Desk Copy

ECE 300
Spring Semester, 2005
HW Set #2

January 25, 2005 **Name** GREEN
wlg AM PM Print (last, first)

Use engineering paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work. Underline your answers. Show how you got your equations.** **Be sure to show how you got your answers.** Each problem counts 4 points.

Study and work the Review Questions at the end of Chapter 2: You are not required to submit your solutions to these review questions.

2.10 $i_1 = 7$ A, $i_2 = -5$ A

2.16 $v_1 = 14$ V, $v_2 = 22$ V

2.18 On your own

2.22 $v_o = -4.44$ V, $P_{disp} = 99$ W

2.31 $v = 10$ V, $I = 1$ A, $P_{abs\ 4\ ohm} = 4$ W

2.33 $v = 3$ V, $I = 6$ A

2.34 $i_1 = 2$ A, $i_2 = 0.24$ A, $v_1 = 12$ V, $v_2 = 3.12$ V

2.40 $R_{eq} = 5$ ohms, $I = 2$ A

2.43 (a) $R_{ab} = 12$ ohms, (b) $R_{ab} = 16$ ohms

2.56 $v = 42.18$ V

2.58 $V_S = 210$ V

2.64 $R = 11$ ohms, $R_x = 99$ ohms

2.77 (a) 4 @ 20 in parallel

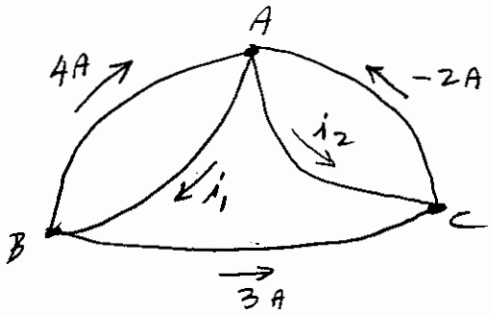
(b) 300 ohms in series with 1.8 ohms and a parallel combination of two 20 ohms resistors

(c) two 29 k ohms in parallel, connected in series with 2, 50 k ohms in parallel

wlg

Homework Set #2
ECE 300

2.10 Find i_1 & i_2 in the following circuit



At C:

$$i_2 + 3 = -2$$

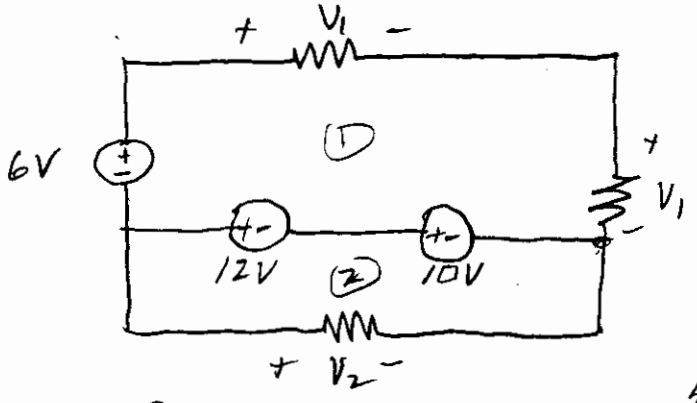
$$\boxed{i_2 = -5A}$$

At B:

$$i_1 = 3 + 4 = 7$$

$$\boxed{i_1 = 7A}$$

2.16 Find V_1 and V_2 in the following ckt.



AROUND mesh ①

Σ rises = 0 CW

$$2V_1 - 6 - 12 - 10 = 0$$

$$2V_1 = 28$$

$$\boxed{V_1 = 14\,V}$$

AROUND mesh ②

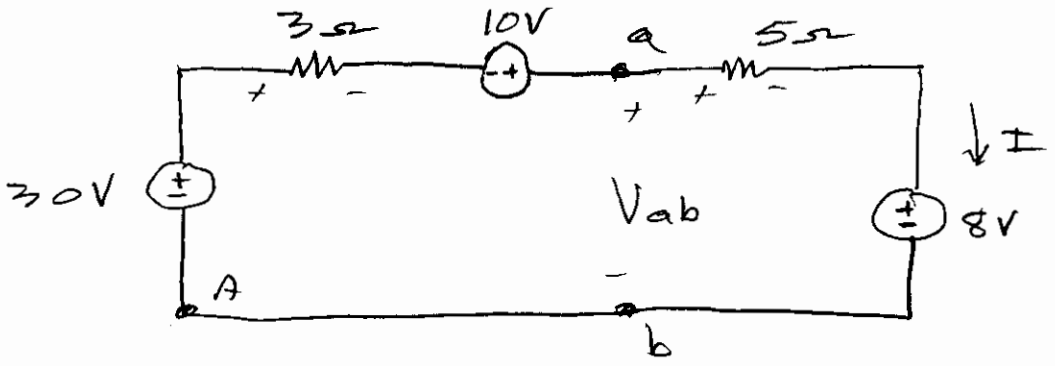
Σ rises = 0 CW

$$10 + 12 - V_2 = 0$$

$$\boxed{V_2 = 22\,V}$$

Volts

2.18 Find I and V_{ab} in the ckt below.



Σ rises $= 0$,

start at A, go CW

$$30 - 3I + 10 - 5I - 8 = 0$$

$$8I = 32$$

$$\boxed{I = 4\ A}$$

start at "b" go CW using

Σ rises $= 0$

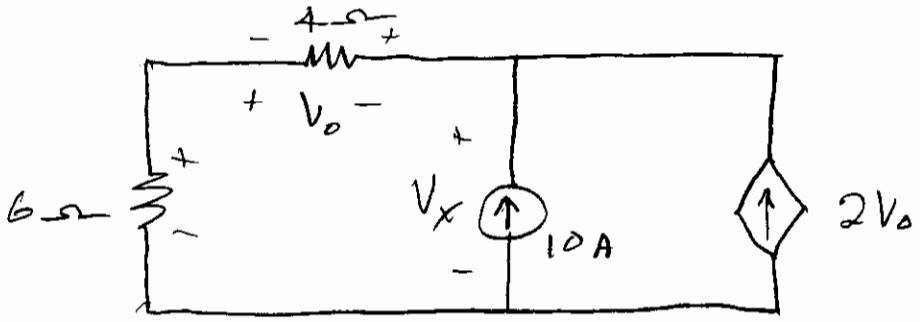
$$V_{ab} - 5I - 8 = 0$$

$$V_{ab} = 5I + 8 \Big|_{I=4} = 20 + 8$$

$$\boxed{V_{ab} = 28V}$$

wkg

2.22 Find V_o in the following ckt and the power dissipated by the controlled source.



$$V_x + V_o - 6(10 + 2V_o) = 0$$

$$V_x + V_o - 12V_o - 60 = 0$$

$$\boxed{V_x - 11V_o = 60}$$

Also,

$$V_o + 4.(10 + 2V_o)$$

$$9V_o = -40$$

$$\therefore V_o = -4.44\ V$$

Also

$$V_x = 60 + 11V_o = 60 - 11 \times 4.44 = 11.16\ V$$

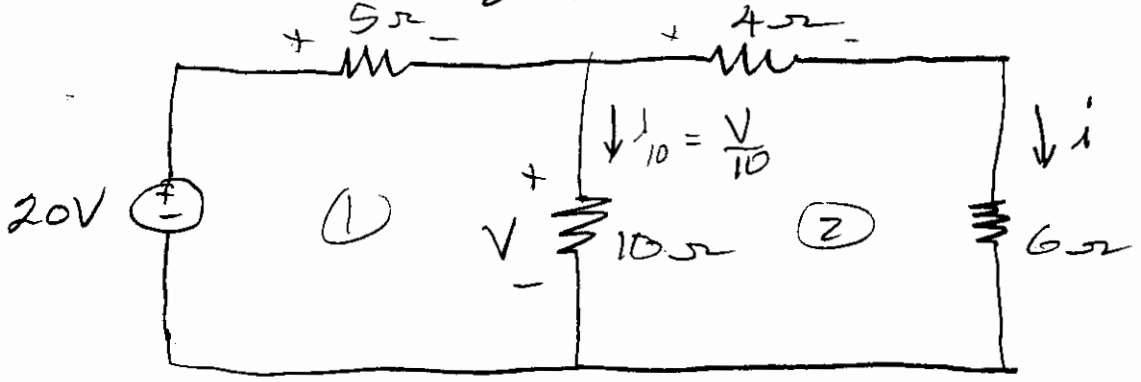
$$P_{disp} = (-V_x)(2V_o) = (-11.16)(2(-4.44))$$

$$\boxed{P_{disp} = 99.1\ W}$$

wkg

2.31

Find v and i and the power absorbed by the 4Ω resistor.



Around ① $\sum$ rises $= 0$, CW

$$20 - 5\left(\frac{V}{10} + i\right) - V = 0$$

$$-1.5V - 5i = -20$$

or

$$\boxed{1.5V + 5i = 20} \quad (A)$$

Around ② $\sum$ rises $= 0$, CW

$$\boxed{V - 10i = 0} \quad (B)$$

Solving (A) and (B)

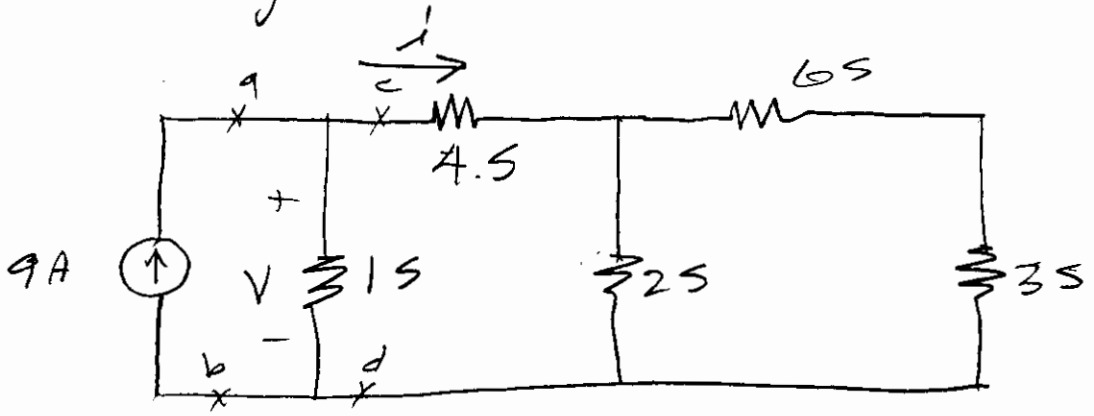
$$V = 10\ V$$

$$i = 1\ A$$

$$P_{abs\ 4\Omega} = i^2 R = (1)^2 \times 4 = 4\ W$$

wkg

2.33 Find V and i in the following circuit.



3S in series with 6S

$$\frac{3\times 6}{3+6} = 2S$$

2S in parallel with 2S

$$2S + 2S = 4S$$

Then 4S in series with 4S

$$\frac{4\times 4}{4+4} = 2S$$

Then 2S in parallel with 1Ω

$$Y_{ab} = 2S + 1S = 3S$$

$$V = \frac{9}{3} = 3V$$

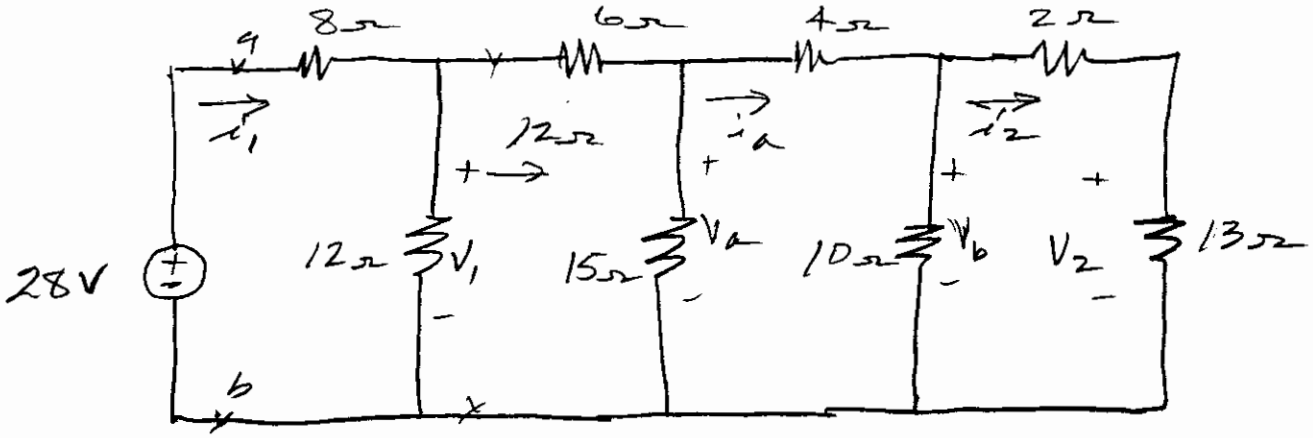
$$Y_{cd} = 2S$$

$$i = V \times Y_{cd} = 3\times 2 = 6A$$

wlq

2.34

Determine i_1, i_2, V_1 and V_2 in the network below. Calculate the power dissipated in the 2Ω resistor.



Find R_{ab}

$$25 \parallel 10 = \frac{15 \times 10}{25} = 6\,\Omega$$

6Ω in series with 4Ω = 10Ω

Then

$$10\,\Omega \parallel 15\,\Omega = 6\,\Omega$$

6Ω in series with 6Ω = 12Ω

$$12\,\Omega \parallel 12\,\Omega = \underline{\underline{6\,\Omega}}$$

6Ω in series with 8Ω = 14Ω

So $R_{ab} = 14\,\Omega$

$$i_1 = \frac{28}{14} = 2\,A$$

2.34 continued

$$V_1 = i_1 \times 6 = 2 \times 6 = 12\ V$$

$$\{V_1 = 12\ V\}$$

$$V_4 = \frac{V_1 \times 6}{6+6} = \frac{V_1}{2} = \frac{12}{2} = 6\ V$$

$$V_6 = \frac{6\ V \times 6}{6+4} = 3.6\ V$$

$$V_2 = \frac{(3.6)(13)}{13+2} = 3.12\ V$$

$$\{V_2 = 3.12\ V\}$$

$$i_2 = \frac{3.12}{13} = 0.24\ A$$

$$\{i_2 = 0.24\ A\}$$

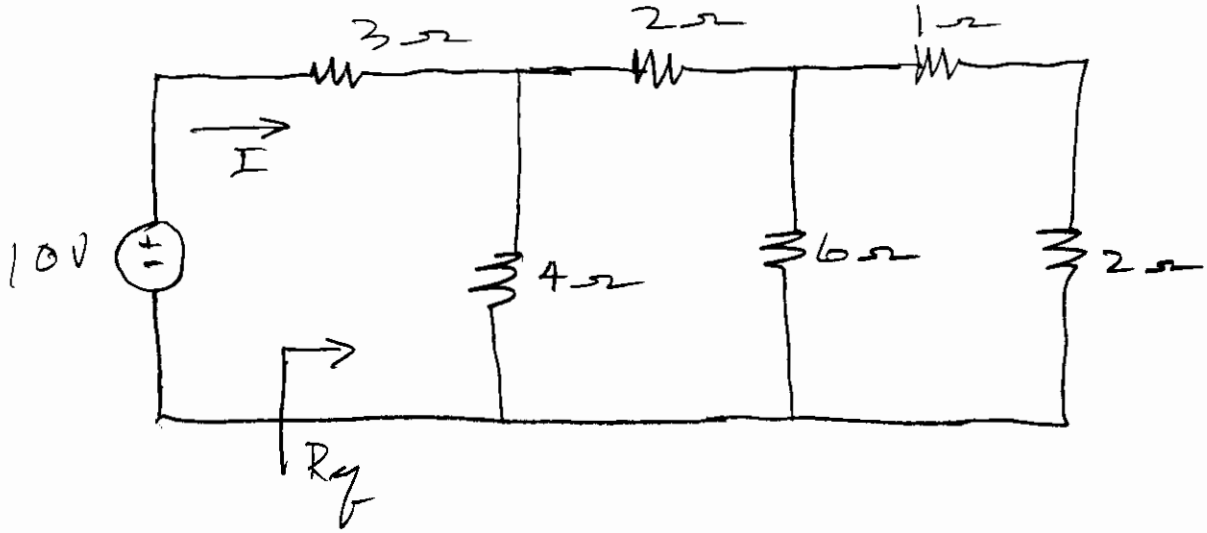
$$P_{2\Omega} = (i_2^2)2 = (0.24)^2 \times 2$$

$$\{P_{2\Omega} = 0.115\ W\}$$

wlg

2.40

Find I and R_{eq} for the ckt below.



For R_{eq}, starting at the far right.

$$3 \| 6 = \frac{3 \times 6}{3+6} = \frac{18}{9} = 2\Omega$$

2 in series with $2 = 4\Omega$

$$4 \| 4 = \frac{4 \times 4}{8} = 2\Omega$$

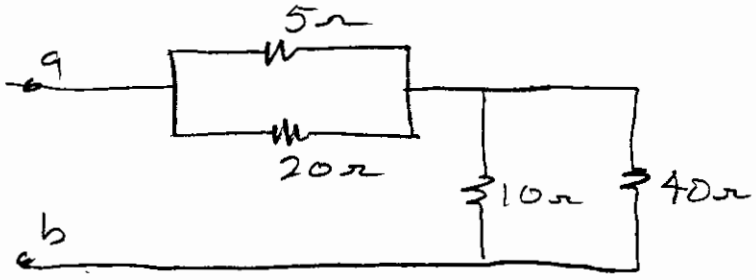
$$\boxed{R_{eq} = 3 + 2 = 5\Omega}$$

$$\boxed{I = \frac{10V}{5} = 2A}$$

WQ1

2.43

(a) Find R_{ab} for the following



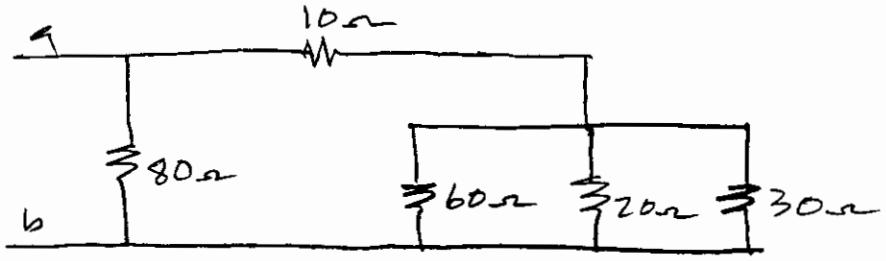
$$R_{ab} = 5 \| 20 + 10 | 40$$

$$= \frac{5 \times 20}{20+5} + \frac{10 \times 40}{10+40}$$

$$R_{ab} = 4\Omega + 8\Omega = 12\Omega$$

$$\boxed{R_{ab} = 12\Omega}$$

(b)



60; 20; 30 IN parallel

$$\frac{20 \times 30}{20+30} = 12\Omega$$

$$\frac{60 \times 12}{72} = 10\Omega$$

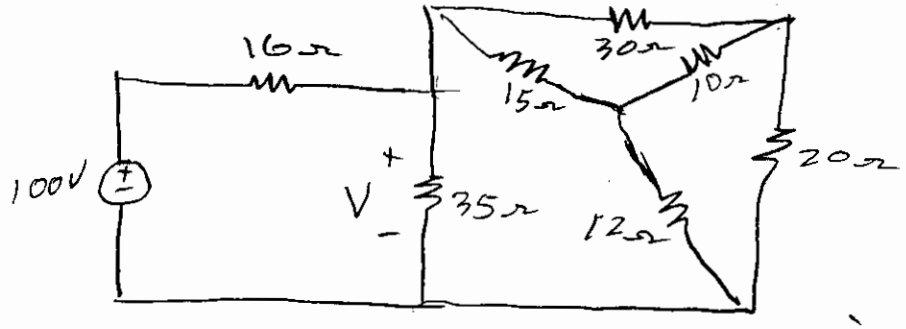
$$\boxed{R_{ab} = \frac{80 \times 20}{80+20} = 16\Omega}$$

wtg

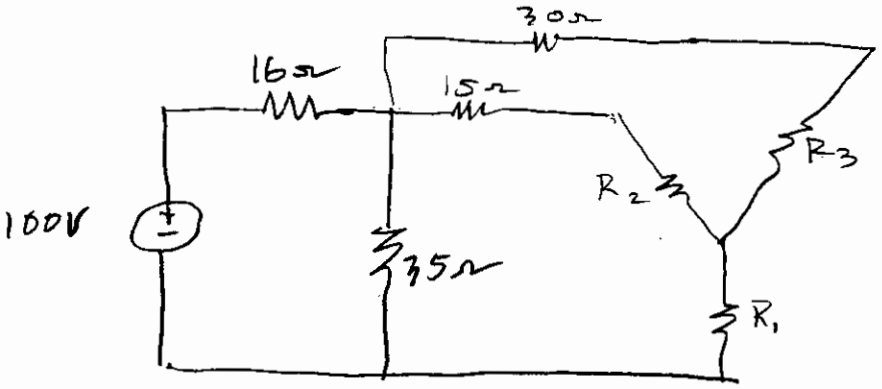
2.56

Find V in the circuit below. Since this is in the wye-~~delta~~ section of the problems, I will use Y-Δ.

First I redraw the circuit identifying the Y-Δ portions, that I see.



I will use the Δ on the right



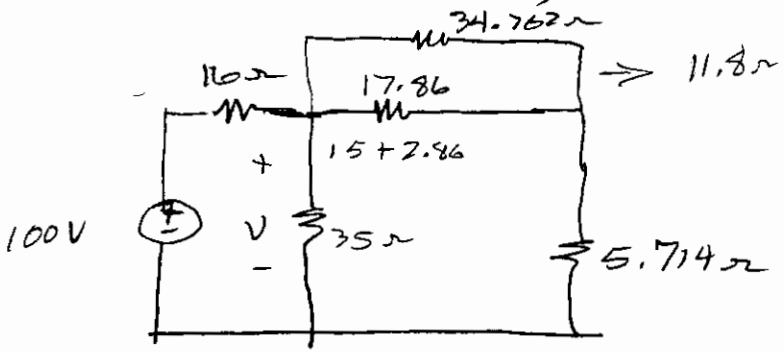
$$R_1 = \frac{12 \times 20}{12+20+10} = 5.714\,\Omega$$

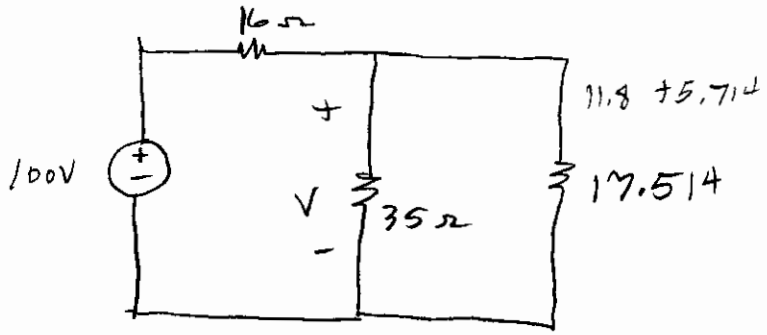
$$R_2 = \frac{10 \times 12}{12+20+10} = 2.86\,\Omega$$

$$R_3 = \frac{10 \times 20}{12+20+10} = 4.762\,\Omega$$

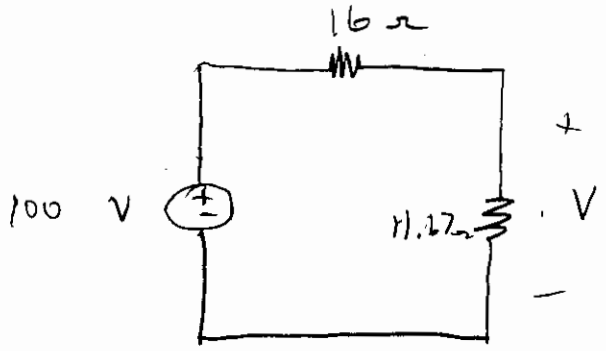
2.56 continued

The ckt becomes;





$$35 \parallel 17.514 = \frac{35 \times 17.514}{35 + 17.514} = 11.67$$



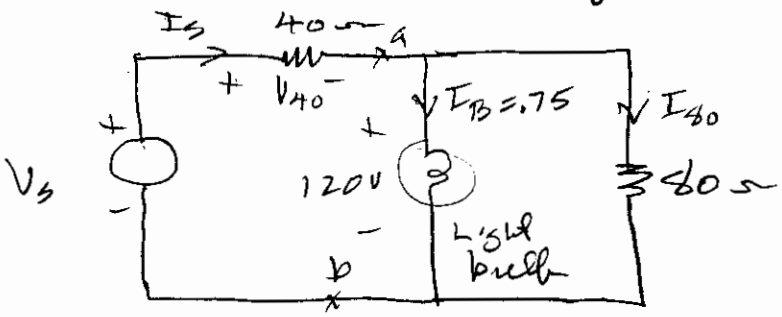
By voltage division

$$V = \frac{100 \times 11.67}{16 + 11.67} = 42.18\ V$$

wlg

2.58

Given the following



Light bulb is rated at 120V, 0.75A.

I assume this means d.c. since we have not covered A.C. I further assume there is 120V drop across the bulb and it is drawing 0.75A,

Calculating I_s

$$I_s = I_B + I_{80}$$

where $I_{80} = \frac{120V}{80} = 1.5A$

$$I_s = 0.75 + 1.5 = 2.25\ A$$

Calculating V_s

$$V_s = V_{40} + 120 = 2.25 \times 40 + 120$$

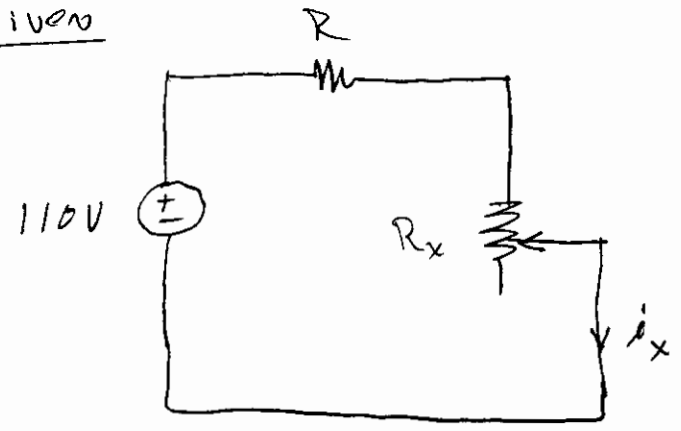
$$V_s = 90 + 120$$

$$\boxed{V_s = 210\ V}$$

wlg

2.64

Given



Assume High End For i_x

With R_x giving zero resistance to the circuit;

$$i_x = \frac{110}{R} = 10$$

$$\therefore \boxed{R = \frac{110}{10} = 11\ \Omega}$$

Assume Low End For i_x

R_x fully in

$$\frac{110}{11 + R_x} = 1$$

$$R_x + 11 = 110$$

$$\boxed{R_x = 99\ \Omega}$$

$$\boxed{\begin{aligned} R &= 11\ \Omega \\ R_x &= 99\ \Omega \end{aligned}}$$

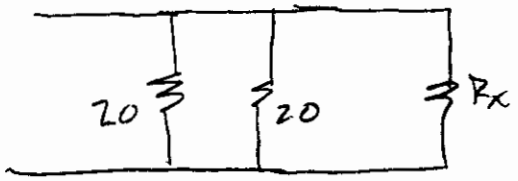
2.77

Given in large quantities

1.8Ω, 20Ω, 300Ω, 24KΩ, 56KΩ

Using series & parallel combinations and a minimum number of available resistors, how would you obtain the following resistances?

(a) 5Ω



$20 \| 20 = 10$

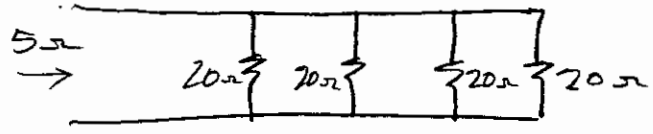
Try $10 \| R_x = 5$

$$\frac{10 R_x}{10 + R_x} = 5$$

$10R_x = 50 + 5R_x$

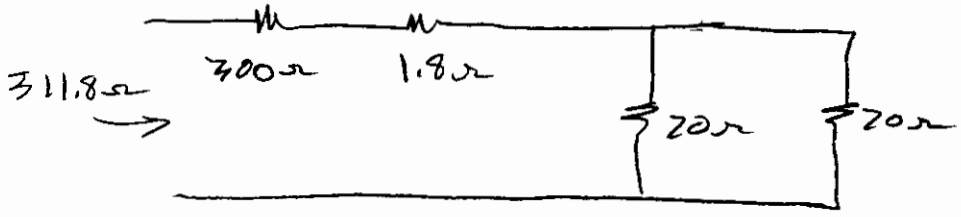
$R_x = 10\Omega$ can do this with 2, 20Ω resistors.

So:



(b) Want 311.8

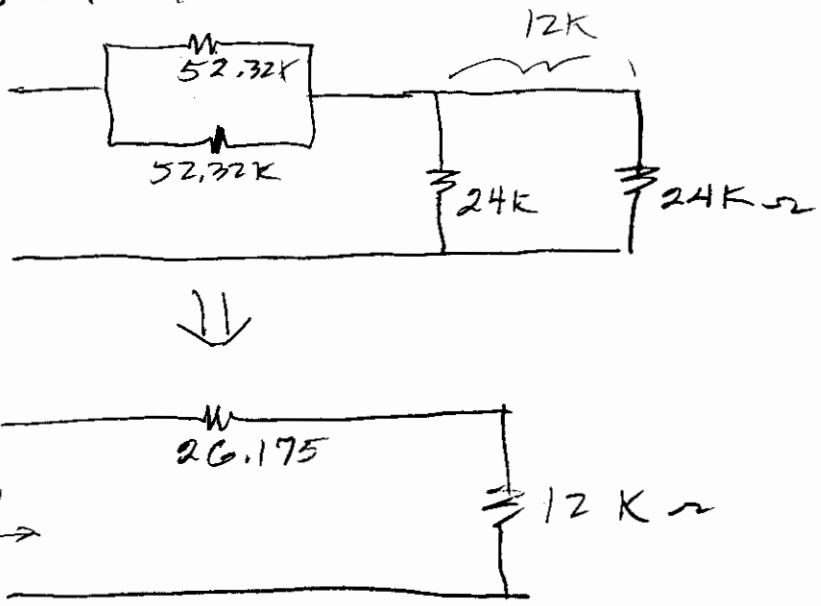
$300 + 1.8 + 20 \| 20$



2.77 cont

(c) Want 40 KΩ

Want 40 KΩ



R_{IN} = 38.175 KΩ

Close As I can get

with 4 or fewer resistors. You could continue with 300Ω (several) and 20Ω and 1.8Ω and get closer but many resistors.

Book Answer Assumes we have 56KΩ

With this