

1.

i.

$$R_N = 4 + 6$$

$$\mathbf{R_N = 10\Omega}$$

$$2 = I_1 + I_N$$

$$I_N = \frac{V_1 + 12}{6}$$

$$I_1 = \frac{V_1}{4}$$

$$\Rightarrow I_N = \frac{V_1}{6} + 2$$

$$\therefore 2 = \frac{V_1}{4} + \frac{V_1}{6} + 2$$

$$V_1 = 0$$

$$\mathbf{I_N = \frac{0}{6} + 2 = 2A}$$

ii.

$$I_{RN} + i = 6 + I_N$$

$$I_{RN} + i = 6 + 2 = 8$$

$$I_{RN}R_N = 6i$$

$$10I_{RN} - 6i = 0$$

$$\therefore I_{RN} = 3$$

$$\mathbf{i = 5A}$$

2.

i.

$$\mathbf{R_{TH} = (3 + 5)//2 = 1.6\Omega}$$

ii.

$$20 - 3i - 2i + 10 - 5(i - 6) = 0$$

$$20 - 3i - 2i + 10 - 5i + 30 = 0$$

$$i = 6$$

$$V_{TH} = -2i + 10$$

$$V_{TH} = -2$$

$$P_{max} = \frac{V_{TH}^2}{4R_{TH}}$$

$$P_{max} = \frac{(-2)^2}{4(1.6)}$$

$$\mathbf{= 0.625W}$$

3.

$$3 \times 10^{-3} = \frac{V_1 - V_2}{4 \times 10^3} + \frac{V_1 + 3V_o - V_2}{2 \times 10^3} = \frac{V_2 - 0}{1 \times 10^3}$$

$$\frac{V_2 - 0}{1 \times 10^3} = 3 \times 10^{-3}$$

$$\therefore V_2 = 3$$

$$V_o = V_2 - 0$$

$$= V_2 = 3$$

$$\frac{V_1 - 3}{4 \times 10^3} + \frac{V_1 + 3 \times 3 - 3}{2 \times 10^3} = 3 \times 10^{-3}$$

$$V_1 - 3 + 2V_1 + 18 - 6 = 12$$

$$\therefore V_1 = 1$$

4.

i.

$$2\sqrt{3} + 2j = 4\angle 30^\circ$$

$$= 4e^{\frac{\pi}{6}i}$$

ii.

$$-6 - 6j = 6\sqrt{2}\angle -135^\circ$$

$$= 6\sqrt{2}e^{\frac{-3\pi}{4}i}$$

iii.

$$5 - 5\sqrt{3}j = 10\angle -60^\circ$$

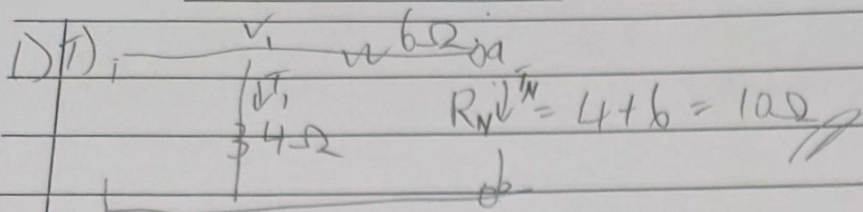
$$= 10e^{\frac{-\pi}{3}i}$$

5.

i. $(8 - 3j) \times (4 + 6j) = 50 + 36j$

ii. $(3 + 5j)(8 - 2j) = \frac{7}{34} + \frac{23}{34}j$

iii. $\frac{1}{2-3\sqrt{3}j} = \frac{2}{31} + \frac{3\sqrt{3}}{31}j$



$$I = I_1 + I_N$$

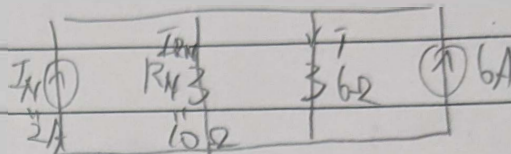
$$I_N = (V_1 - (-12)) / 6 \rightarrow I_N = V_1 / 6 + 2$$

$$I_1 = V_1 / 4$$

$$I = V_1 / 4 + V_1 / 6 + 2$$

$$0 = 5V_1 / 12 \quad V_1 = 0$$

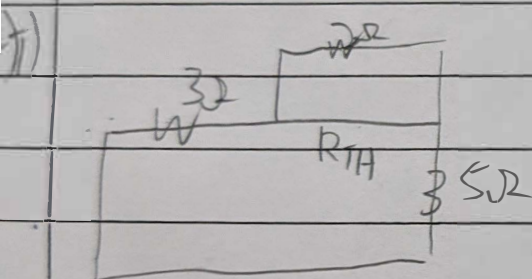
$$I_N = 2$$



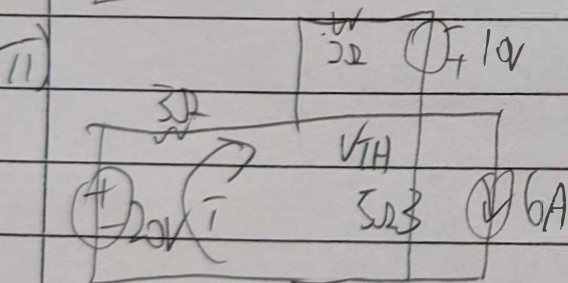
2) $I_{RN} + I = 6 + I_N \rightarrow I_{RN} + I = 6 + 2 = 8$

$$I_{RN} R_N = 6I \rightarrow 10 I_{RN} = 6I$$

$$I_{RN} = 3 \quad I = 5$$



$$R_{TH} = (3 + 5) / 2 = 4 \Omega$$



$$V_{TH} = -2I + 10$$

$$20 - 3I - 2I + 10 - 5(I - 6) = 0$$

$$20 - 3I - 2I + 10 - 5I + 30 = 0$$

$$I = 6$$

$$V_{TH} = -2$$

$$P_{max} = \frac{V_{TH}^2}{4R_{TH}} = \frac{(-2)^2}{4(1.6)} = 0.625 \text{ W}$$

3) Use NVA:

$$3 \times 10^{-3} = \frac{V_1 - V_2}{4 \times 10^3} + \frac{V_1 + 3V_0 - V_2}{2 \times 10^3} = \frac{V_2 - 0}{1 \times 10^3}$$

$$V_2 = 3 //$$

$$V_0 = V_2 - 0 \\ = V_2 = 3$$

$$12 = V_1 - V_2 + 2V_1 + 6V_0 - 2V_2$$

$$12 = 3V_1 - 3V_2 + 6V_0$$

$$12 = 3V_1 - 3(3) + 6(3)$$

$$V_1 = 1 //$$