

$$I = \frac{V_x}{3} \rightarrow V_x = 3I$$

$$\text{KVL: } V = V_x + 2j(I + I_s) + 3V_x$$

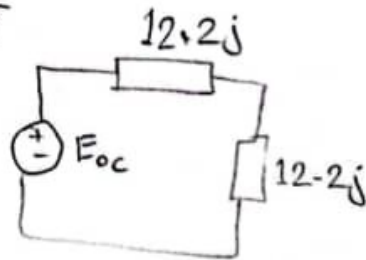
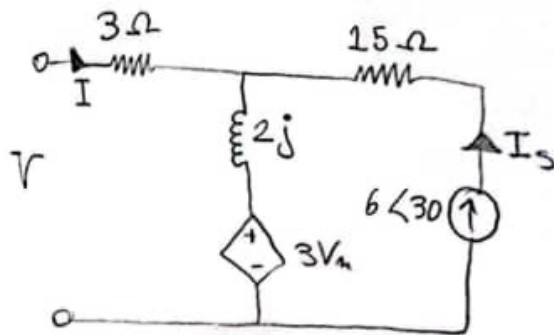
$$V = 4V_x + 2jI + 2jI_s$$

$$V = (12 + 2j)I + 2j(3\sqrt{3} + 3j)$$

$$V = (12 + 2j)I + (6j\sqrt{3} - 6)$$

$$Z_L = \bar{Z} = 12 - 2j$$

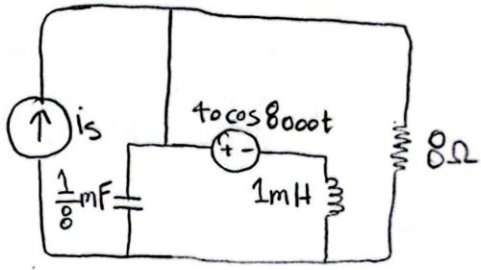
$$P_{\max} = \frac{|V_{oc}|^2}{8R_L} = \frac{|-6 + 6j\sqrt{3}|^2}{8 \times 12} = \frac{(12)^2}{8 \times 12} = \frac{3}{2}$$



برای محاسبه توان متوسطی که از فرستنده می‌تواند منتقل شود:

$$P_{\max} = \frac{|V_{oc}|^2}{8R_L} \leftarrow P_{\max} = \frac{|V_{oc}|_{\text{rms}}^2}{4R_L} \leftarrow V_{\text{rms}}^2 = \frac{V_m^2}{2} \leftarrow V_{\text{rms}} = \frac{V_m}{\sqrt{2}}$$

یعنی ما داریم



$i_s(t) = 5 \cos 2000t$

$$I_R = \frac{-4j \parallel 2j}{(-4j \parallel 2j) + 8} \times 5 = \frac{4j}{4j + 8} \times 5 \rightarrow$$

$$I_R = \frac{20j}{4j + 8} \rightarrow |I_R|^2 = 5$$

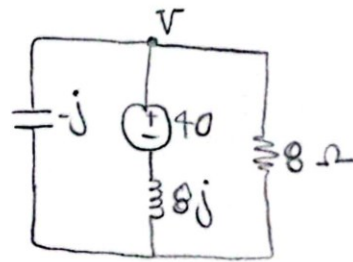
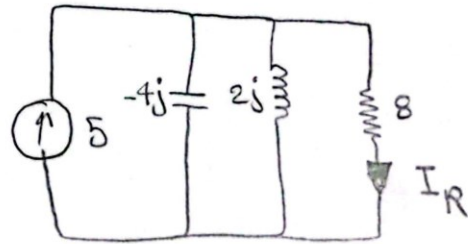
$$P_1 = \frac{1}{2} R |I_R|^2 = \frac{1}{2} \times 8 \times 5 = 20W$$

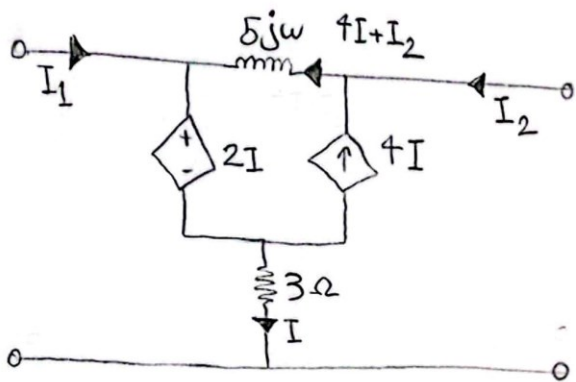
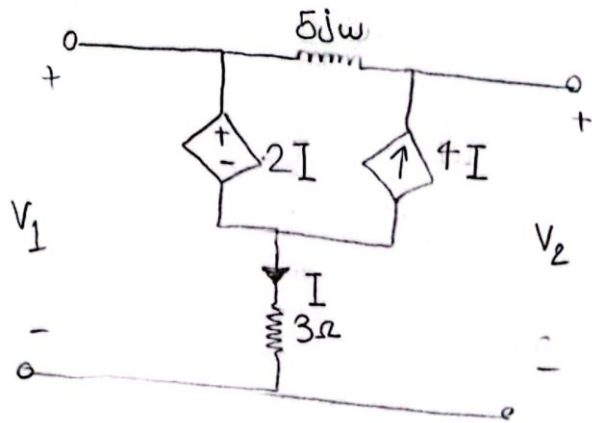
$$KCL(V): \frac{V}{-j} + \frac{V - 40}{8j} + \frac{V}{8} = 0$$

$$\rightarrow V = \frac{40}{j - 7} \rightarrow |V|^2 = 32$$

$$P_2 = \frac{1}{2} \frac{|V|^2}{R} = \frac{1}{2} \times \frac{32}{8} = 2W$$

$$P_1 + P_2 = 22W$$





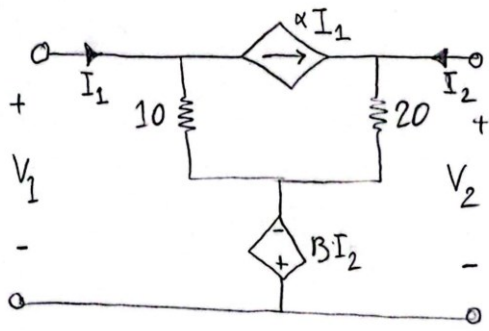
$$I = I_1 + I_2$$

$$V_1 = 2I + 3I = (2+3)I_1 + (2+3)I_2$$

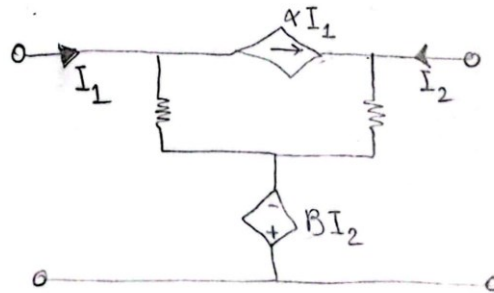
$$V_2 = 5j\omega(4I + I_2) + 2I + 3I = (5 + 20j\omega)I_1 + (5 + 5j\omega + 20j\omega)I_2$$

$$Z = \begin{bmatrix} -5 & 5 \\ 5 + 20j\omega & 5 + 25j\omega \end{bmatrix}$$

$$\det(Z) = 0 \rightarrow \omega = 0$$



$$h_{12} = h_{21} = 2$$



$$\text{KVL (sum)}: V_1 = 10(I_1 - \alpha I_1) - \beta I_2 \quad \text{(A)}$$

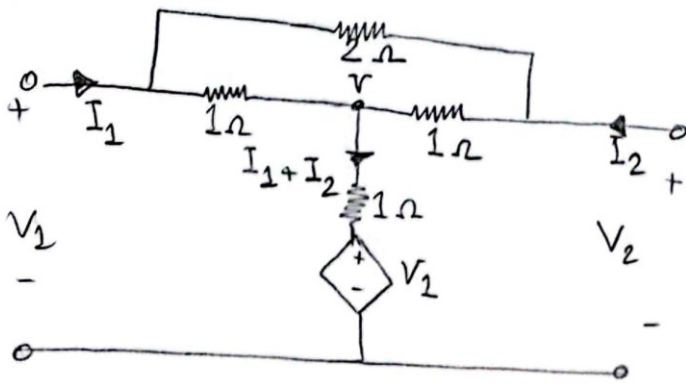
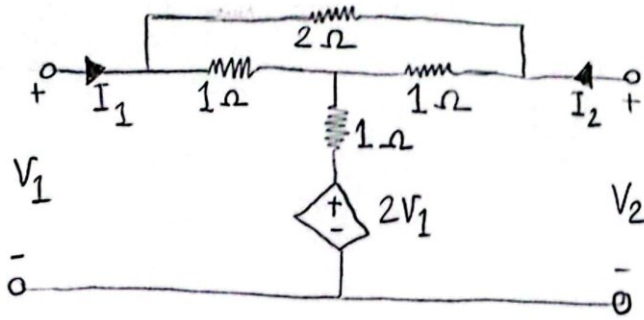
$$V_2 = 20(I_2 + \alpha I_1) - \beta I_2 \quad \text{(B)}$$

$$h_{12} = \frac{V_1}{V_2} \Big|_{I_1=0} \quad \begin{array}{l} \text{(A)} \rightarrow V_1 = -\beta I_2 \\ \text{(B)} \rightarrow V_2 = (20 - \beta) I_2 \end{array}$$

$$\frac{V_1}{V_2} = \frac{-\beta}{20 - \beta} = 2 \rightarrow \beta = 40$$

$$h_{21} = \frac{I_2}{I_1} \Big|_{V_2=0} \rightarrow 20(I_2 + \alpha I_1) - \beta I_2 \rightarrow (20 - \beta) I_2 = -20\alpha I_1$$

$$\frac{I_2}{I_1} = \frac{-20\alpha}{20 - \beta} = 2 \rightarrow \frac{-20\alpha}{20 - 40} = 2 \rightarrow \alpha = 2$$



$$V = 1(I_1 + I_2) + V_1$$

$$\text{Kcl (top node)}: I_1 = \frac{V_1 - V_2}{2} + \frac{V_1 - (I_1 + I_2 + V_1)}{1} \rightarrow V_1, V_2 = -I_1 - 2I_2 \quad (A)$$

$$\text{Kcl (bottom node)}: I_2 = \frac{V_2 - V_1}{2} + \frac{V_2 - (I_1 + I_2 + 2V_2)}{1} \rightarrow 3V_2 - 5V_1 = 2I_1 + I_2 \quad (B)$$

$$(A, B) \quad V_1 + V_2 = -4I_1 - 2 \left(\frac{3V_2 - 5V_1 - 2I_1}{4} \right)$$

$$V_1 = 2I_1 + \frac{5}{3}V_2$$

$$(A, B) \quad \left(\frac{3V_2 - 2I_1 - 4I_2}{5} \right) + V_2 = 4I_2 - 2I_2 \rightarrow I_2 = -3I_1 - \frac{4}{3}V_2$$

$$H = \begin{bmatrix} 2 & \frac{5}{3} \\ -3 & -\frac{4}{3} \end{bmatrix}$$

$$V_1 = 2I_1$$

$$I_2 = -10I_1 + \frac{1}{4}V_0$$

