Ex: Find the value of each of the following:

a) $\left[\dfrac{\cos(60°)e^{2-j2}\cdot 16}{20}\right]^*$

e) $\mathbf{P}[5\sin(2\pi 100kt - 20°)]$

b)   Polar form of $\dfrac{2+j1.5}{4e^{j45°}}$

f) $\mathbf{P}^{-1}\left[\dfrac{5e^{j45°}}{3+j4}\right]$

c)   Rectangular form of $\dfrac{16e^{j30°}}{4e^{j45°}}$

g) $\left|\dfrac{3e^{j\frac{\pi}{2}}}{5-j12}\right|$

d) $\mathrm{Re}\left[\dfrac{j3(6-j7)}{e^{j30°}}\right]$

h)   Rationalized value of $\dfrac{5-j4}{1-j}$

Sol'n:

a) $\left[\dfrac{\cos 60°\, e^{2-j2}\; 16}{20}\right]^* = \dfrac{\cos 60°\, e^{2+j2}\; 16}{20}$ change every j to $-j$

$= \dfrac{1}{2} e^2 e^{j2}\cdot \dfrac{16}{20} = \dfrac{2}{5} e^2 (\cos 2 + j \sin 2)$

b) Polar form of $\dfrac{2+j1.5}{4e^{j45°}} = \dfrac{\sqrt{2^2 + 1.5^2}\; e^{j\tan^{-1}\frac{1.5}{2}}}{4e^{j45°}}$

$= \dfrac{2.5\, e^{j37°}}{4\, e^{j45°}} = 0.625\, e^{j(37°-45°)} = \dfrac{4 e^{j45°}}{} = 0.625\, e^{-j8°}$

c) Rectangular form $\dfrac{16 e^{j30°}}{4 e^{j45°}} = 4\, e^{j(30°-45°)} = 4 e^{-j15°}$

$= 4\cos 15° - j4\sin 15° = 3.86 - j1.04$

d) $\mathrm{Re}\left[\dfrac{j3(6-j7)}{e^{j30°}}\right] = \mathrm{Re}\left[j3(6-j7)\, e^{-j30°}\right] = \mathrm{Re}\left[(21+j18)e^{-j30°}\right]$

$= \mathrm{Re}\left[(21+j18)(\cos 30° - j\sin 30°)\right] = \mathrm{Re}\left[(21+j18)\left(\dfrac{\sqrt{3}}{2} - j\dfrac{1}{2}\right)\right]$

$= \mathrm{Re}\left[\dfrac{21\sqrt{3}}{2} + \dfrac{18}{2} - j\dfrac{21}{2} + j\dfrac{18\sqrt{3}}{2}\right] = \dfrac{21\sqrt{3}}{2} + 9$

e) $P\left[5\sin(2\pi 10^5 t - 20°)\right] = 5\angle -90° - 20° = 5\angle -110°$

$\underset{\text{sin adds } -90°}{\uparrow}$

f) $P^{-1}\left[\dfrac{5e^{j45°}}{3+j4}\right] = P^{-1}\left[\dfrac{5e^{j45°}}{\sqrt{3^2+4^2}\,e^{j\tan^{-1}4/3}}\right] = P^{-1}\left[\dfrac{5\,e^{j45°}}{5\,e^{j53°}}\right]$

$= P^{-1}\left[e^{j\,45°-53°}\right] = P^{-1}\left[1\angle -8°\right] = 1\cdot\cos(\omega t - 8°)$

g) Abs mag of $\dfrac{3e^{j\frac{\pi}{2}}}{5-j12} = \left|\dfrac{3e^{j\frac{\pi}{2}}}{5-j12}\right| = \dfrac{\left|3e^{j\frac{\pi}{2}}\right|}{|5-j12|} = \dfrac{3}{\sqrt{5^2+12^2}} = \dfrac{3}{13}$

h) Rationalize $\dfrac{5-j4}{1-j} = \dfrac{5-j4}{1-j}\cdot\dfrac{1+j}{1+j} = \dfrac{5+4+j5-j4}{1^2+1^2} = \dfrac{9}{2}+j\dfrac{1}{2}$