

10/3/2005

University of Portland
School of Engineering

EE 261-Electrical Circuits-3 cr. hrs.
Fall 2005

Midterm Exam # 1

(Friday, September 30, 2005)
(Closed Book Exam, One Formula Sheet Allowed)
(Total Time: 55 minutes)

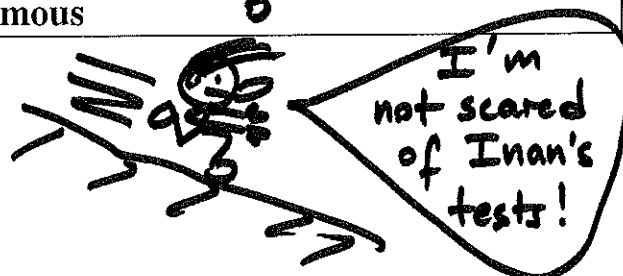
Name: SOLUTIONS ! ☺

Signature: SOLUTIONS ! ☺

"An honest mind possesses a kingdom."
Lucius Annaeus Seneca (4B.C.-65A.D.)

"Honest people are the true winners of the universe."
Anonymous

We will see...
I know Inan
doesn't give easy
tests...

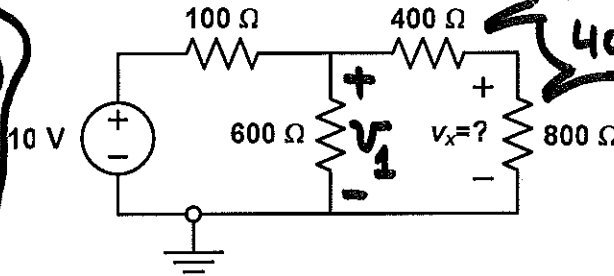


NOTE: On all the problems, please show your work clearly, and provide the appropriate units for your answers. Also mark on the schematic to show any current or voltage that you define in your solution.

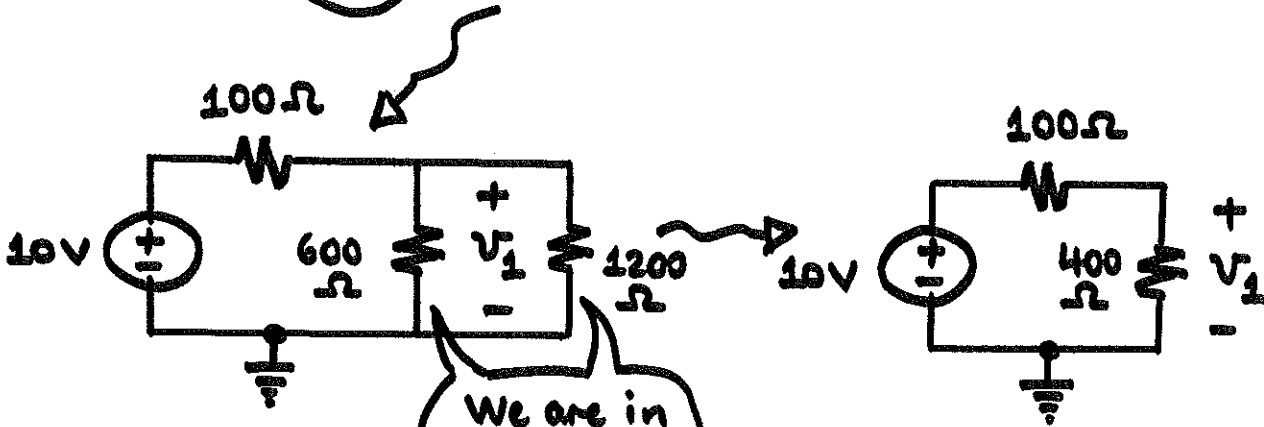
1. (25 points) In the circuit shown, find the value of the voltage v_x across the 800Ω resistor. (Please show your work clearly and provide brief justifications for the steps you take. Also, don't forget to provide the correct units for your answers.)

Inan should not sense that. I'm a bit scared...

I'm ready to tackle his problems one by one!



We are in series!
 $400 + 800 = 1200 \Omega \dots$



We are in parallel!
 $\frac{(600)(1200)}{600 + 1200} = 400 \Omega \dots$

Using voltage divider principle twice:

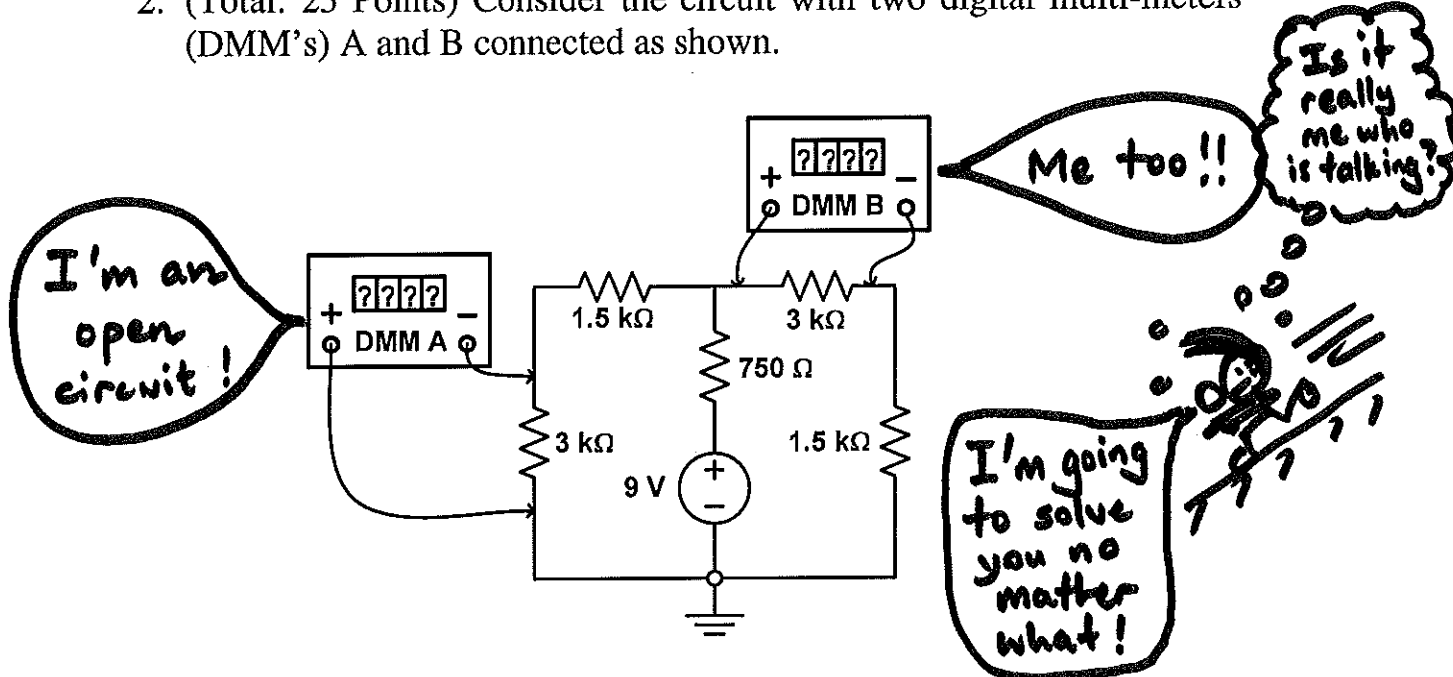
$$v_1 = \frac{400}{100 + 400} (10V) = 8V$$

$$v_x = \frac{800}{400 + 800} v_1 = \frac{800}{400 + 800} (8V) \approx 5.33V$$

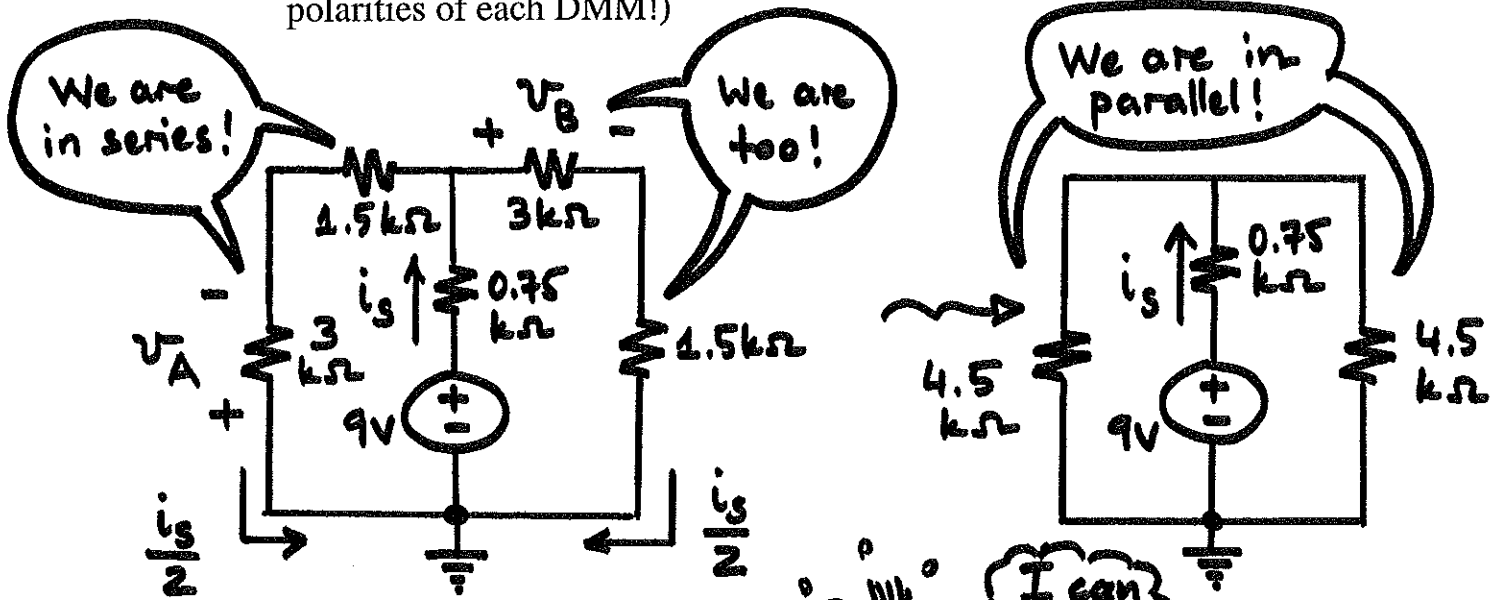
Next problem! Where are you, you coward?

10/3/2005

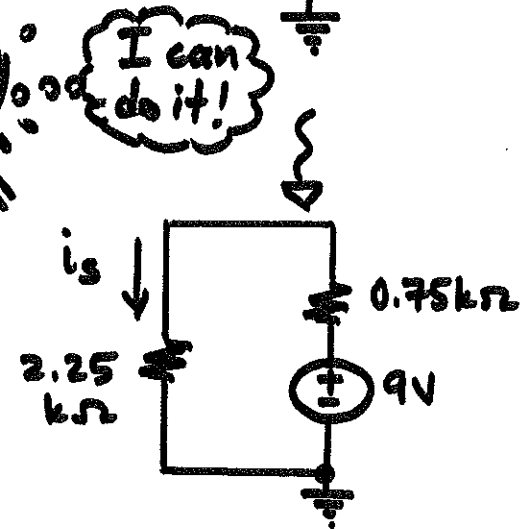
2. (Total: 25 Points) Consider the circuit with two digital multi-meters (DMM's) A and B connected as shown.



(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!)



$$\therefore i_s = \frac{9V}{(2.25 + 0.75)k\Omega} = 3mA$$
$$\therefore V_A = -(3k\Omega)(1.5mA) = -4.5V$$
$$V_B = (3k\Omega)(1.5mA) = 4.5V$$



10/3/2005

Inan must be impressed!
I can't put him down!

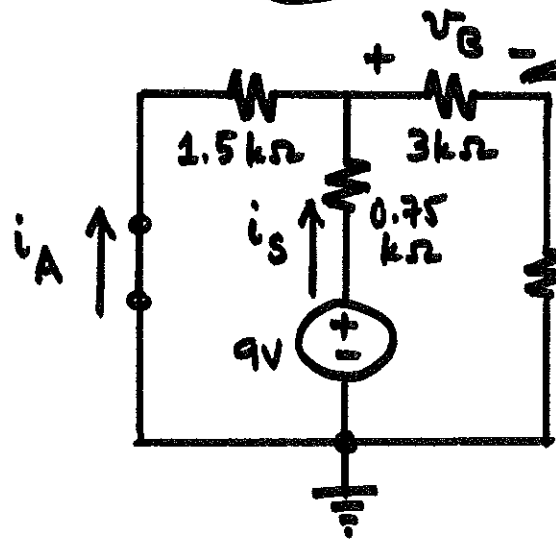
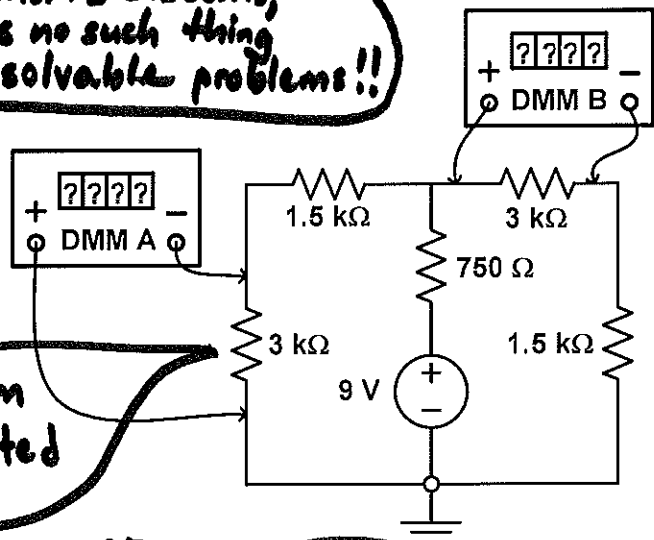
(b) (12.5 points) Repeat part (a) if DMM A by mistake is set to measure current. Again, indicate your units.

For Inan's students, there is no such thing as unsolvable problems!!

I'm a short circuit!

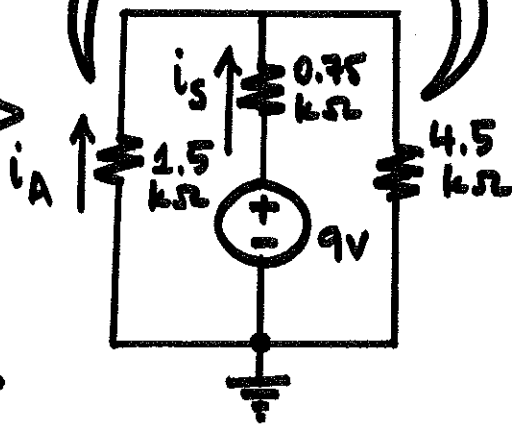
I'm shorted!!

I'm still an open circuit!



Combine us into 4.5kΩ...

Combine us to 1.125kΩ...

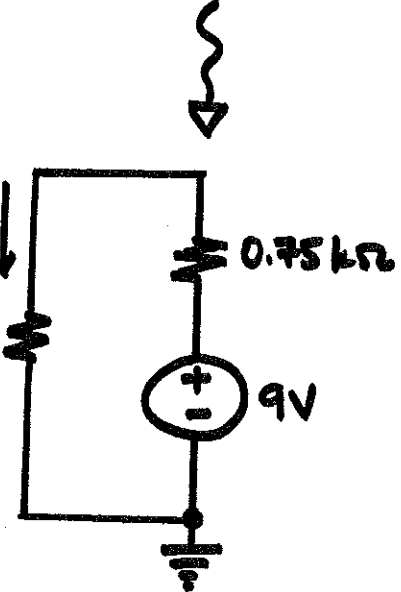


This is baby stuff!

$$\therefore i_s = \frac{9V}{(1.125 + 0.75)k\Omega} = 4.8mA$$

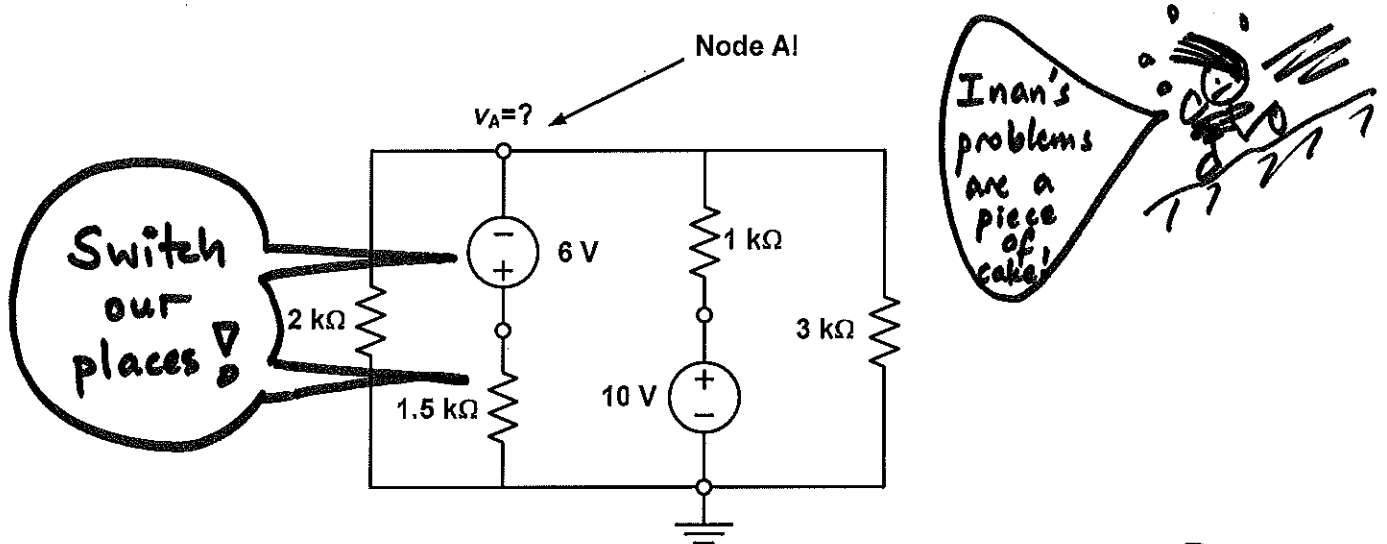
$$\therefore i_A = -\frac{4.5k\Omega}{(1.5 + 4.5)k\Omega} (4.8mA) = -3.6mA$$

$$\therefore v_B = (3k\Omega)(i_s + i_A) = (3k\Omega)(4.8 - 3.6)mA = 3.6V$$



10/3/2005

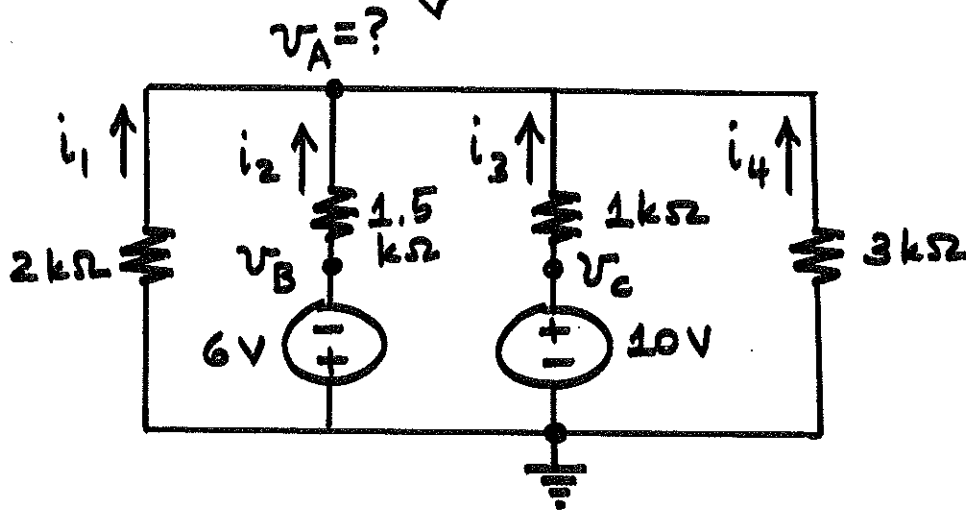
3. (25 Points) Consider the circuit shown. Determine the node voltage v_A at node A. Please show your work step by step.



Switch our places!

Inan's problems are a piece of cake!

Redraw the circuit!



$$v_B = -6V \quad \& \quad v_C = 10V.$$

KCL at A yields $i_1 + i_2 + i_3 + i_4 = 0$

$$\text{or } -\frac{v_A}{2k} + \frac{-6 - v_A}{1.5k} + \frac{10 - v_A}{1k} - \frac{v_A}{3k} = 0$$

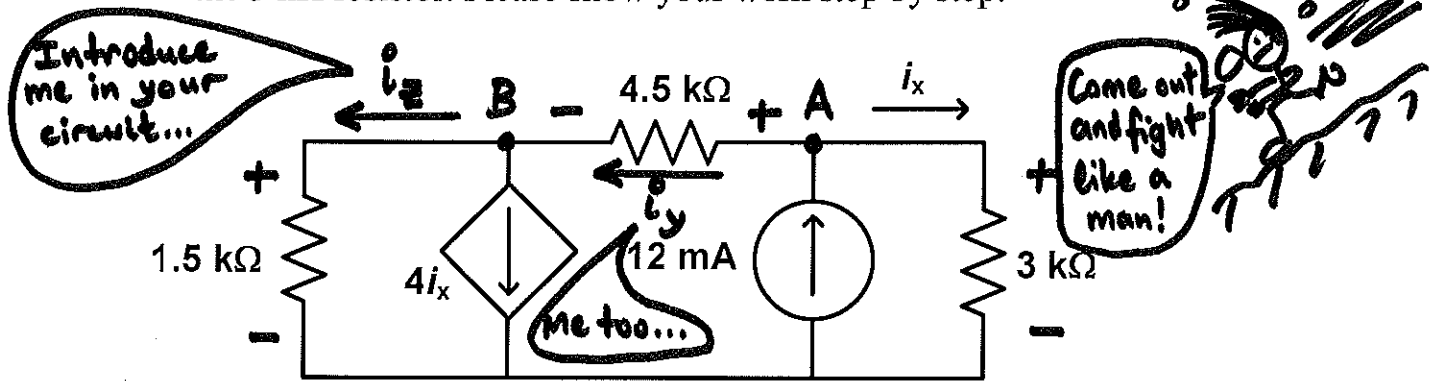
$$\text{or } -3v_A - 24 - 4v_A + 60 - 6v_A - 2v_A = 0$$

$$\text{or } 15v_A = 36 \quad \rightarrow \quad \boxed{v_A = 2.4V}$$

I will get you Problem #4!

10/3/2005

4. (25 Points) In the circuit shown, find the current i_x that flows through the 3 k Ω resistor. Please show your work step by step.



KCL at node A yields $\rightarrow i_y = 12 \text{ mA} - i_x$

KCL at node B yields $\rightarrow i_z = 12 \text{ mA} - 5i_x$

KVL around the outermost loop yields

$$\rightarrow (1.5 \text{ k}\Omega) i_z - (3 \text{ k}\Omega) i_x + (4.5 \text{ k}\Omega) i_y = 0$$

$$\rightarrow 18 - (7.5 \text{ k}) i_x - (3 \text{ k}) i_x + 54 - (4.5 \text{ k}) i_x = 0$$

$$\rightarrow i_x = \frac{72 \text{ V}}{15 \text{ k}\Omega} = \boxed{4.8 \text{ mA}}$$

Inan must be impressed with my performance... I still can't believe how I did it...



Any more problems hiding out there? I will smoke your holes!!

You chickens! You rabbits!!