Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #3
February 25, 2013

Keep this quiz closed and face up until you are told to begin.

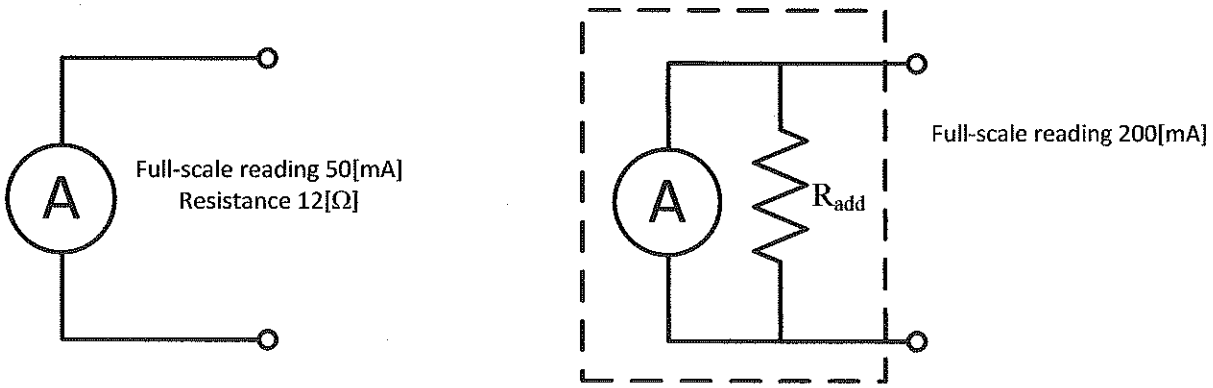
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**
4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz.

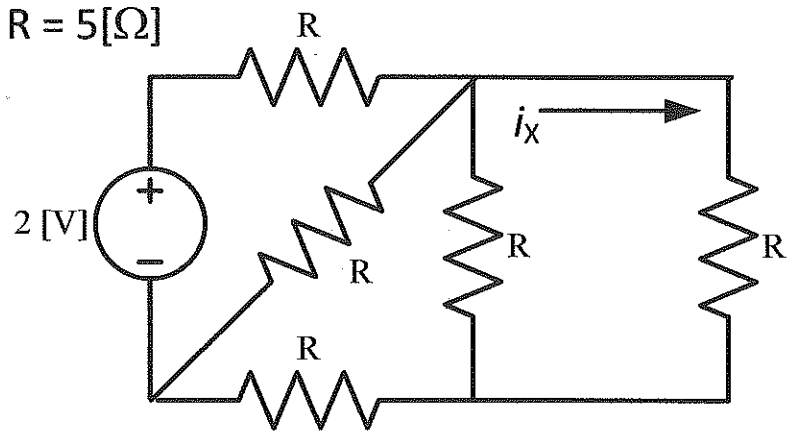
_____/20

The ammeter "A" shown in the top left figure has a full-scale reading of 50[mA] and a resistance of 12[Ω].

a) Resistor R_{add} is added in parallel with the ammeter to make a new ammeter with a full-scale reading of 200[mA], as shown in the top right. Find the value of R_{add}.

b) If the new ammeter, with R_{add} included, is used to measure i_X in the circuit in the bottom figure, what does the ammeter read?





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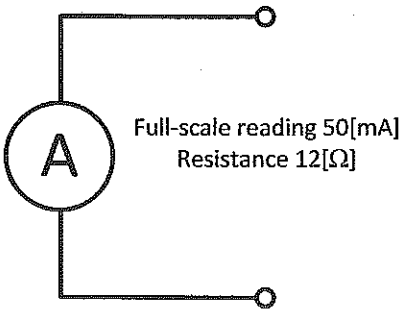
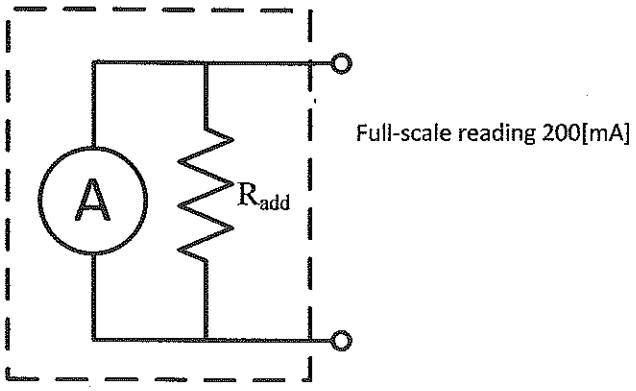
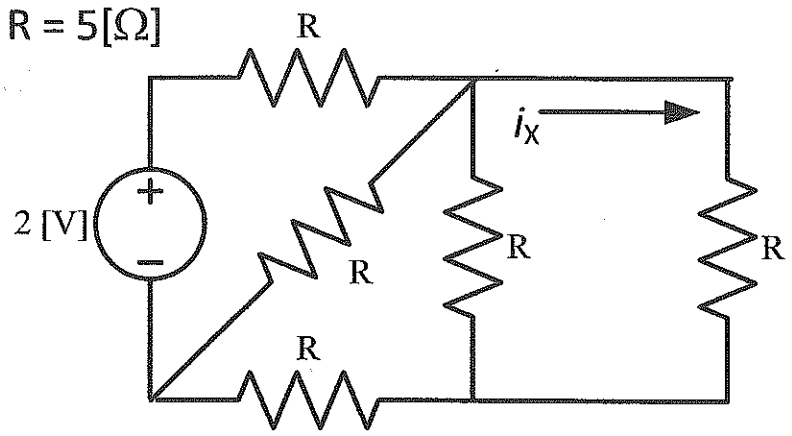
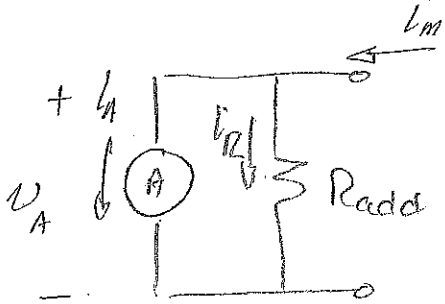






a)



We set the measured current to the max: 200 [mA], in which case $i_A = 50$ [mA] and

$$v_A = (0.05)(12) = 0.6 \text{ [V]}$$

next page

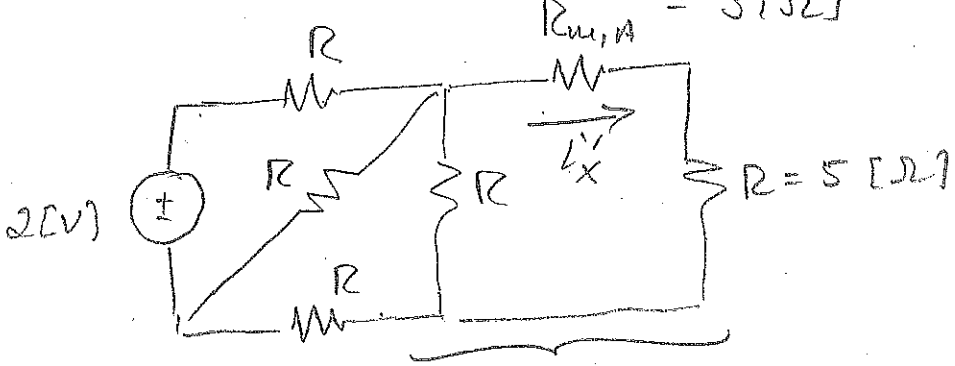
x5 Room for extra work

That means $i'_R = 150\,[mA] \Rightarrow R_{add} = \frac{0.6}{0.150} = 4\,[\Omega]$

b) We need to insert the ammeter in the branch where i_x flows, which means we need the new ammeter resistance $R_{M,A}$:

x1 $$R_{M,A} = R_{add} \,//\, 12\,[\Omega] = 4 \,//\, 12 = 3\,[\Omega].$$

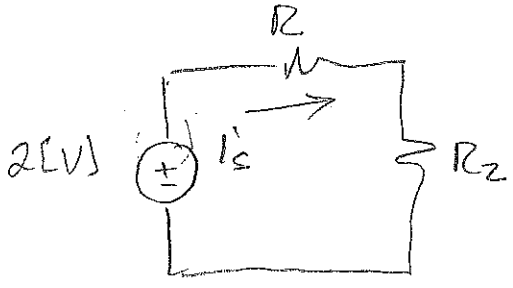
Now we have...



Reducing... $R_1 \equiv (R + R_{M,A}) \,//\, R = 8 \,//\, 5 = 3.077\,[\Omega]$

$R_2 = (R_1 + R) \,//\, R = 8.077 \,//\, 5 = 3.088\,[\Omega]$

x6



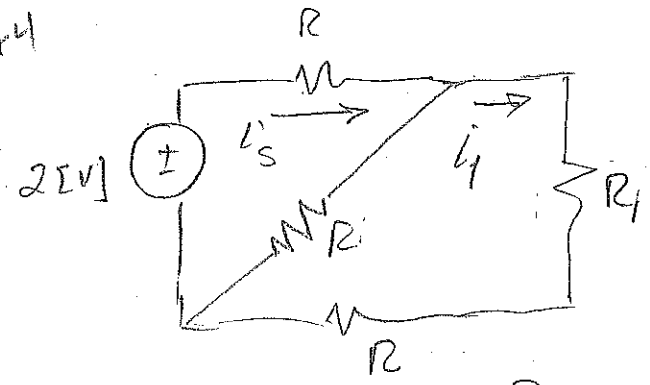
$$i'_s = \frac{2}{R + R_2} = \frac{2}{8.088} = 0.2473\,[A]$$

We now "unfold"

to p. 2

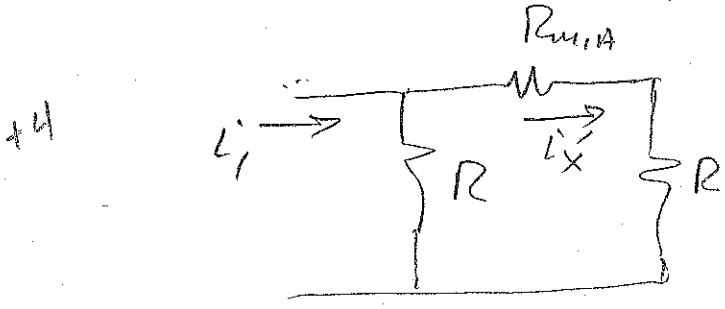
Room for extra work

+4



$$i_1' = i_s' \frac{R}{R+R+R_1} = i_s' \frac{5}{5+5+3.077}$$

$$= 94.56 \text{ [mA]}$$



+4

$$i_x' = i_1' \frac{R}{R+R+R_{mA}} = i_1' \frac{5}{5+5+3}$$

$$= 36.37 \text{ [mA]}$$

So the meter reads $i_x' = 36.37$ [mA].

The ammeter "A" shown in the top left figure has a full-scale reading of 50[mA] and a resistance of 12[Ω].

a) Resistor R_{add} is added in parallel with the ammeter to make a new ammeter with a full-scale reading of 200[mA], as shown in the top right. Find the value of R_{add}.

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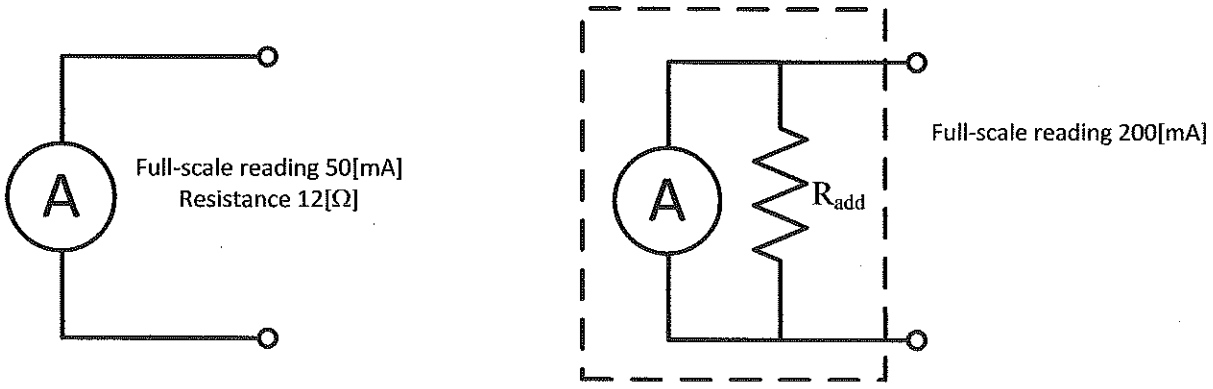

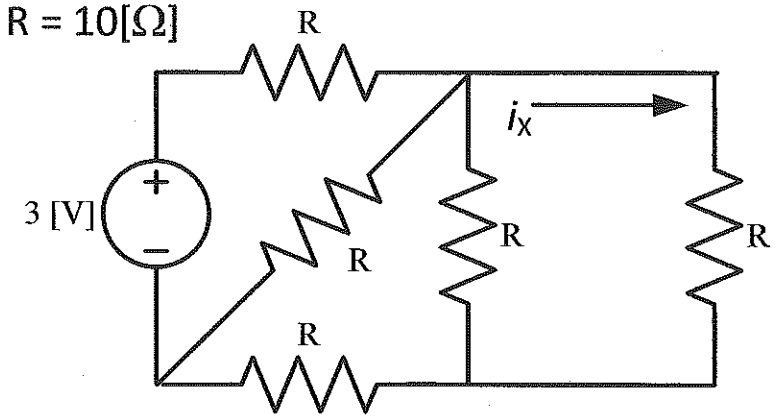

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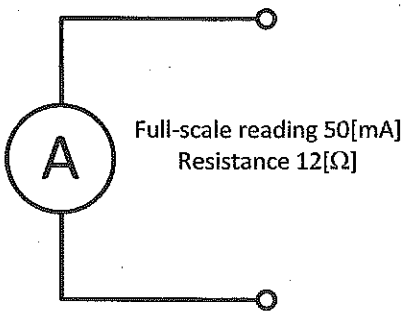
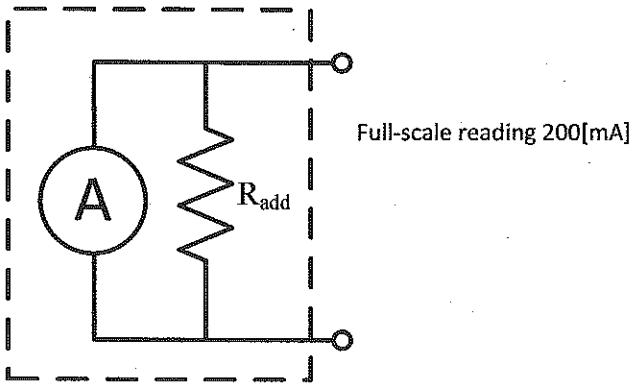
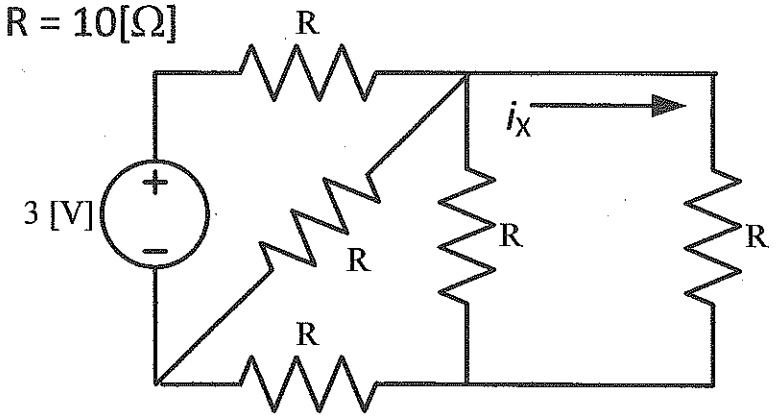
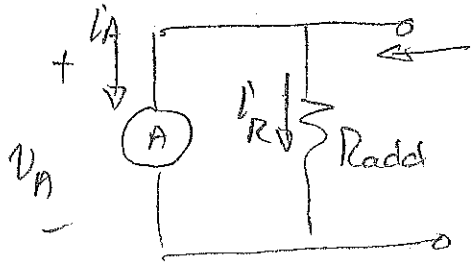






a)



We set the measured current to the max: 200 [mA], in which case $i_A = 50$ [mA] and

$v_A = (0.05)(12) = 0.6$ [V]

next page

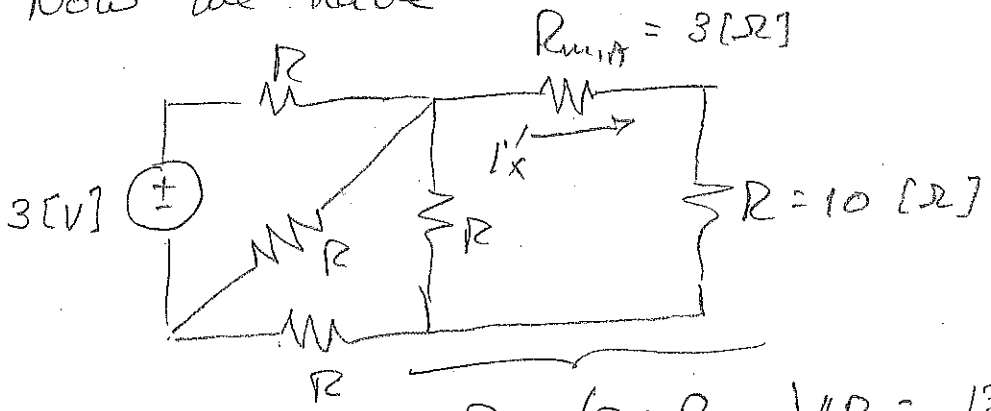
Room for extra work

That means $i'_R = 150\ [mA] = \frac{0.6}{R_{add}} = \frac{0.6}{0.150} = 4\ [\Omega]$

b) We need to insert the ammeter in the branch where i'_x flows, which means we need the new meter resistance $R_{m,A}$:

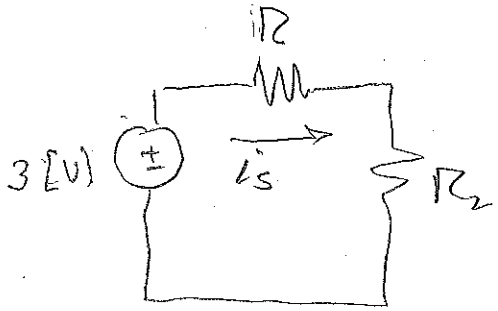
$$R_{m,A} = R_{add} \,//\, 12\ [\Omega] = 4 \,//\, 12 = 3\ [\Omega]$$

Now we have



$$R_1 = (R + R_{m,A}) \,//\, R = 13 \,//\, 10 = 5.652\ [\Omega]$$

$$R_2 = (R_1 + R) \,//\, R = 15.652 \,//\, 10 = 6.102\ [\Omega]$$

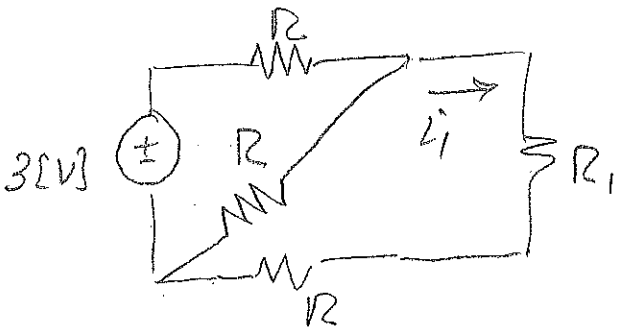


$$i'_s = \frac{3}{R + R_2} = \frac{3}{16.102} = 0.1863\ [A]$$

We now "unfold"

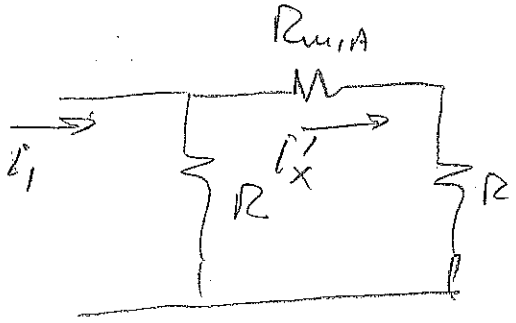
to p. 2

Room for extra work



$$i_1' = i_s' \frac{R}{R+R+R_1} = i_s' \frac{10}{10+10+5.65^{-2}}$$

$$= 22.63 \text{ [mA]}$$



$$i_x' = i_1' \frac{R}{R+R+R_{mA}} = i_1' \frac{10}{10+10+3}$$

$$= 31.58 \text{ [mA]}$$

So the meter reads $i_x' = 31.58$ [mA]