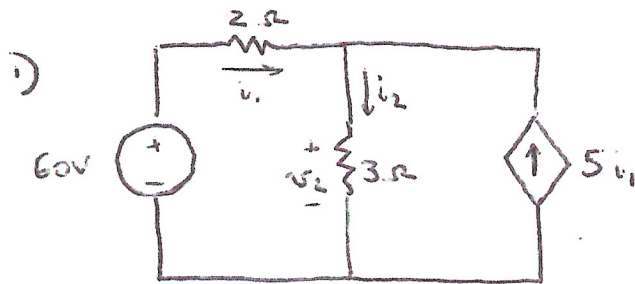


ENGR 2910  
MIDTERM 1 SOLUTIONS



$$i_1 = \frac{60 - v_2}{2} \quad i_2 = \frac{v_2}{3}$$

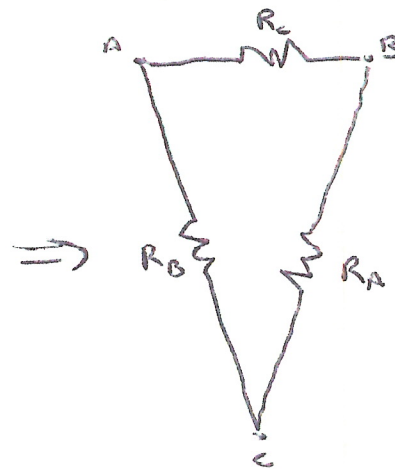
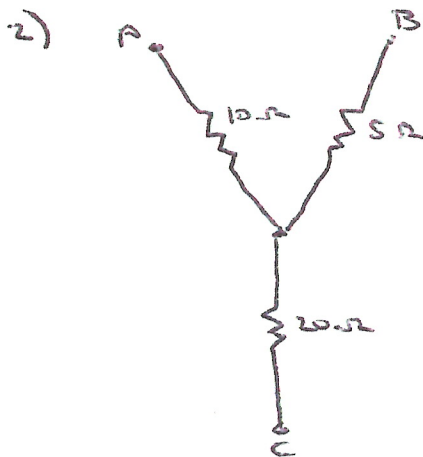
$$\text{KCL: } i_1 + 5i_1 = i_2$$

$$6i_1 = i_2$$

$$6 \left( \frac{60 - v_2}{2} \right) = \frac{v_2}{3}$$

$$180 - 3v_2 = \frac{1}{3}v_2$$

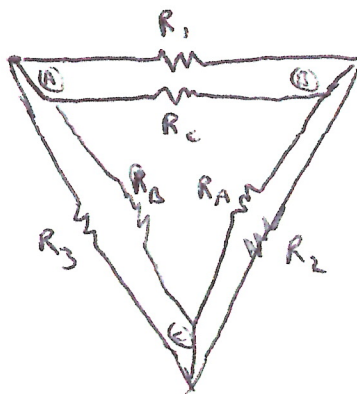
$$\boxed{v_2 = \frac{180}{3.33} = 54\text{V}}$$



$$R_A = 5 + 20 + \frac{(5)(10)}{10} = 35\Omega$$

$$R_B = 10 + 20 + \frac{(10)(20)}{5} = 70\Omega$$

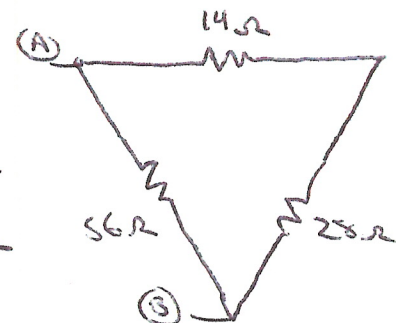
$$R_C = 5 + 10 + \frac{(5)(10)}{20} = 17.5\Omega$$



$$R_1 \parallel R_c = 14\Omega$$

$$R_2 \parallel R_a = 28\Omega$$

$$R_3 \parallel R_b = 56\Omega$$

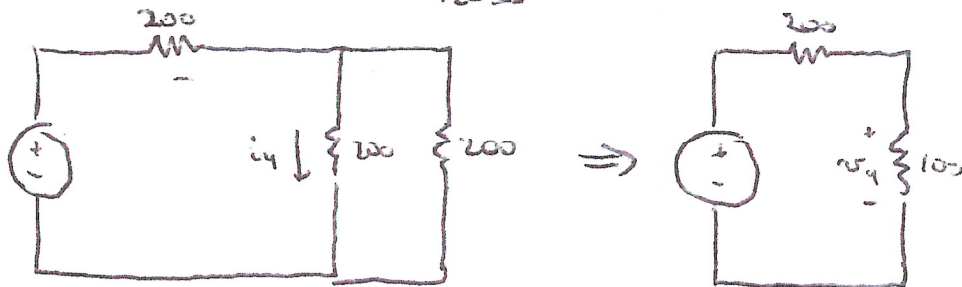
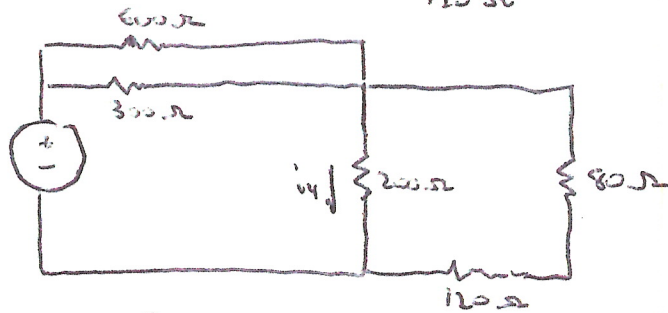
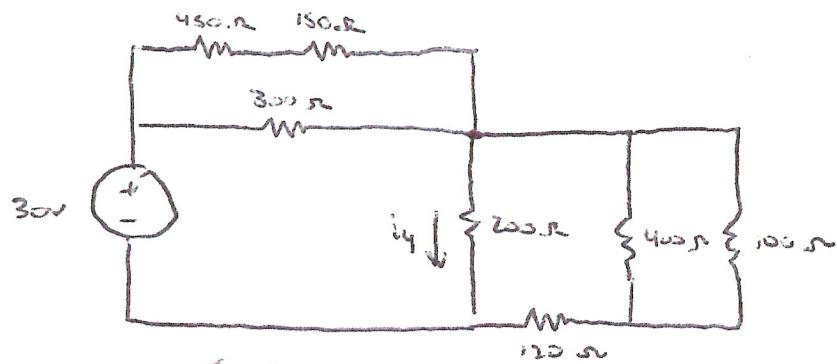


$$R_{EQ} = 56 \parallel (14 + 28)$$

$$= 56 \parallel 42$$

$$\boxed{R_{EQ} = 24\Omega}$$

3) REDRAW AS



$$R_{EQ} = 300\Omega$$

$$V_1 = \frac{100}{100+200}(30) = 10V$$

$$i_4 = \frac{10}{200} = 0.05A$$

$$i_4 = 50mA$$

## 4) VOLTAGE DIVIDER

$$a) V_{out} = \frac{R_2}{R_1 + R_2} V_{in}$$

$$3 = \frac{R_2}{42 + R_2} 10$$

$$\boxed{R_2 = 18 \Omega}$$

$$b) R_L = 9 \Omega$$

$$i) \frac{R_2 \parallel R_L}{R_1 + (R_2 \parallel R_L)} = \frac{3}{10}$$

$$R_2 \parallel R_L = 18 \parallel 9 = 6 \Omega$$

$$\boxed{R_1 = 14 \Omega}$$

$$ii) V_{out} = 3V$$

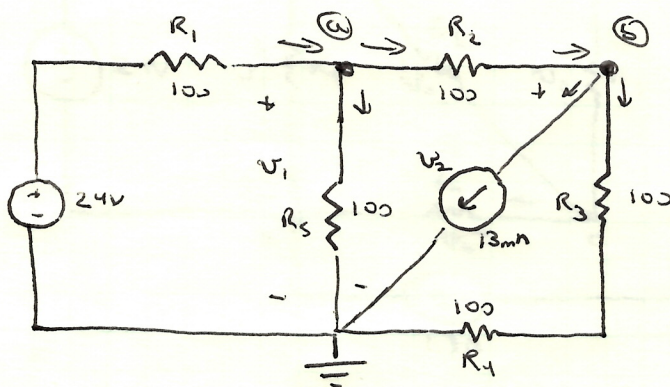
$$P_L = \frac{(V_{out})^2}{R_L} = \frac{9}{9} = \boxed{1W}$$

$$iii) R_{Th} = 14 + 18 \parallel 6 = 20 \Omega$$

$$I = 0.5A$$

$$P = IV = (0.5)(10) = \boxed{5W}$$

5)



a) THREE

$$b) \textcircled{a} \frac{24 - V_1}{100} = \frac{V_1}{100} + \frac{V_1 - V_2}{100}$$

$$\textcircled{b} \frac{V_1 - V_2}{100} = \frac{V_2}{200} + 0.013$$

$$c) \left[ \begin{array}{cc|c} 3 & -1 & 24 \\ 2 & -3 & 2.6 \end{array} \right]$$