WS#7   Joseph Specht

1a) $z = \dfrac{1}{1+j\omega} \cdot \dfrac{1-j\omega}{1-j\omega} = \dfrac{1-j\omega}{1+\omega^2} = \dfrac{1}{1+\omega^2} - \dfrac{\omega j}{1+\omega^2}$ $R = \sqrt{\dfrac{1}{(1+\omega^2)^2} + \dfrac{\omega^2}{(1+\omega^2)^2}} = \boxed{\dfrac{1}{\sqrt{1+\omega^2}} = R}$

$\theta = \boxed{atan\left(\dfrac{-\omega}{1}\right)} = \boxed{atan(-\omega)}$

b) $z = \dfrac{-1}{1+j\omega} \cdot \dfrac{1-j\omega}{1-j\omega} = \dfrac{-1}{(1+\omega^2)} + \dfrac{j\omega}{(1+\omega^2)}$ $R = \sqrt{\dfrac{1}{(1+\omega^2)^2} + \dfrac{\omega}{(1+\omega^2)^2}}$ $\boxed{\dfrac{1}{\sqrt{1+\omega^2}} = R}$

$\theta = atan\left(\dfrac{\omega}{-1}\right) = \boxed{atan(-\omega) + \pi = \theta}$

c) $z = \dfrac{1}{1-j\omega} \cdot \dfrac{1+j\omega}{1+j\omega} = \dfrac{1+j\omega}{1+\omega^2}$ $R = \sqrt{\dfrac{1^2 + \omega^2}{(1+\omega^2)^2 (1+\omega^2)^2}} = \boxed{\dfrac{1}{\sqrt{1+\omega^2}} = R}$

$\theta = atan\left(\dfrac{\omega}{1}\right) = \boxed{atan(\omega) = \theta}$

2) $V = 5\sin(5t) + 5\sqrt{2}\sin(5t+45°) = 5\cos(5t-90°) + 5\sqrt{2}\cos(5t-45°)$

$\bar{F} = 5\angle -90° + 5\sqrt{2} \angle -45° = 5(\cos(-90°) + j\sin(-90°)) + 5\sqrt{2}(\cos(-45°) + j\sin(-45°))$

$= 5(0-j) + 5\sqrt{2}\left(\dfrac{-\sqrt{2}}{2} + \dfrac{\sqrt{2}}{2}j\right) = -5j + 5 + 5j = 5 = 5\angle 0°$

$\bar{V}(t) = 5\cos(5t) = \boxed{5\sin(5t+90°) = V(t)}$