Quiz 3 – Some good answers from you

Q1:

a). $10.45\angle -104.02°$.

b). 1000.

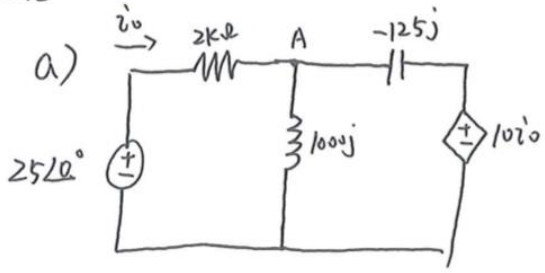
c). $-j500$.

d). Lags V_2 by 30°.

e). $4.789\angle -16.7°$.

Q2:

a)



b)

$$\begin{cases} \frac{V_A - 25\angle 0°}{2000} + \frac{V_A}{1000j} + \frac{V_A - 10i_o}{-125j} = 0 & ① \\ i_o = \frac{25\angle 0° - V_A}{2000} & ② \end{cases}$$

c) $V_A = 25 - 2000 i_o$

replace V_A in the formula ①

$$-i_o + 2j i_o - 0.025j + 0.2j - 16.08j i_o = 0$$

$$(-1 - 14.08j) i_o = (0.025 - 0.2)j$$

$$i_o = 0.012\angle 4.06 \text{ A}$$

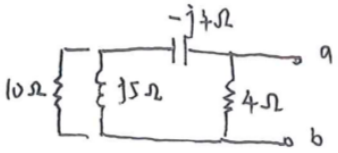
$$i_o = \boxed{0.012\cos(4000t + 4.06)} \text{ A}$$

Q3:

$$\begin{cases} \dfrac{V_A - 20\angle 0^\circ}{10} + \dfrac{V_A}{j5} + \dfrac{V_A - V_B}{-j4} = 0 \\ \dfrac{V_B - V_A}{-j4} - 4\angle 0^\circ + \dfrac{V_B}{4} = 0 \end{cases}$$

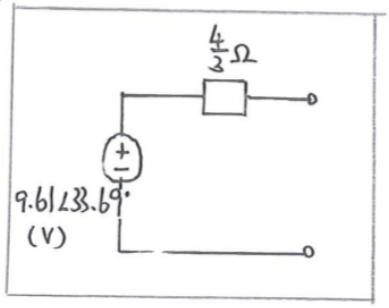
$V_B = 8 + \frac{10}{3}i = 9.61\angle 33.69^\circ$ (V)

$\therefore V_{Th} = 9.61\angle 33.69^\circ$



$R_1 = \frac{10 \times j5}{10 + j5} - j4 = 2\Omega$

$R_{Th} = \frac{2 \times 4}{2+4} = \frac{4}{3}\Omega$



Q4

a) $Z_L = 2 + 2j\ \Omega$

$Z_{in} = \frac{Z_L}{4} = 0.5 + 5j\ \Omega$

$\vec{I}_1 = \frac{80\angle 0^\circ}{50 - 1j + 0.5 + 5j} = 1.58\angle -4.53^\circ$ A

b) $\vec{I}_1 = 2\vec{I}_2$

$\vec{I}_2 = 0.79\angle -4.53^\circ$ A

c) $P_{2\Omega} = |\vec{I}_2|^2 R = 1.25$ W

Q5:

a) $I_1 = \frac{V}{Z_1} = \frac{120\angle 10^\circ}{60\angle 30^\circ} = \boxed{2\angle -20^\circ\ A}$

$I_2 = \frac{V}{Z_2} = \frac{120\angle 10^\circ}{40\angle 45^\circ} = \boxed{3\angle -35^\circ A}$

$I_t = I_1 + I_2 = \boxed{4.01\angle -6.22\ A}$

b) $S = V_{eff} \cdot I_{eff}^* = 120\angle 10^\circ \times 4.01\angle -6.22^* = \boxed{481.2\angle 16.22}$

apparent power = $\boxed{481.2\ VA}$

real power = $481.2 \cdot \cos 16.22^\circ = \boxed{462.05\ W}$

reactive power = $481.2 \cdot \sin 16.22^\circ = \boxed{134.41\ VAR}$

c) $pf = \cos 16.22$

$= \boxed{0.96}$

$\boxed{\text{lagging}}$, because $\theta_v - \theta_i = 16.22^\circ$ means current lags voltage.