REŠENJA

1. a)

$$U'_{OUT} = U_{OUT}(I_{G1} \neq 0, U_{G1} = 0, U_{G2} = 0) = -\frac{1}{3}RI_{G1}$$

$$U''_{OUT} = U_{OUT}(I_{G1} = 0, U_{G1} \neq 0, U_{G2} = 0) = -\frac{1}{3}U_{G1}$$

$$U'''_{OUT} = U_{OUT}(I_{G1} = 0, U_{G1} = 0, U_{G2} \neq 0) = \frac{1}{3}U_{G2}$$

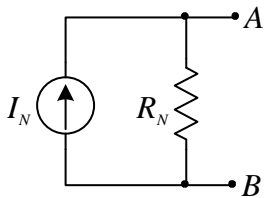$$U_{OUT} = U'_{OUT} + U''_{OUT} + U'''_{OUT} = -\frac{1}{3}RI_{G1} - \frac{1}{3}U_{G1} + \frac{1}{3}U_{G2}$$

b)

$$P_{I_{G1}} = (-U_{G1} - U_{OUT})I_{G1} = \left(\frac{1}{3}RI_{G1} - \frac{2}{3}U_{G1} - \frac{1}{3}U_{G2}\right)I_{G1}$$

2. a)
$$R_N = (a + 2)R$$
$$I_N = -\frac{u_G + R(2a + 3)i_G}{(a + 2)R}$$

b)
$$P = R\left(\frac{R_N}{R_N + R}I_N\right)^2$$

3. a)

$$V_1: \left(\frac{1}{1\Omega} + \frac{1}{1\Omega}\right)V_2 - \frac{1}{1\Omega}V_2 = 1A + \frac{1}{1\Omega}$$

$$V_2: -\frac{1}{1\Omega}V_1 + \left(\frac{1}{1\Omega} + \frac{1}{2\Omega} + \frac{1}{2\Omega}\right)V_2 - \frac{1}{2\Omega}V_3 = -\frac{2V}{1\Omega}$$
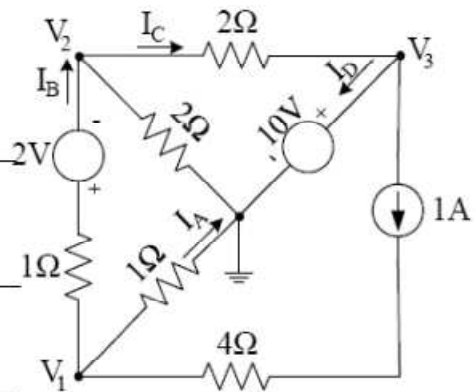
$$V_3: \boxed{V_3 = 10V}$$

$$2sV_1 - 1sV_2 = 3A$$

$$-1sV_1 + 2sV_2 = 3A \quad / \cdot 2$$

$$2sV_1 - 1sV_2 = 3A$$

$$-2sV_1 + 4sV_2 = 6A$$

$$3sV_2 = 9A \Rightarrow \boxed{V_2 = 3V}$$

$$2sV_1 - 1s \cdot 3V = 3A \Rightarrow \boxed{V_1 = 3V}$$

b)

$$I_A = \frac{V_1}{1\Omega}$$

$$\boxed{I_A = 3A}$$

$$I_B = \frac{V_1 - (V_2 + 2V)}{1\Omega}$$

$$\boxed{I_B = 2A}$$

$$I_c = \frac{V_2 - V_3}{2\Omega}$$

$$\boxed{I_B = -3.5A}$$

$$I_D = I_C - 1A$$

$$\boxed{I_D = -4.5A}$$

c)

$$P_{2V} = 2V \cdot (-I_B)$$

$$\boxed{P_{2V} = -4W}$$

$$P_{10V} = 10V \cdot (-I_D)$$

$$\boxed{P_{10V} = 45W}$$

$$P_{1A} = 1A \cdot (V_1 + 1A \cdot 4\Omega - V_3)$$

$$P_{1A} = 1A \cdot (3V + 4V - 10V)$$

$$\boxed{P_{1A} = -3W}$$

4. a)

$$V_1: V_1 = 5V$$

$$V_2: \left(\frac{1}{4\Omega} + \frac{1}{3\Omega}\right)V_2 - \frac{1}{3\Omega}V_3 = \frac{20V}{4\Omega} + 2A$$

$$V_3: -\frac{1}{1\Omega}V_1 - \frac{1}{3\Omega}V_2 + \left(\frac{1}{1\Omega} + \frac{1}{3\Omega}\right)V_3 = -1A$$

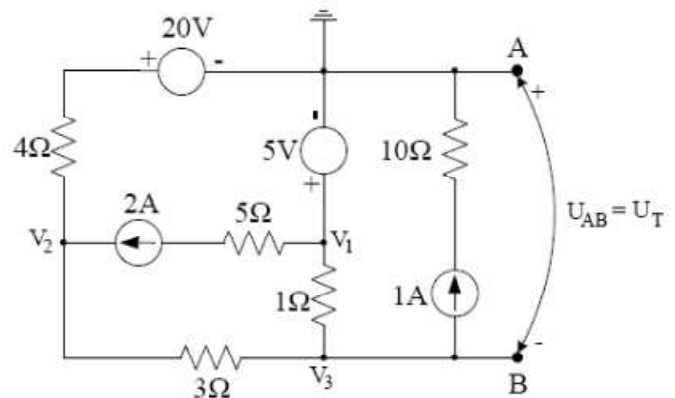$$\frac{7}{12}sV_2 - \frac{1}{3}sV_3 = 7A$$

$$-\frac{1}{3}sV_2 + \frac{4}{3}sV_3 = 4A$$

$$7sV_2 - 4sV_3 = 84A$$

$$-1sV_2 + 4sV_3 = 12A$$

$$6sV_2 = 96A \Rightarrow V_2 = 16V$$

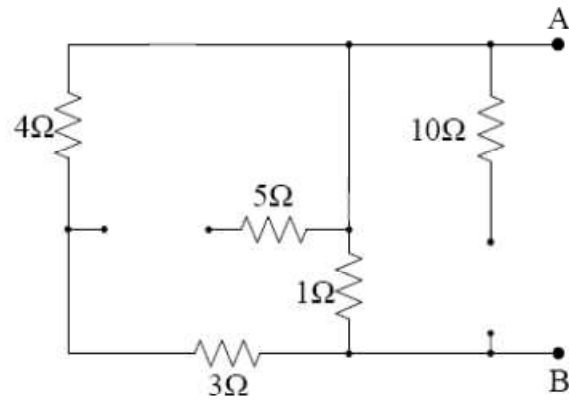$$-16V + 4sV_3 = 12V \Rightarrow 4sV_3 = 28V \Rightarrow V_3 = 7V$$

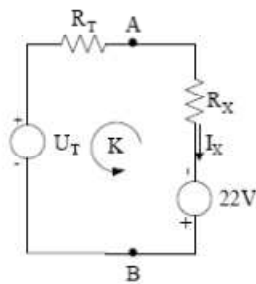$$U_T = V_A - V_B = 0 - V_3 = -7V$$

$$\boxed{U_T = -7V}$$

$$R_T = (4\Omega \oplus 3\Omega)||1\Omega$$

$$R_T = \frac{(4\Omega + 3\Omega) \cdot 1\Omega}{(4\Omega + 3\Omega) + 1\Omega}$$

$$\boxed{R_T = \frac{7}{8}\Omega}$$

b)

$$-U_T + I_X(R_T + R_X) - 22V = 0$$

$$I_X(R_T + R_X) = 22V + U_T$$

$$R_X = \frac{22V + U_T}{I_X} - R_T$$

$$R_X = \frac{22V + (-7V)}{8A} - \frac{7}{8}\Omega$$

$$\boxed{R_X = 1\Omega}$$

c)

$$P_{R_x} = R_X \cdot I_X^2$$

$$P_{R_x} = 1\Omega \cdot 64A^2$$

$$\boxed{P_{R_x} = 64W}$$

$$P_{22V} = 22V \cdot I_X$$

$$P_{R_x} = 22V \cdot 8A$$

$$\boxed{P_{R_x} = 172W}$$