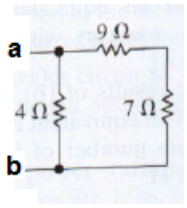
ENGR 12 Assignment 3 Due: next wed

Part I. Drills -- 1 point each

Find the equivalent resistance measured at terminals a and b. Remember all currents in a series path are the same. All voltages across parallel paths are the same.

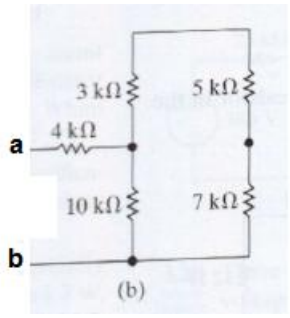
1)



$R = 4 \| (9+7)$

$= \frac{4 \cdot 16}{9+16} = 3.2\,\Omega$

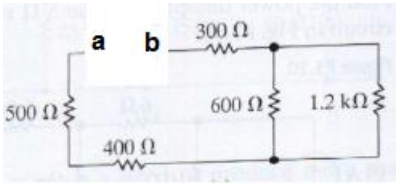
2)



$R_{ab} = 4 + 10 \| (3+5+7)$

$= 4 + \frac{10 \cdot 15}{10+15} = 4+6 = 10\,k\Omega$

3)



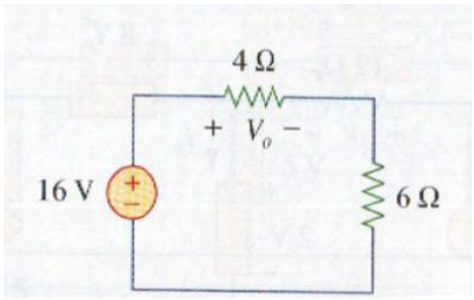
$R_{ab} = 500 + 400 + 600 \| 1200 + 300$

$= 1200 + \frac{600 \cdot 1200}{1800} = 1200 + 900$

$= 1600\,\Omega$

4) Use voltage division to find the voltages v0 and v1

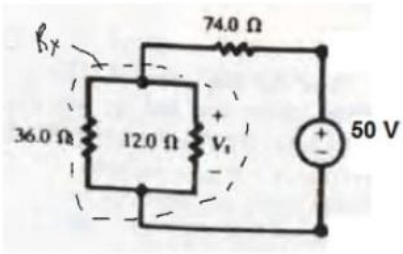
a) This is Prob 2.27 in your text



Using voltage division,

$$V_o = \frac{4}{4+16}(16\text{V}) = \underline{6.4\text{ V}}$$

b) Note V1 is measured across the 36||12 combination

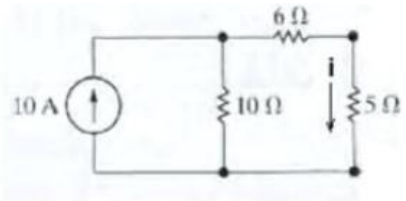


$R_x = 12 \| 36 = 9\,\Omega$

$V_1 = \frac{50 \cdot 9}{9+74} = 5.42\text{V}$

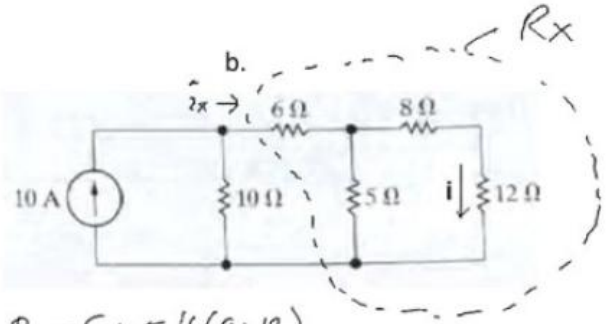
5) Find the current *i* using current division

a.



$i = \frac{10\text{A} \cdot 10\,\Omega}{(10+11)\,\Omega} = 4.76\text{A}$

b.



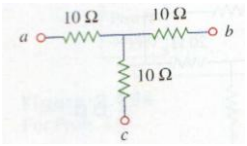
$R_x = 6 + 5 \| (8+12)$

$= 6 + \frac{5 \cdot 20}{25} = 6+4 = 10\,\Omega$

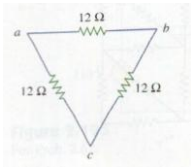
$i_x = \frac{10\text{A} \cdot 10\,\Omega}{(10+10)\,\Omega} = 5\text{A}, \quad i = \frac{i_x \cdot 5}{5+8+12} = \frac{25}{25} = 1\text{A}$

6) Convert the Wye to Delta and the Delta to Wye

a. this is 2.48a



b. this is 2.49a



(a) R_a =

$$\frac{R_1R_2+R_2R_3+R_3R_1}{R_3}=\frac{100+100+100}{10}=30$$

$R_a = R_b = R_c =$ **30 Ω**

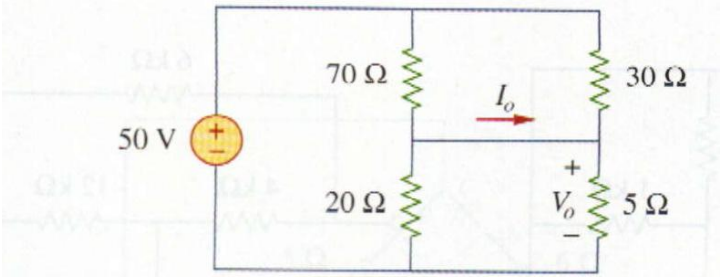
(a) **R_1 =**

$$\frac{R_aR_c}{R_a+R_b+R_c}=\frac{12*12}{36}=4\Omega$$

$R_1 = R_2 = R_3 =$ 4 Ω

Part II. Assisted Problem Solving – 2 pts each

2.35 Calculate V_o and I_o in the circuit



Combining the versions in parallel,

$$70\|30=\frac{70x30}{100}=21\Omega\,,\qquad 20\|5=\frac{20x5}{25}=4\ \Omega$$

$$i=\frac{50}{21+4}=2\ \text{A}$$

$v_i = 21i = 42$ V, $v_0 = 4i = 8$ V

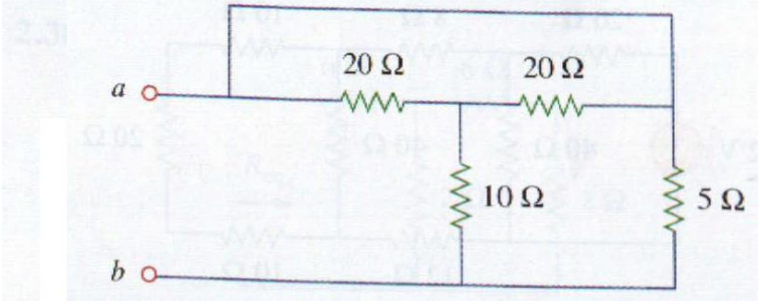
$$i_1=\frac{v_1}{70}=0.6\ \text{A},\quad i_2=\frac{v_2}{20}=0.4\ \text{A}$$

At node a, KCL must be satisfied

$$i_1 = i_2 + I_0 \longrightarrow 0.6 = 0.4 + I_0 \longrightarrow I_0 = 0.2\ \text{A}$$

Hence $v_0 =$ **8 V** and $I_0 =$ **0.2A**

2.44 For the circuit obtain the equivalent resistance at terminals *a-b*.

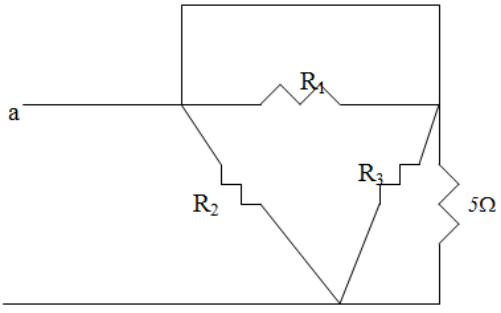


Convert Y to Delta to obtain

$$R_1=\frac{20x20+20x10+10x20}{10}=\frac{800}{10}=80\Omega$$

$$R_2=\frac{800}{20}=40\Omega=R_3$$

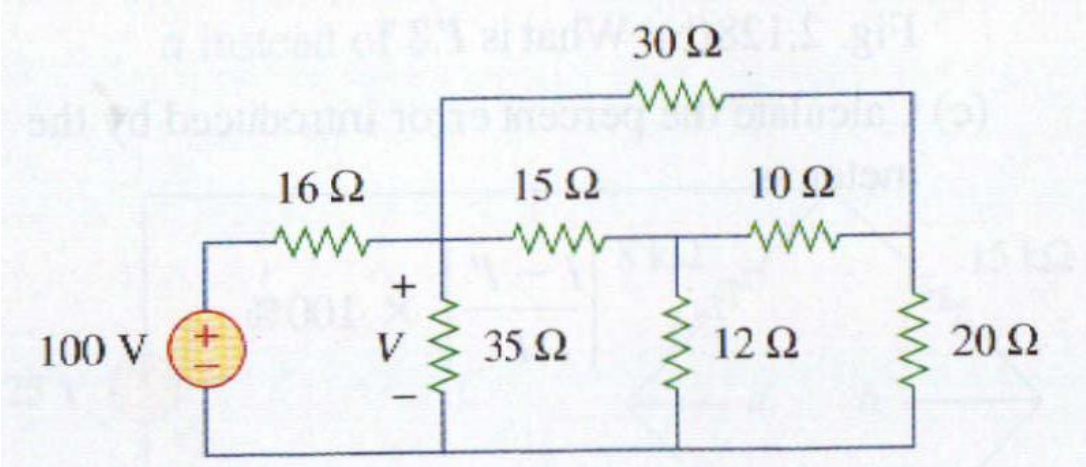
The circuit becomes that shown below.



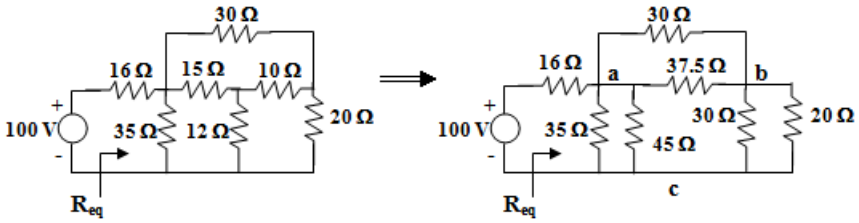
$R_1//0 = 0$, $R_3//5 = 40//5 = 4.444\ \Omega$

$R_{ab} = R_2 // (0 + 4.444) = 40 // 4.444 =$ 4Ω

9) Find V in the following circuit



We need to find R_{eq} and apply voltage division. We first tranform the Y network to Δ.



$$R_{ab} = \frac{15x10 + 10x12 + 12x15}{12} = \frac{450}{12} = 37.5\Omega$$

$R_{ac} = 450/(10) = 45\Omega$, $R_{bc} = 450/(15) = 30\Omega$

Combining the resistors in parallel,

$$30||20 = (600/50) = 12\ \Omega,$$

$$37.5||30 = (37.5x30/67.5) = 16.667\ \Omega$$

$$35||45 = (35x45/80) = 19.688\ \Omega$$

$$R_{eq} = 19.688||(12 + 16.667) = 11.672\Omega$$

By voltage division,

$$v = \frac{11.672}{11.672 + 16}100 = \underline{\mathbf{42.18\ V}}$$