Makeup Exam #1

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1) $-V_s + R_1 i_1 + R_3(i_1 - i_4) = 0$

$-V_s + R_2(i_2 - i_3) + R_4(i_2 - i_5) = 0$

$R_2(i_3 - i_2) - i_5 + R_5(i_3 - i_6) = 0$ $\quad i_3 = -i_5$

$= R_2(i_3 - i_2) + i_3 + R_5(i_3 - i_6) = 0$

$2V_x + R_3(i_4 - i_1) + R_6(i_4 - i_5) = 0$

$R_6(i_5 - i_4) + R_4(i_5 - i_2) + R_5(i_6 - i_3) + R_7 i_6 = 0$

$2i_x = i_6 - i_5$ $\quad i_x = \frac{i_6 - i_5}{2}$

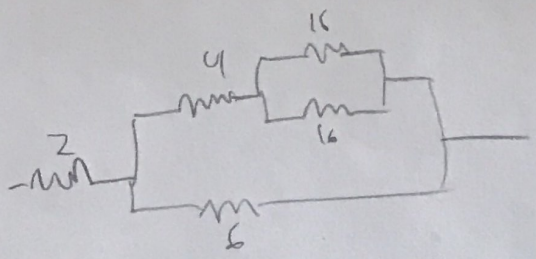
$2i_x = 2(i_4 - i_5)$ $\quad i_x = i_4 - i_5$

2)

$$\frac{V_1}{R_1} + \frac{V_2}{R_3} + \frac{V_3 - V_4}{R_4} - i_{s1} - i_{s2} = 0$$

$$\frac{V_4 - V_{s2}}{R_6} + \frac{V_4}{R_5} + \frac{V_4 - V_3}{R_4} = 0$$

3)



$V = IR$

$\left(\frac{1}{16} + \frac{1}{16}\right)^{-1} = 8 + 4 = 12$

$\left(\frac{1}{12} + \frac{1}{6}\right)^{-1} = 4 + 2 = \boxed{6\,k\Omega}$

$18\,V = i_s(6 \cdot 10^3) = \boxed{0.003\,A} = i_s$

$i_s = i_4 + i_0 \qquad i_3 = i_2$

$i_4 = i_3 + i_2 = 2i_2$

$-18 + 2i_3 + 4i_4 + 16i_2 = 0$

$18 = 2(3) + 8i_2 + 16i_2$

$i_2 = 0.5 \cdot 10^{-3}\,A$

$0.003 = 2(0.5 \cdot 10^{-3}) + i_0$

$\boxed{i_0 = 0.002\,A}$

$P = I \cdot V = 0.003 \cdot 18 = \boxed{0.054\,W}$

4) $R_4 + R_{10} = 8$

$\left(\frac{1}{8} + \frac{1}{R_9}\right)^{-1} = 4$

$4 + R_{13} = 8$

$\left(\frac{1}{8} + \frac{1}{R_8}\right)^{-1} = 4$

$4 + R_{12} = 8$

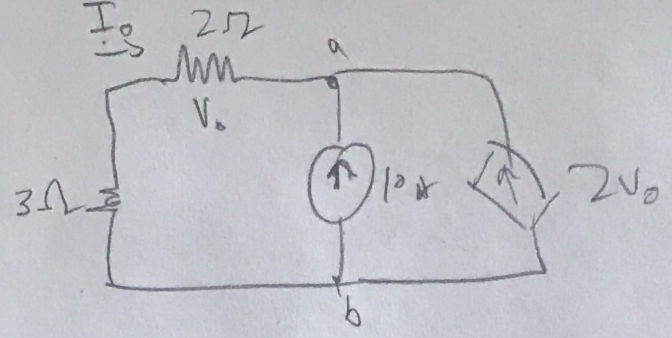
$\left(\frac{1}{8} + \frac{1}{R_7}\right)^{-1} = 4 + 4 = 8$

$\left(\frac{1}{8} + \frac{1}{R_6}\right)^{-1} = 4 + R_{11} = 8$

$\left(\frac{1}{8} + \frac{1}{R_5}\right)^{-1} = 4 + R_1 = \boxed{9\ \Omega}$

$\left(\frac{1}{R_2} + \frac{1}{R_3}\right)^{-1} = 4$

5)



$V = IR$

$i_o = -10 - 2V_o$

$V_o = 2i_o$

$R_{eq} = 5\,\Omega$

$i_o = -10 - 4i_o$

$5i_o = -10$

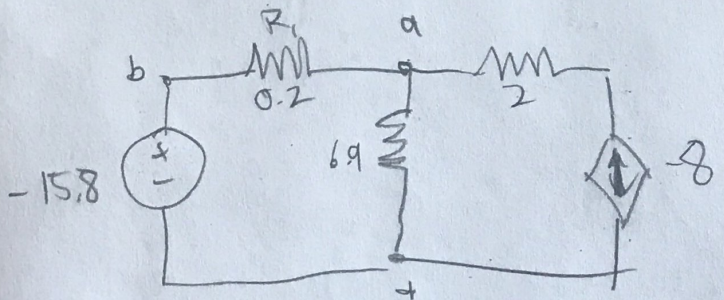
$\boxed{i_o = -2\,A}$

$\boxed{V_o = 2(-2) = -4\,V}$

6)

$i_d = 4(-2) = -8\,A$

$V = IR \quad P = VI$



$P_{vd} = 8 \cdot 2.2 =$

$\boxed{17.6\,W}$

$\boxed{P_{R_1} = (10)^2(0.2) = 20W}$

$-15.8 + R_1 I_1 + R_3 I_3 = 0$

$-2 = i_1\, 0.2$

$\boxed{i_1 = -10}$

$\boxed{I_3 = -10 + 8 = -2\,A}$

$-15.8 - 2 + (6.9) I_3 = 0$

$P_{R3} = (2)^2(6.9) = \boxed{27.6\,W}$

$\boxed{P_{R2} = (8)^2(2) = 128\,W}$

$158 + 17.6 = 128 + 27.6 + 20$

$P_{VS} = (15.8)(10) = \boxed{158\,W}$