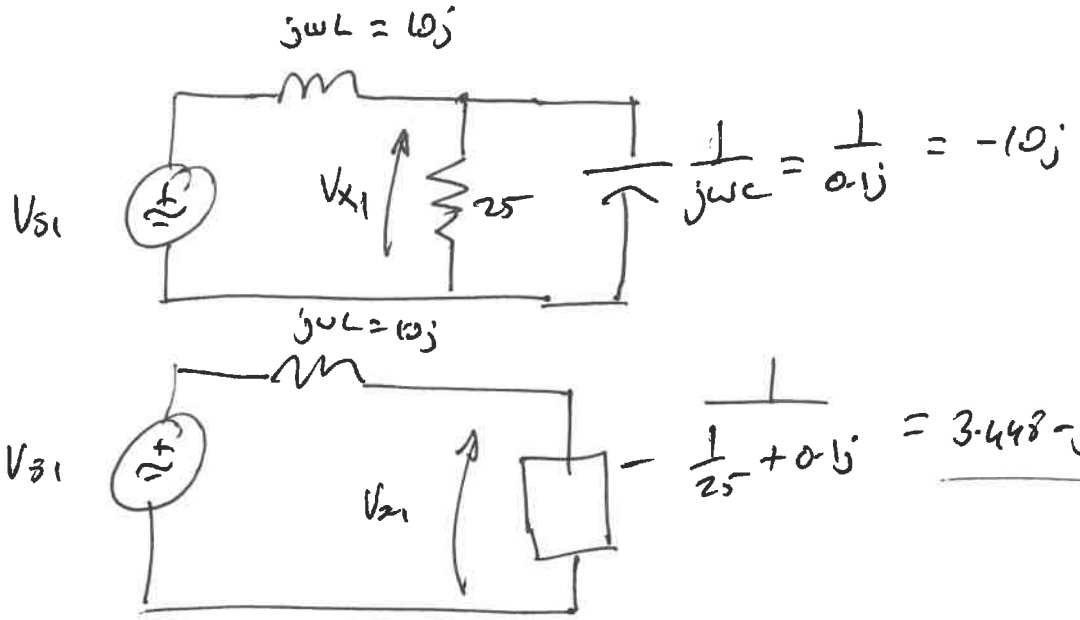
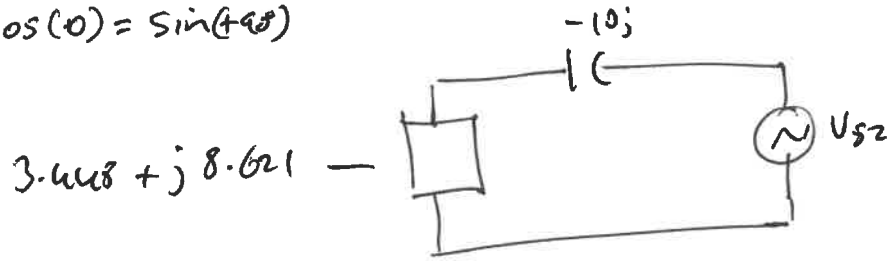
EE5302I TUTORIAL 3A

Q1 a)



$$V_{x1} = \frac{3.448 - j\,8.621}{3.448 - j\,8.621 + j10} V_{s1} = -2.5j\, V_{s1}$$

$\cos(0) = \sin(+90)$



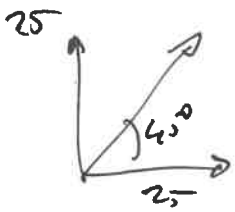
$$V_{x2} = \frac{3.448 + j\,8.621}{3.448 + j\,8.621 - 10j} V_{s2} = 2.5j\, V_{s2}$$

$$V_x = V_{x1} + V_{x2}$$

$V_{s1} = 10\angle 90°$ $\quad V_{s2} = 10\angle 0°$

$$V_x = \underbrace{(-2.5j)}_{2.5\angle -90°}\, 10\angle 90° + \underbrace{2.5j}_{2.5\angle 90°}\, 10\angle 0°$$

$$= 25\angle 0° + 25\angle 90°$$



$$v_x(t) = 35.36 \sin(1000t + 45°)$$

or $35.36 \cos(1000t - 45°)$

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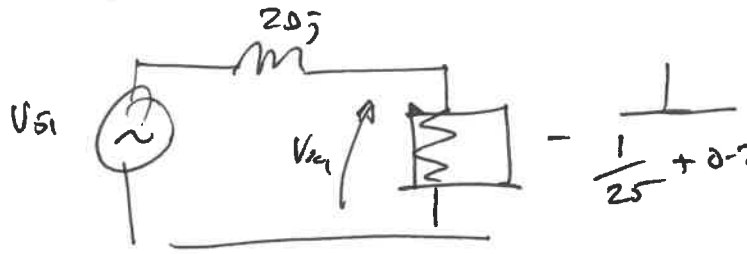
Q1b)

already have response for $V_{S2}(t)$

need just for $V_{S1}(t) = 10\cos(2000t)$



$$V_{x1} = \frac{0.9615 - j4.808}{0.9615 - j4.805 + 20j} V_{S1} = (-0.3112 - j0.08299) V_{S1}$$

$$\downarrow$$

$$0.322 \angle -165^\circ \; V_{S1}$$

$$V_{x1} = 3.22 \angle -75^\circ$$

$$V_{x_1}(t) = 3.22 \sin(2000t - 75^\circ)$$

$$V_{x_2}(t) = 25 \sin(1000t + 90^\circ)$$

$$V_x(t) = V_{x_1}(t) + V_{x_2}(t)$$

$$V_x(t) = 3.22\sin(2000t - 75^\circ) + 25\sin(1000t + 90^\circ)$$

$$= 3.22\cos(2000t - 165^\circ) + 25\cos(1000t)$$

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Q2

$$\frac{V_{xy} - 10\angle 0^\circ}{20} + \frac{V_{xy}}{-j10} - 0.02V_a = 0$$

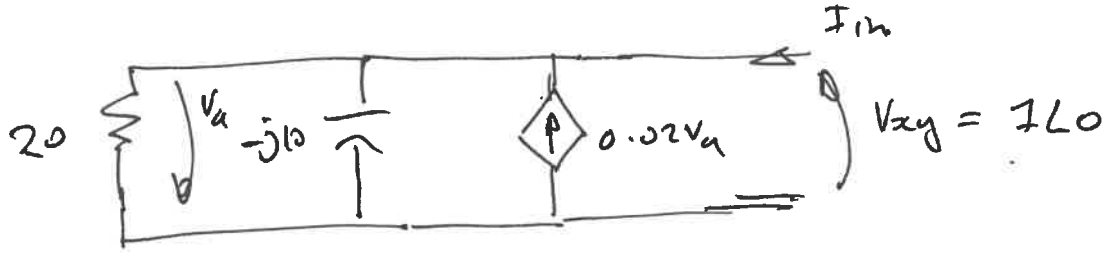
$$V_{xy} = 10 - V_a \qquad V_a = 10 - V_{xy}$$

$$0.05V_{xy} - 0.5 + \frac{V_{xy}}{-j10} - 0.2 + 0.02V_{xy} = 0$$

$$V_{xy}(0.07 + 0.1j) = 0.7$$

$$V_{xy} = 3.2a - j4.70$$

$$V_{th} = 5.73\angle -55^\circ$$



$$I_{in} = \left(\frac{1}{20} + \frac{1}{-j10} + 0.02\right) V_{xy}$$

$$I_{in} = (0.07 + 0j)\, V_{xy}$$

$$Z_{th} = \frac{V_{xy}}{I_{in}} = \frac{1}{0.07 + j0.1} = 4.70 - 6.71j$$