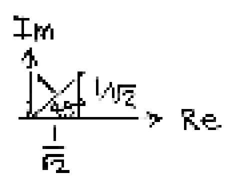
Sol'n: a) $\dfrac{-65 + j3}{-52 - j39} = \dfrac{-65 + j3}{13(-4 - j3)}$

$$= \frac{-65 + j3}{13(-4 - j3)} \cdot \frac{-4 + j3}{-4 + j3}$$

$$= \frac{260 - 9 - j195 - j12}{13(4^2 + 3^2)}$$

$$= \frac{251 - j207}{325}$$

b) $\left(\dfrac{2}{e^{-j45°}}\right)^* = \dfrac{2}{e^{j45°}}$ (change all j's to −j's to get conjugate)



$$\left(\frac{2}{e^{-j45°}}\right)^* = \frac{2}{\frac{1}{\sqrt{2}} + j\frac{1}{\sqrt{2}}}$$

$$= \frac{2\sqrt{2}}{1+j} \cdot \frac{1-j}{1-j}$$

$$= \frac{2\sqrt{2}\,(1-j)}{1^2+1^2}$$

$$= \sqrt{2} - j\sqrt{2}$$

c) $P^{-1}\left[6\cos(40°)(1+j)\right]$

$$= 6\cos(40°)\cos(9t) - 6\cos(40°)\sin(9t)$$

Note: $\cos(40°)$ is just a constant

Note: $P^{-1}[j] = \sin(\omega t) = \sin(9t)$

For the polar form of inverse phasor, we convert $1+j$ to $\sqrt{2}\angle 45°$:

$P^{-1}\left[6\cos(40°)(1+j)\right]$

$$= P^{-1}\left[6\cos(40°)\sqrt{2}\angle 45°\right]$$

$$= 6\sqrt{2}\cos(40°)\cos(9t+45°)$$

d) $\left|\frac{j}{4+j}\cdot\frac{e^{j15°}}{4-j}\right| = \frac{|j|}{|4+j|^2}\cdot|e^{j15°}|$

We observe that $|j| = 1$, $|e^{j\theta}| = 1$

" $= \frac{1\cdot 1}{4^2+1^2}$

" $= \frac{1}{17}$

e) $\mathrm{Re}\left[\dfrac{10\, e^{j360^\circ}}{j^2}\right] = \mathrm{Re}\left[\dfrac{10 \cdot 1}{-1}\right] = -10$

Note: $e^{j360^\circ} = 1$ and $j^2 = -1$.