University of Portland
School of Engineering

EE 261-Electrical Circuits-3 cr. hrs.
Fall 2013

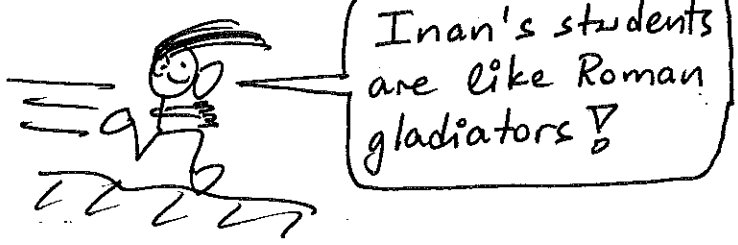
Midterm Exam # 1

(Friday, September 27, 2013)
(Closed Book Exam, One Formula Sheet Allowed)
(Total Time: 55 minutes)

Name: SOLUTIONS ☺

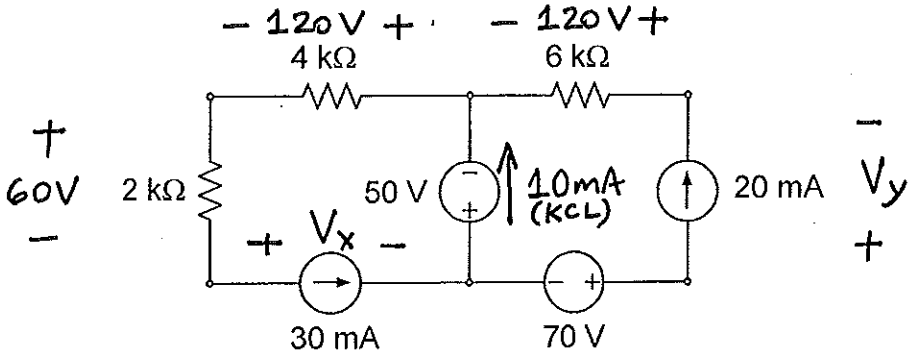
Signature: ☺

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



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. (20 points) In the electric circuit shown, find the power of each source. Provide your answers based on passive convention. Show your work and provide brief justifications for the steps you take. Also, don't forget to provide the correct units for your answers. Please box each answer.



KVL left loop : $V_x + 50 + 120 + 60 = 0 \rightarrow V_x = -230\,V$

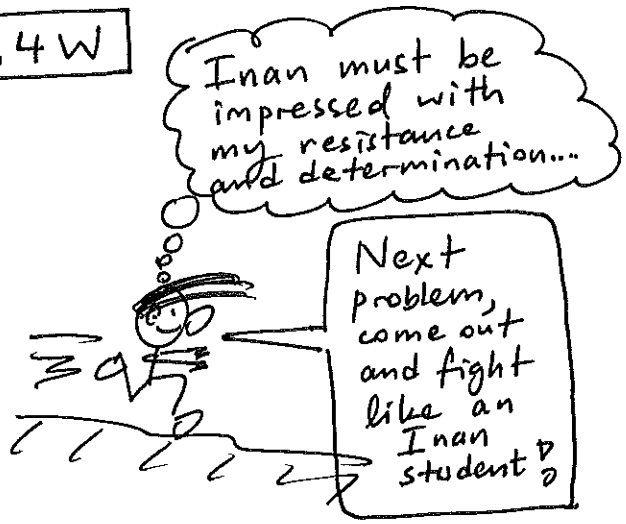
KVL right loop : $50 - 120 - V_y + 70 = 0 \rightarrow V_y = 0$

$P_{\substack{30mA \\ source}} = V_x(30mA) = (-230V)(30mA) = \boxed{-6.9\,W}$

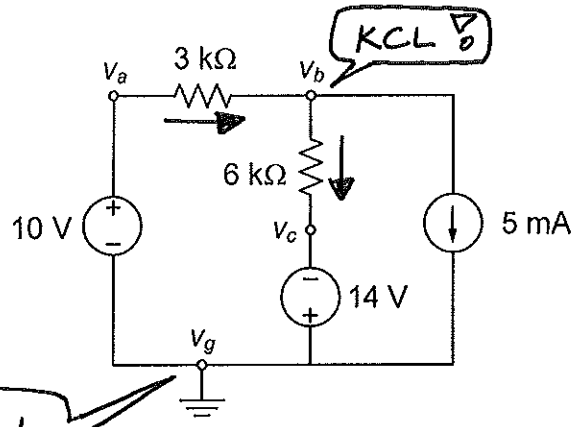
$P_{\substack{50V \\ source}} = (50V)(10mA) = \boxed{0.5\,W}$

$P_{\substack{70V \\ source}} = (70\,V)(-20mA) = \boxed{-1.4\,W}$

$P_{\substack{20mA \\ source}} = V_y(20mA) = \boxed{0}$



2. (20 Points) Consider the electric circuit shown. Determine the values of each node voltage v_a, v_b, v_c, and v_g. Show your work step by step including justifications. Box your answers with appropriate units.



My node voltage is zero the hero

$V_a = \boxed{10\,V}$

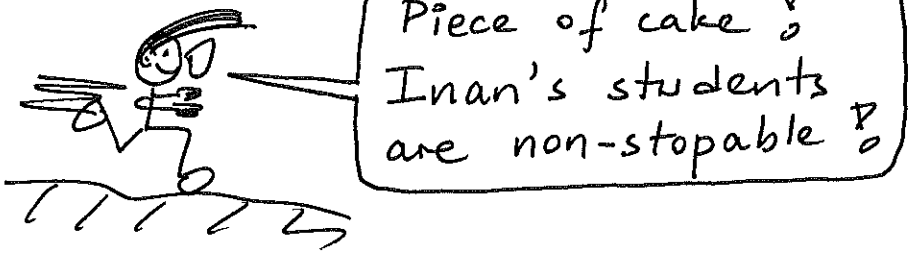
$V_c = \boxed{-14\,V}$

$V_g = \boxed{0}$

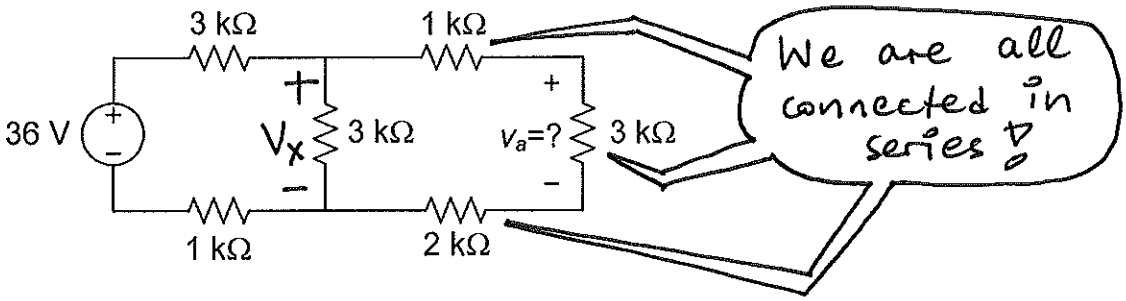
KCL at node "b" yields:

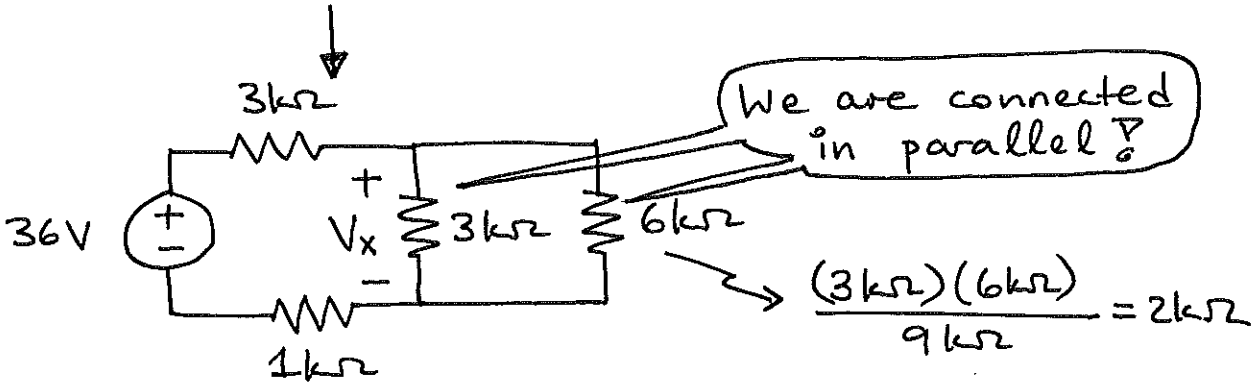
$$\frac{V_a - V_b}{3k\Omega} = \frac{V_b - V_c}{6k\Omega} + 5mA$$

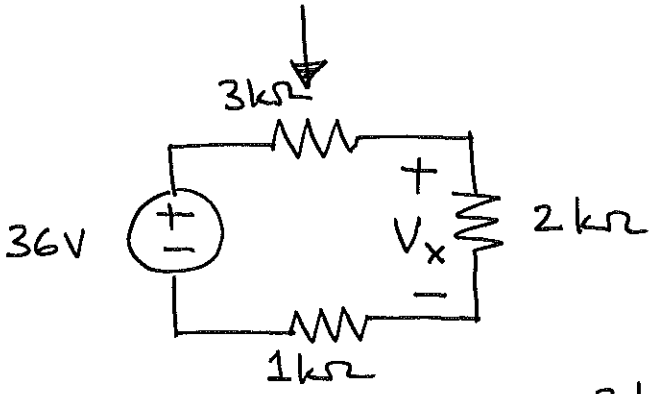
$$20 - 2V_b = V_b + 14 + 30 \rightarrow V_b = \boxed{-8\,V}$$



3. (20 Points) Consider the electric circuit shown. Determine the voltage v_a across the 3 kΩ resistor on the right-hand-side as indicated. Please provide your work step by step with justifications. Box your answer.



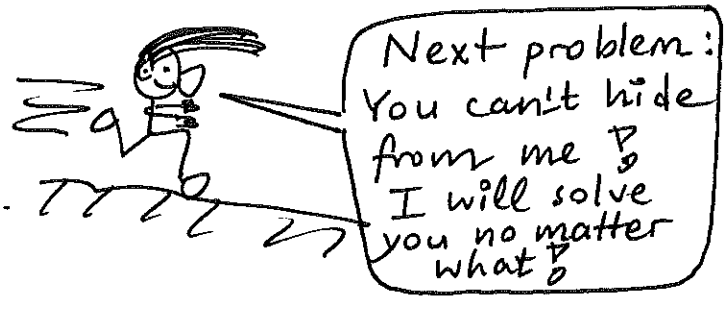




Using VDP $\rightarrow V_x = \frac{2k\Omega}{6k\Omega}(36V) = 12\,V$

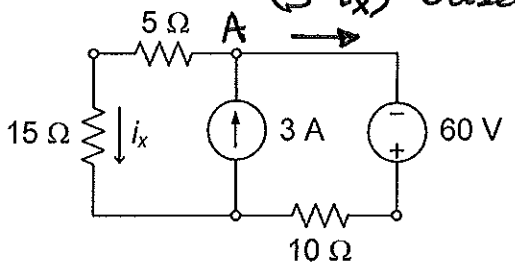
Using VDP in the original circuit:

$$V_a = \frac{3k\Omega}{6k\Omega} V_x = \boxed{6V}$$



4. (20 Points) For the electric circuit shown, find the current i_x through the 15 Ω resistor. Show your work step by step and provide justifications. Box your answers with appropriate units.

$(3-i_x)$ based on KCL applied at node A

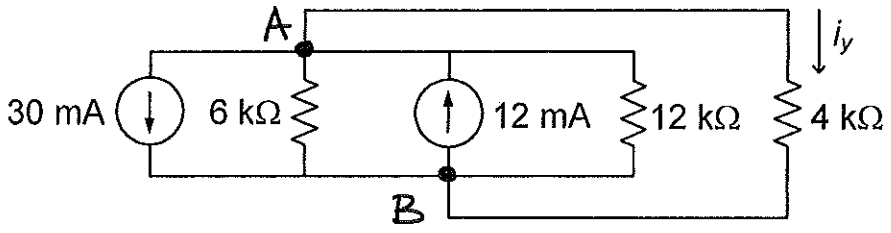


Using KVL around the outermost loop:

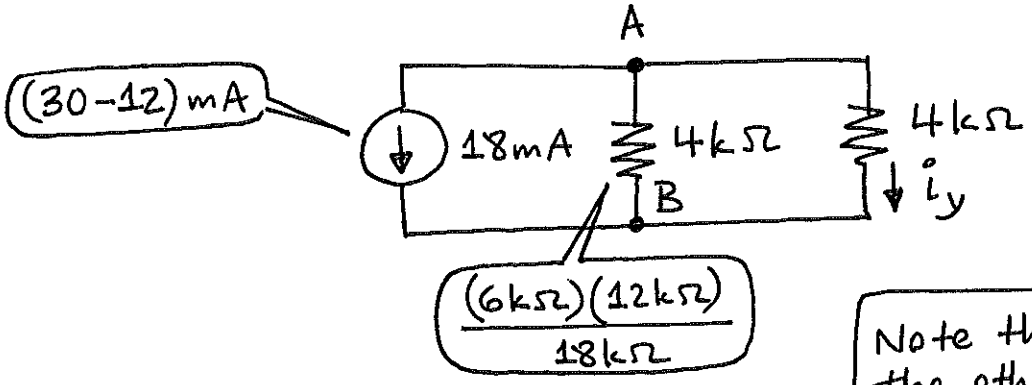
$$5i_x + 15i_x - 10(3-i_x) + 60 = 0$$

$$\rightarrow 30i_x + 30 = 0 \rightarrow i_x = \boxed{-1\ \text{A}}$$

5. (20 Points) In the electric circuit shown, determine the value of the current i_y. Show your work step by step.



All elements are connected in parallel since they all share the same terminals A and B.



Note that I'm the other 4kΩ !!

Using CDP:

$$i_y = -\frac{4\text{k}\Omega}{8\text{k}\Omega}(18\text{mA}) = \boxed{-9\text{mA}}$$