

1) a) Deactivated voltage source is a short.

$$\Rightarrow R_{eq} = 60 \parallel (50 + 90 \parallel 72) = 60 \parallel (50 + 40) = 60 \parallel 90 = \underline{\underline{36 \Omega}}$$

b) $V_a = R_{eq} 2A = (36 \Omega)(2A) = \underline{\underline{72 V}}$

c) Deactivated current source is an open.

d) Voltage source sees resistance of $72 + 90 \parallel (50 + 60) = 72 + 49.5$

Voltage division: $V_b = \frac{49.5}{49.5 + 72} (27V) = \underline{\underline{11 V}}$

e) Voltage division:

$$V_a' = \frac{60}{60 + 50} V_b = \frac{6}{11} (11V) = \underline{\underline{6 V}}$$

2) a) $\underline{\underline{-2 + \frac{V_a}{60} + \frac{V_a - V_b}{50} = 0}}$

b) $\underline{\underline{\frac{V_b - V_a}{50} + \frac{V_b}{90} + \frac{V_b - 27}{72} = 0}}$

c) $\underline{\underline{60(i_1 - 2) + 50i_1 + 90(i_1 - i_2) = 0}}$ d) $\underline{\underline{90(i_2 - i_1) + 72i_2 + 27 = 0}}$

e) $\underline{\underline{V_a = 60(2 - i_1)}}$

3) a) $V_\Delta = (0.5A)(12\Omega) = 6V$, $\underline{\underline{V_{oc} = V_\Delta + 3V_\Delta = 24V}}$

b) $\underline{\underline{V_\Delta = 12(0.5 - I_{sc})}}$ c) $\underline{\underline{12(I_{sc} - 0.5) - 3(12(0.5 - I_{sc})) + 48I_{sc} = 0}}$

d) $12I_{sc} - 6 - 18 + 36I_{sc} + 48I_{sc} = 0 \Rightarrow 96I_{sc} = 24 \Rightarrow \underline{\underline{I_{sc} = 0.25A}}$

e) $R_{th} = V_{oc}/I_{sc} = 24V/0.25A = \underline{\underline{96\Omega = R_{th}}}$

4) For maximum power transfer, want $R_L = R_{th} = R_N$.

Deactivate independent sources and find remaining resistance.

$$\Rightarrow R_{th} = 42 \parallel (26 + 55 \parallel 66) = 42 \parallel (26 + 30) = 42 \parallel 56 = \underline{\underline{24\Omega = R_L}}$$

5) a) $V_n = V_p = \underline{\underline{0}}$ b) $\underline{\underline{\frac{0 + 0.7}{12000} + \frac{0 - V_o}{60000} = 0}}$ c) $V_o = \frac{60}{12} 0.7V = \underline{\underline{3.5V}}$

d) KCL: $\underline{\underline{\bar{i}_o + \frac{V_o}{60000} + \frac{V_o}{84000} = 0 \Rightarrow \bar{i}_o = -\left(\frac{1}{60k} + \frac{1}{84k}\right)3.5 = -100 \mu A}}$

$$\underline{\underline{= -0.1 mA}}$$