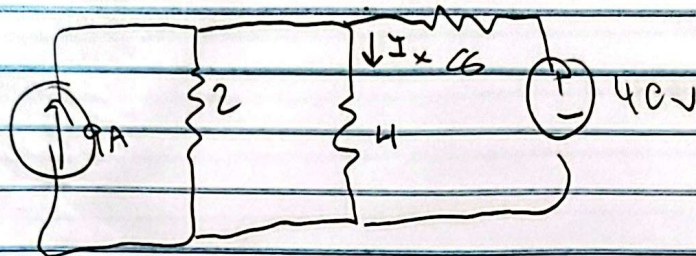


# Circuit Theory HW3

Chapter 3

3)



$$\frac{V_a - 40}{8} + \frac{V_a}{4} + \frac{V_a}{2} = 9$$

$$.675 V_a = 9 + 5$$

$$V_a = 16V$$

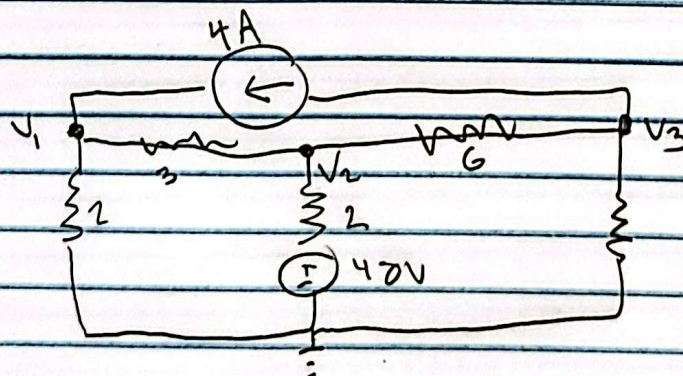
$$P = VI$$

$$I = \frac{40 - V_a}{8} = \frac{24}{8} = 3A$$

$$I_x = \frac{V_a}{4} = \frac{16}{4} = 4A$$

$$P = 40 \times 3 = 120W$$

9)



$$\frac{V_1}{2} + \frac{V_1 - V_2}{3} = 4$$

$$3V_1 + 2(V_1 - V_2) = 24$$

$$6\left(\frac{V_1}{2} + \frac{V_1 - V_2}{3}\right) = 6 \cdot 4$$

$$5V_1 - 2V_2 = 24$$

$$-2V_2 + 5V_3 = -48$$

$$-2V_1 + 6V_2 - V_3 = 144$$

$$\frac{V_2 - V_1}{3} + \frac{V_2 - 48}{2} + \frac{V_2 - V_3}{6} = 0$$

$$6\left(\frac{V_2 - V_1}{3} + \frac{V_2 - 48}{2} + \frac{V_2 - V_3}{6}\right) = 6 \cdot 0$$

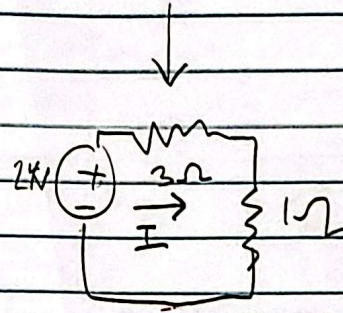
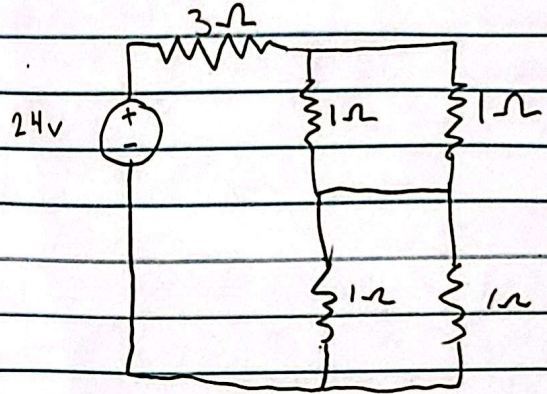
$$I_x = \frac{V_2 - V_3}{6} = \frac{30 - 1.6}{6}$$

$$4.73A$$



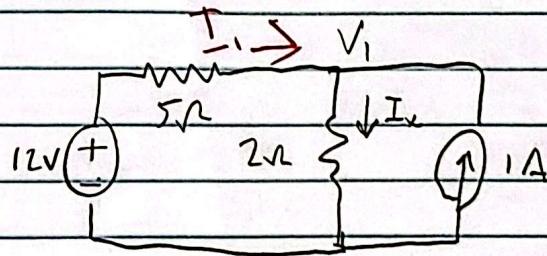
2.13  $I_o = 0A$  so voltage across the  $2\Omega$  resistor is 0.

$$I = \frac{24}{3+1} = 6A$$



2.15

$$\frac{12 - V_1}{5} + 1 = \frac{V_1}{2}$$



$$V_1(.5 + .2) = 12/5 + 1$$

so

$$I_x = \frac{4.857}{2} = 2.428A$$

$$V_1 = 4.857V$$

~~2.17~~  $4A = I_1 + I_2 + I_3$

$$12 - 4 = 4 \cdot I_1$$

$$I_1 = 2A$$

KCL

$$I_2 + I_3 = 1A$$

$$8I_3 + 5 = 6I_2$$

$$8I_3 + 5 = 12 - 6I_3$$

$$I_3 = .5A$$

$$I_2 = 1.5A$$



2.27

$$I_2 = \frac{V_3 + 6}{9} \quad V_2$$

$$42/81 = \frac{V_3 + 6}{9} = -1.33V$$

$$I_1 = \frac{6 - V_4}{9}$$

$$42/81 = \frac{6 - V_4}{9}$$

$$I_1 = 42/81 \text{ A}$$

$$I_2 = 42/81 \text{ A}$$

$$I_3 = 24/81 \text{ A}$$

$$V_1 = 0V \text{ (Ground)}$$

$$V_3 = -1.33V$$

$$V_2 = 0V$$

$$V_4 = 1.33V$$

$$\frac{V_2}{6} + \frac{V_2 - V_3}{6} + \frac{V_2 - V_4}{6} = 0$$

" " " "

$$3V_2 = V_3 + V_4$$

$$3V_2 = -1.33 + 1.33$$

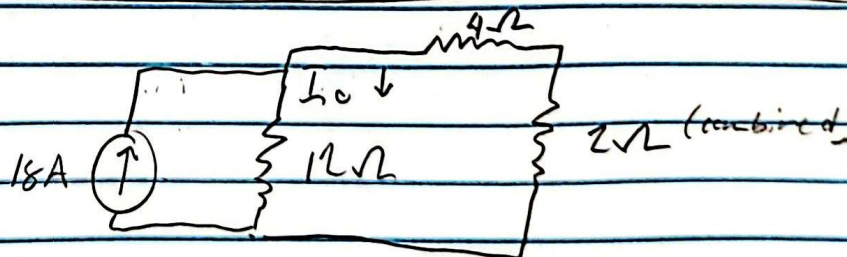
$$V_2 = 0V$$

2.31

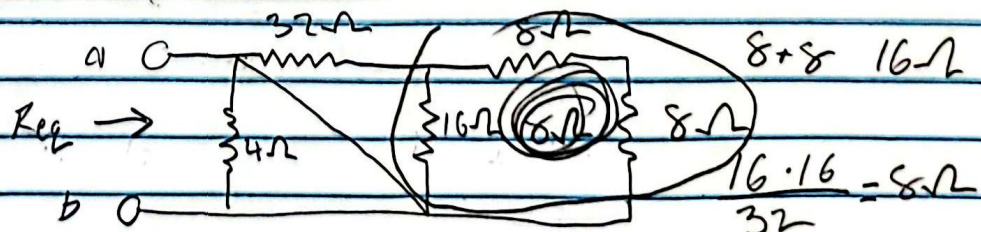
$$I_0 = 18 \cdot \left( \frac{4+2}{12+4+2} \right)$$

~~76~~

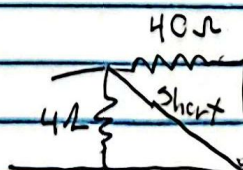
$$I_0 = 6A$$



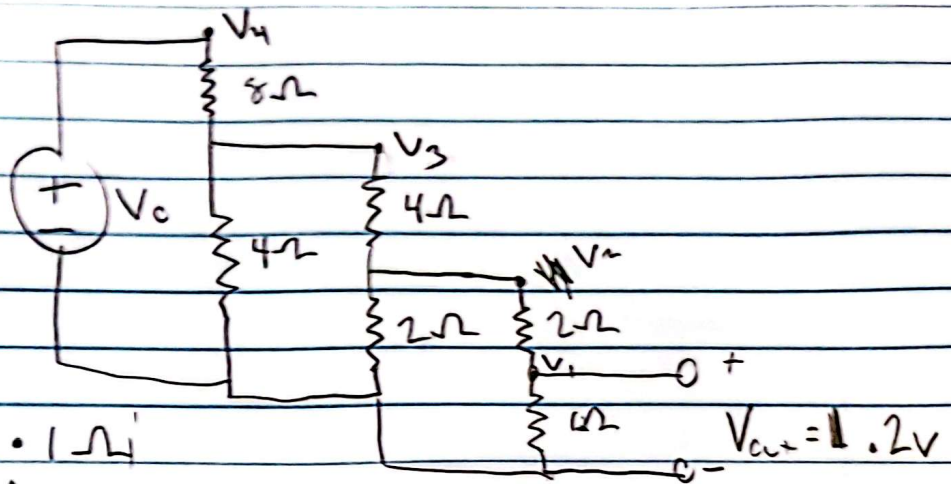
2.33



Because  
of the  
Short in the  
circuit,  $R_{eq} = 0$



2.43



$$V_{out} = I_1 \cdot 1\Omega$$

$$I_1 = .2A$$

$$V_1 = 2I_1$$

$$V_1 = .4V$$

$$V_2 = V_1 + V_{out}$$

$$V_2 = .6V$$

$$I_3 = I_1 + I_2 = 1.5A$$

$$V_3 = 4I_3$$

$$V_3 = 2V$$

$$V_4 = V_2 + V_3$$

$$= 2.6V$$

$$I_5 = I_3 + I_4 = 1.15A$$

$$V_0 = V_5 + V_4$$

$$8I_5 + 2.6 = 11.8V$$



2.53

$$R_1 = 3\Omega$$

$$R_2 = 6\Omega$$

$$R_3 = 1\Omega$$

Conversion Formulas

$$R_A = \frac{R_1 R_2}{R_T}, \quad R_B = \frac{R_2 R_3}{R_T}, \quad R_C = \frac{R_3 R_1}{R_T}$$

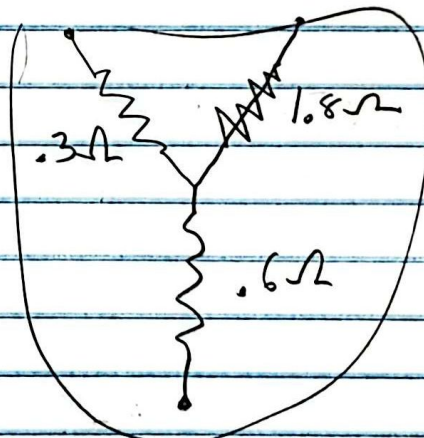
$$R_T = R_1 + R_2 + R_3 = 10\Omega$$

$$R_A = 1.8\Omega$$

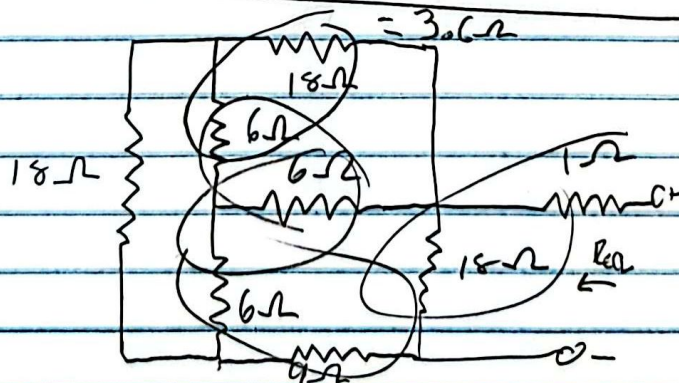
$$R_B = 0.6\Omega$$

$$R_C = 0.3\Omega$$

SC

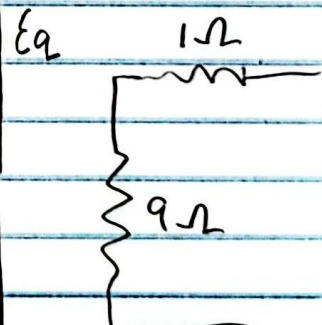


2.61



$$\frac{6 \cdot 18}{6 + 6 + 18} = 3.6\Omega$$

$$\frac{6 \cdot 6}{6 + 6 + 18} = 1.2\Omega$$



$$R_{Eq} = 10\Omega$$