ECSE-200 Electric Circuits 1
Quiz #6 (Feb. 22, 2019)

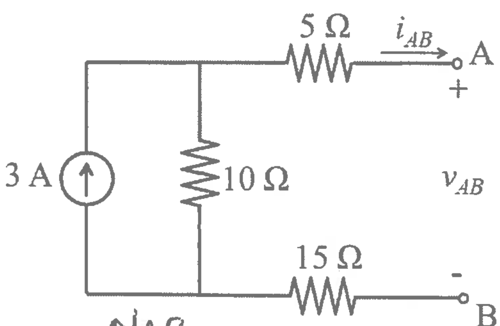
LAST NAME ______________________________ **MCGILL ID#** ______________

FIRST NAME ______________________ **SIGNATURE** ______________________

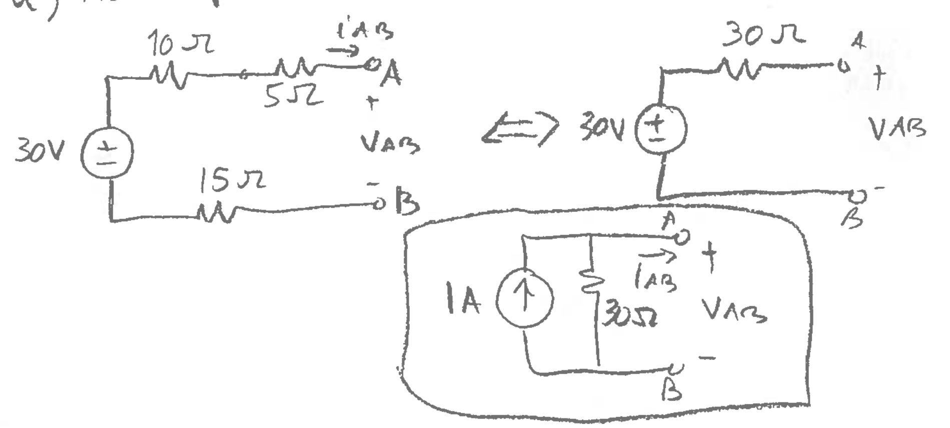
- ***Only Faculty standard calculator accepted***
- ***No cellphone allowed***
- ***Show all your work***
- ***Clearly indicate your final answer with the SI unit and multiplier***
- ***You have 45 minutes to complete this quiz***

Question 1: Consider the circuit shown. Answer the following questions.

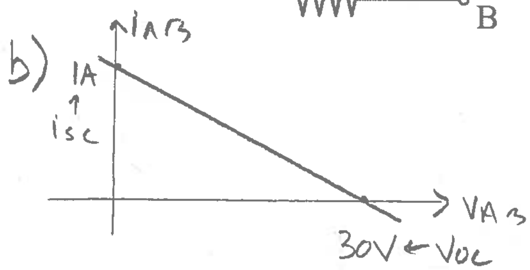
a) Find and draw the Norton equivalent circuit of the circuit. [2 pt]
b) Draw the $i_{AB} - v_{AB}$ diagram indicating the open-circuit voltage (v_{OC}) and the short-circuit current (i_{SC}). [2 pt]
c) What is the value of the power delivered by the independent current supply of the circuit shown (i.e., the 3 A supply) if a short-circuit connects terminals A and B? [1 pt]
d) What is the current value i_{AB} at the terminals A and B if a load resistance equal to the Thévenin resistance is connected across terminals A and B? [1 pt]



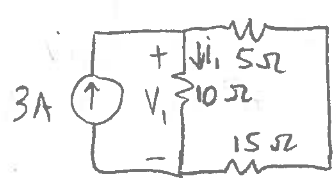
a) no dep src → use src transformation



b)



c) $R_L = 0$



$Pwr = 3A * V_1$

$V_1 = 10\Omega\, i_1 = 10\Omega \left(\frac{3A\,(5\Omega + 15\Omega)}{(10\Omega + 5\Omega + 15\Omega)} \right)$

$V_1 = 20\,V$

Pwr delivered 60 W

d) $R_L = R_T = 30\,\Omega$

$\boxed{i_{AB} = 0.5A}$

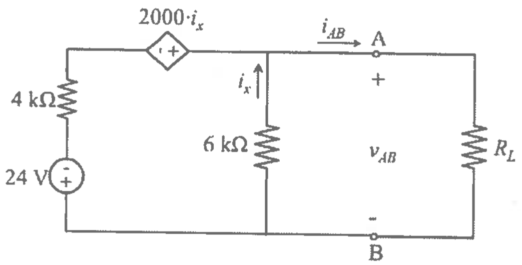
Question 2: Consider the circuit shown below. Answer the following questions.

a) As shown, a load resistance R_L is connected across the terminals A and B. What is the voltage value v_{AB} if the load resistance R_L is replaced with an open-circuit (i.e., $R_L \to \infty$)? [2 pt]

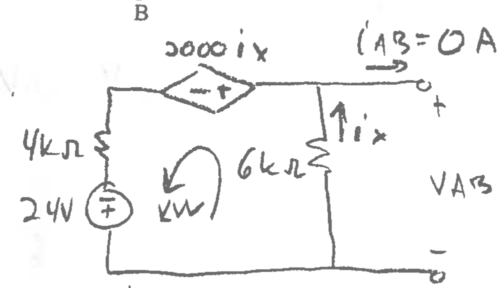
b) What is the current value i_{AB} if the load resistance R_L is replaced by a short-circuit (i.e., $R_L = 0\ \Omega$)? [2 pt]

c) Replace and redraw the part of the circuit to the left of terminals A and B by its Thévenin equivalent circuit. Clearly indicate the open-circuit voltage (v_{OC}) value and the Thévenin resistance value (R_T). [2 pt]

d) What should the resistance value R_L be for the current at the terminal be -2 mA ($i_{AB} = -2mA$)? [2 pt]



a) $R_L = \infty$



KVL $6000 i_x + 2000 i_x + 4000 i_x - 24V = 0$

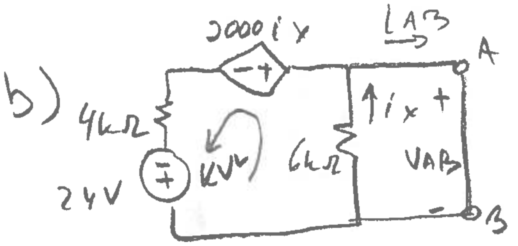
$12{,}000 i_x = 24V$

$i_x = 2mA$

$V_{AB} = -i_x \cdot 6k\Omega = -12V$

$\boxed{V_{AB} = -12V}$

b)



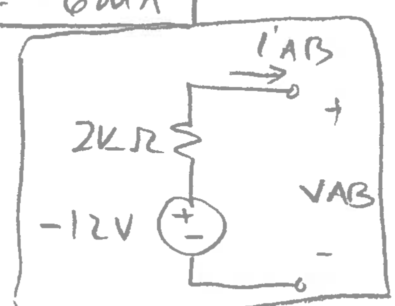
$i_x = 0A$ b/c of $V_{AB}: 0V$

KVL: $2000(0) + 4000(-i_{AB}) - 24V + 6000(0) = 0$

$4000\, i_{AB} = -24V$

$\boxed{i_{AB} = -6mA}$

c) from a) & b) $R_T = \frac{V_{oc}}{i_{sc}} = \frac{-12V}{-6mA} = 2k\Omega$



d) $V_{AB} = V_{oc} - i_{AB} R_T$

$V_{AB} = -12V - (-2mA)(2k\Omega) = -12V + 4V = -8V$

$R_L = \frac{+V_{AB}}{i_{AB}} = \frac{+(-8V)}{-2mA} = 4k\Omega$ $\boxed{R_L = 4k\Omega}$