9/30/2008

University of Portland
School of Engineering

EE 261-Electrical Circuits-3 cr. hrs.
Fall 2008

Midterm Exam # 1

(Friday, September 26, 2008)
(Closed Book Exam, One Formula Sheet Allowed)
(Total Time: 55 minutes)

Name: SOLUTIONS ☺

Signature: _____ ☺

> ***"An honest mind possesses a kingdom."***
> **Lucius Annaeus Seneca (4B.C.–65A.D.)**
>
> ***"Honest people are the true winners of the universe."***
> **Anonymous**

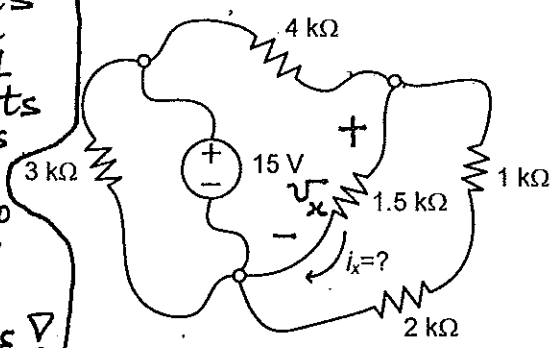
Inan dreams that he will become a famous math puzzlist someday and I will be Bill Gates when he does ☺

9/30/2008

NOTE: On all the problems, please show your work clearly, and provide the appropriate units for your answers. Also mark on the schematic to show any current or voltage that you define in your solution.

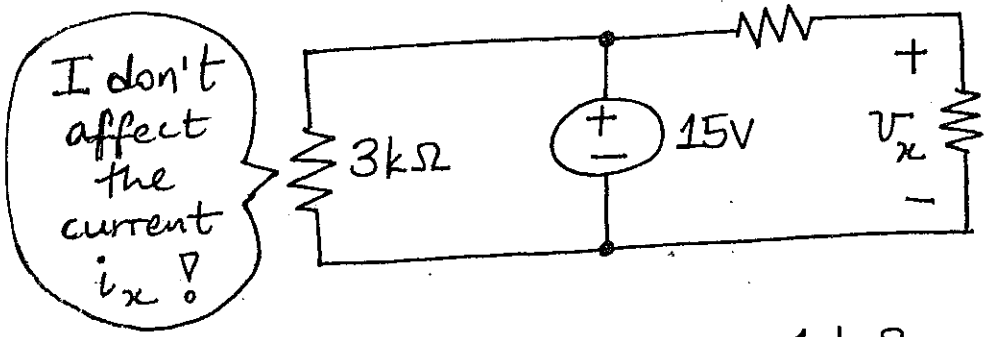
1. (25 points) In the circuit shown, find the value of the current i_x flowing through the 1.5 kΩ resistor. (Please show your work clearly and provide brief justifications for the steps you take. Also, don't forget to provide the correct units for your answers.)

He uses us the EE 261 students as his guinea pigs to fullfill his dreams !



Who cares about his old office#? Number 303 is a palindrome number, so what ?

I'm the equivalent of the 1.5kΩ, 1kΩ & 2kΩ resistors combined !



I don't affect the current i_x !

$$\text{VDP} \rightarrow v_x = \frac{1\text{k}\Omega}{4\text{k}\Omega + 1\text{k}\Omega}(15\text{V}) = 3\text{V}$$

$$\text{Ohm's law} \rightarrow i_x = \frac{v_x}{1.5\text{k}\Omega} = \frac{3\text{V}}{1.5\text{k}\Omega} = \boxed{2\text{mA}}$$

He says that his new office will be on the second floor so it's some two hundred number...

Why should I even care ?

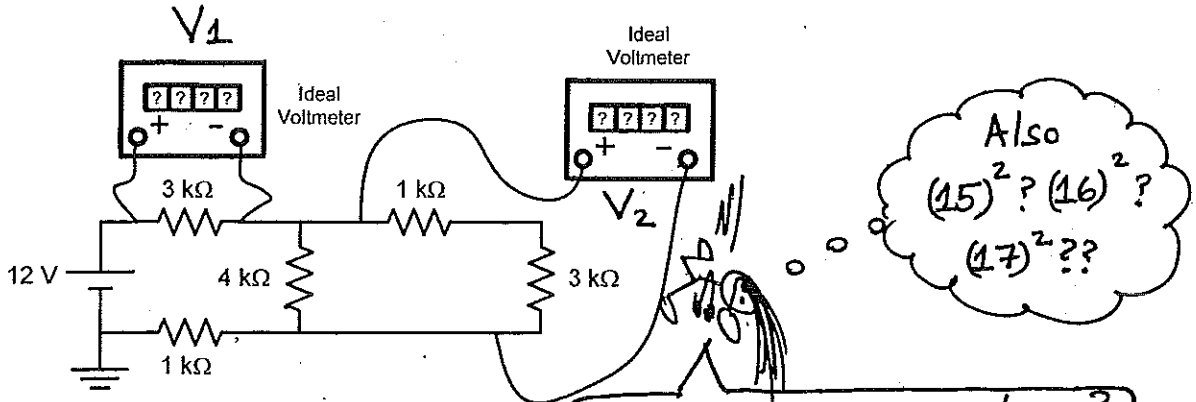
Hmmm... Inan: Tell me again, what is your new office number ?

Never forget again or I will take points off from your EE 261 test !

It's a power number !

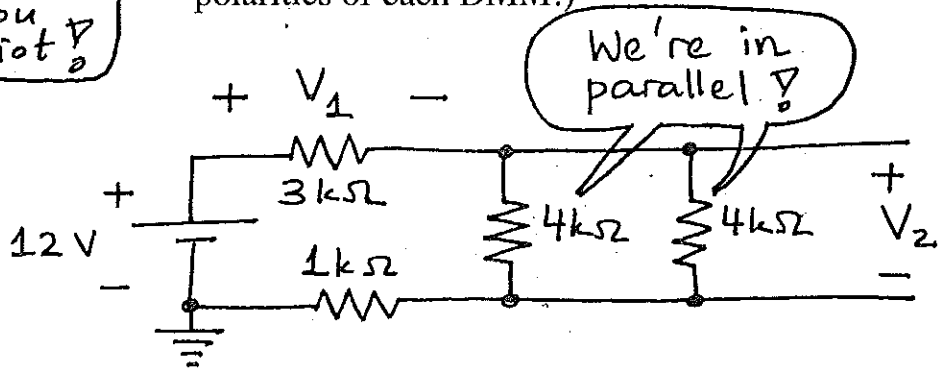
9/30/2008

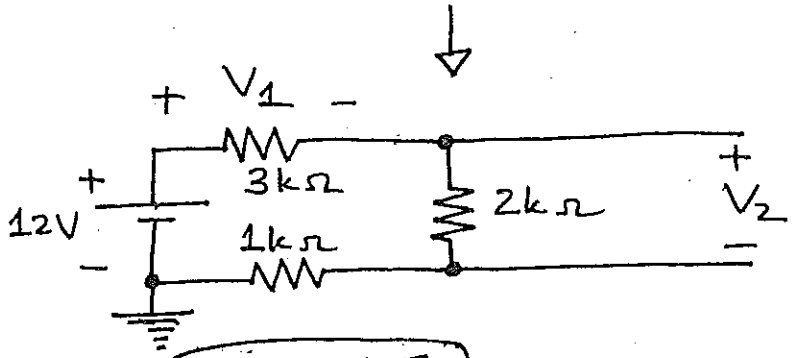
2. (Total: 25 Points) Consider the circuit with two digital multi-meters (DMM's) connected as shown.



It's a cube number you idiot?

(a) (12.5 points) Find the DMM readings if both of them are set to measure voltage, and indicate the units. (Note: Pay attention to the polarities of each DMM!)





VDP:

$$V_1 = \frac{3k\Omega}{6k\Omega}(12V) = \boxed{6V}$$

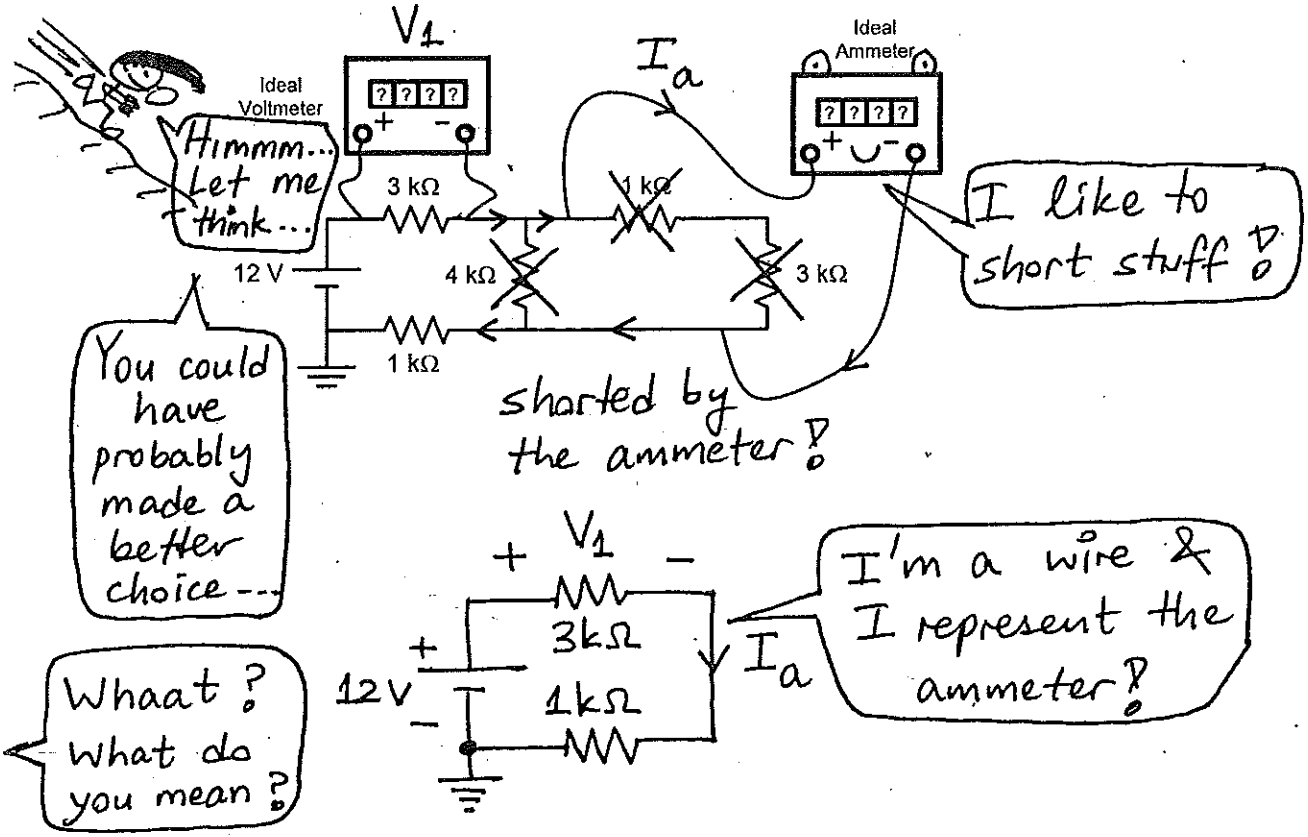
$$V_2 = \frac{2k\Omega}{6k\Omega}(12V) = \boxed{4V}$$

Got it? It must be 216 because that's the only cube number on the office second floor?

Yes, yes? You're absolutely right on that? I made a great choice, didn't I?

9/30/2008

(b) (12.5 points) Repeat part (a) if one DMM by mistake is set to measure current. Again, indicate your units.



$$\text{VDP} \rightarrow V_1 = \frac{3\,k\Omega}{4\,k\Omega}(12\text{ V}) = \boxed{9\text{ V}}$$

$$\text{Ohm's law} \rightarrow I_a = \frac{12\text{ V}}{4\,k\Omega} = \boxed{3\text{ mA}}$$

First of all, the office number you have chosen for your second floor office is not the highest power number on the second floor, that is $256 = 2^8 > 216$ D:

What?

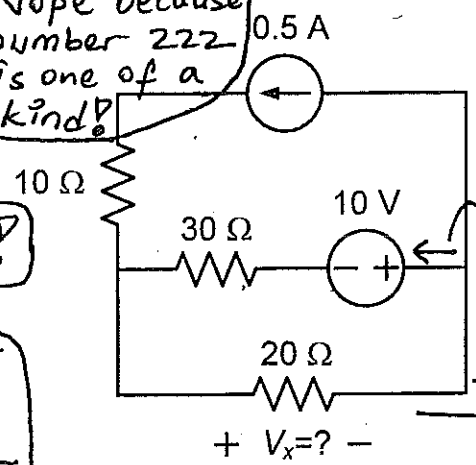
Also, there are other interesting office numbers on the second floor you could have considered such as 202, 210, 212, ---, 276, ---, 283, ---, 285, ---

Okaay, I understand that numbers 202, 212, 222, etc. are palindromes but there are so many of them...

9/30/2008

3. (25 Points) Consider the circuit shown. Determine the voltage V_x across the 20 Ω resistor. Please show your work step by step.

Nope because number 222 is one of a kind!



$\left(\frac{V_x}{20} - 0.5\right)$ based on KCL!

I seee!

$\frac{V_x}{20}$ based on Ohm's law!

What about numbers 210? 276? 283? 285? and so on...

Using KVL around the lower loop yields

$$10 + 30\left(\frac{V_x}{20} - 0.5\right) + V_x = 0$$

What is special about them?

$$10 + 1.5V_x - 15 + V_x = 0 \rightarrow V_x = \boxed{2V}$$

Number 210 equals the sum of all integers between 1 and 20, that is,

$$\sum_{i=1}^{20} i = 210$$

Shoot! I never realized that!

$276 = 1^5 + 2^5 + 3^5$!

Glup!

$283 = 2^5 + 8 + 3^5$!

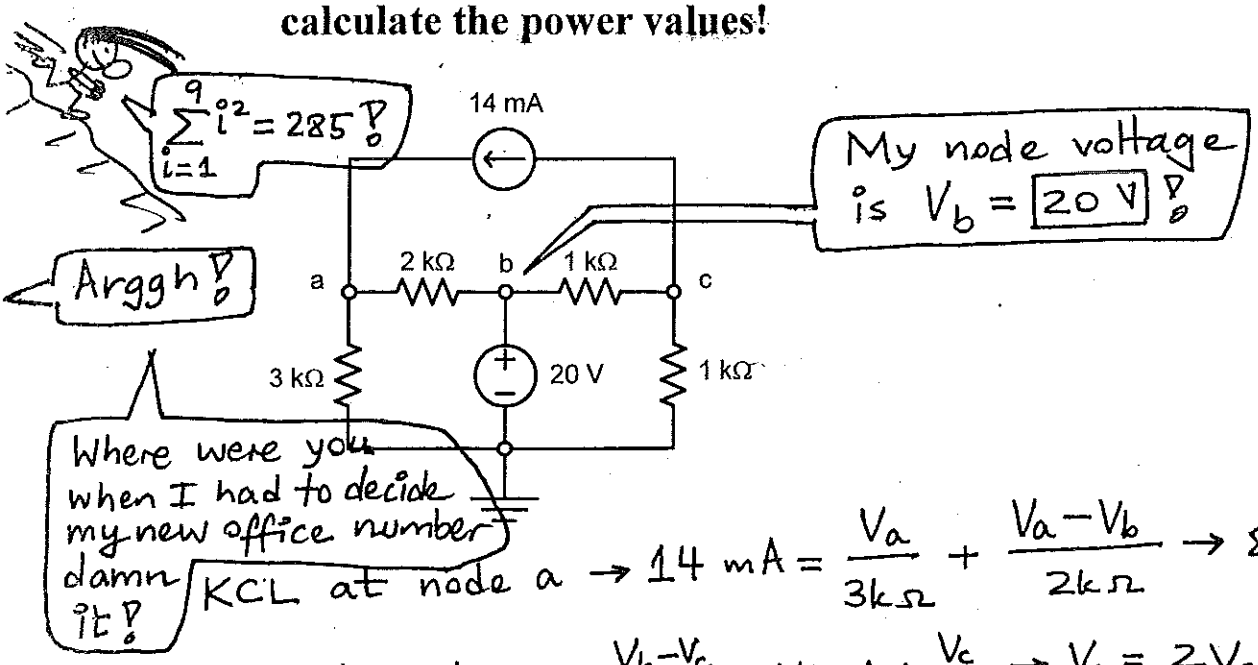
Oops!

Aaand, what makes number 285 special iiis...

What? Quick! Tell me!

9/30/2008

4. (25 Points) In the circuit shown, first, find the node voltages v_a , v_b, and v_c. Then, use these node voltage values to determine the power of each element. Indicate the type of each power value (i.e., absorbed or supplied). Please show your work step by step. **Don't forget to calculate the power values!**



KCL at node a $\rightarrow 14\ mA = \frac{V_a}{3k\Omega} + \frac{V_a - V_b}{2k\Omega} \rightarrow 84 = 5V_a - 3V_b$

KCL at node c $\rightarrow \frac{V_b - V_c}{1k\Omega} = 14\ mA + \frac{V_c}{1k\Omega} \rightarrow V_b = 2V_c + 14$

Since $V_b = 20\ V \rightarrow V_a = \boxed{28.8V}$ & $V_c = \boxed{3V}$

$\therefore P_{2k\Omega} = \frac{(V_a - V_b)^2}{2k\Omega} = \frac{(8.8\ V)^2}{2k\Omega} = \boxed{38.72\ mW}$

$P_{3k\Omega} = \frac{V_a^2}{3k\Omega} = \frac{(28.8)^2}{3k} = \boxed{276.48\ mW}$

$P_{1k\Omega} = \frac{(V_b - V_c)^2}{1k\Omega} = \frac{(17)^2}{1k} = \boxed{289\ mW}$

$P_{1k\Omega} = \frac{V_c^2}{1k\Omega} = \frac{3^2}{1k} = \boxed{9\ mW}$

$P_{\substack{20\ V \\ source}} = (-12.6\ mA)(20\ V) = \boxed{-252\ mW}$

$P_{\substack{14\ mA \\ source}} = (14\ mA)(-25.8V) = \boxed{-361.2\ mW}$

Also, I'm suspecting your choice of number 216 could be influenced by EE 261 since numbers 261 and 216 look alike?

I disagree with you you nerd P

Plus, I found out that my office # is 215 P