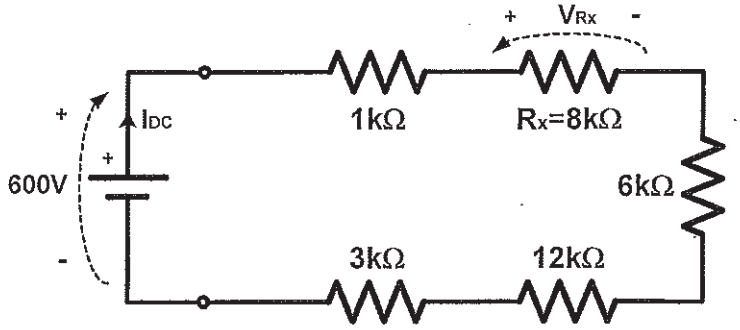
ECET 3000 – Spring 2015

Electrical Principles – Exam I **Print Name (Last Name First):** KEY

Instructions: Show all of your work, making sure your work in legible and that your reasoning can be followed. No credit will be given for illegible or illogical work, or for final answers that are not justified by the work show. Place all final answers in the spaces provided. This exam is closed book except for one, 8½"x11" sheet of handwritten notes that may NOT contain any numerically-solved problems.

Problem #1) Given the following circuit:



Determine:

a) the **total resistance $R_{EQseries}$** "seen" by the voltage source,
b) the magnitude of the **current I_{DC}** that will flow out of the voltage source,
c) the **voltage V_{Rx}** across resistor R_x ***using a voltage divider equation***,
d) the total electric **power produced by the voltage source, P_{DC}**, and
e) the electric **power, P_{Rx}, consumed by resistor R_x**.

$R_{EQ} = (1+8+6+12+3)k = 30k\Omega$

$I_{DC} = \frac{600V}{30k\Omega} = 0.02A$

$V_{Rx} = 600\left(\frac{8k}{30k}\right) = 160V$

$P_{DC} = (600)(0.02) = 12W$

$P_{Rx} = (160)(0.02) = 3.2W$

$R_{EQseries}$ = 30 (kΩ)

I_{DC} = 0.02 (A)

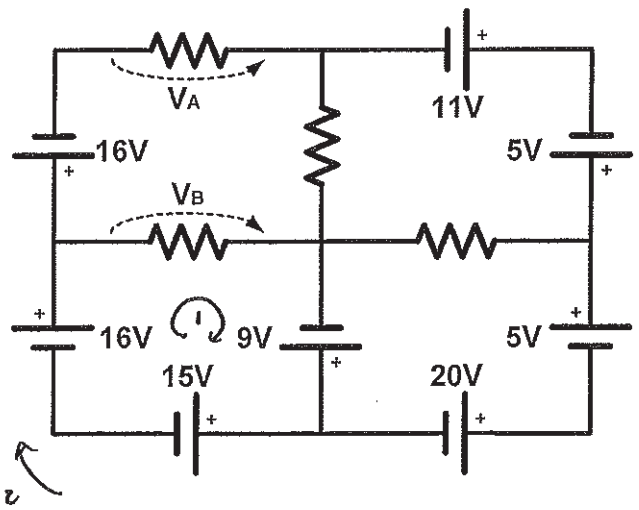
V_{Rx} = 160 (V)

P_{DC} = 12 (W)

P_{Rx} = 3.2 (W)

Problem #2) Use ***Kirchhoff's Voltage Law*** (KVL) to determine the voltage rises V_A and V_B as defined in the following circuit.

(Note – to receive full credit, you must show the two KVL equations that you used to get your answers)



$16 + V_B + 9 - 15 = 0$

$10 + V_B = 0$

$V_B = -10\ V$

$16 - 16 + V_A + 11 + 5 - 5 - 20 - 15 = 0$

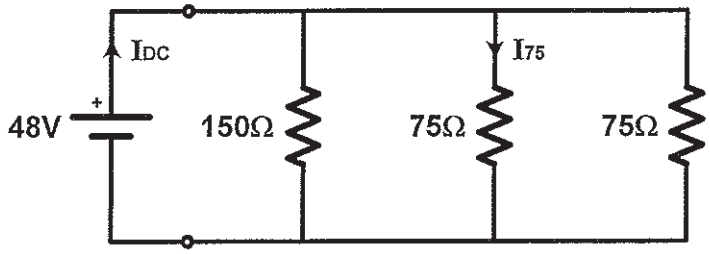
$V_A - 24 = 0$

$V_A = 24$

$V_A =$ 24 (V)

$V_B =$ −10 (V)

Problem #3) Given the following circuit:



Determine:

a) the **total resistance $R_{EQparallel}$** "seen" by the voltage source,

b) the magnitude of the **current I_{DC}** that will flow out of the voltage source,

c) the **current I_{75}** as shown in the figure ***using a current divider equation***,

$R_{eq} = \left(\frac{1}{150} + \frac{1}{75} + \frac{1}{75}\right)^{-1} = 30\ \Omega$

$I_{DC} = \frac{48}{30} = 1.6\ A$

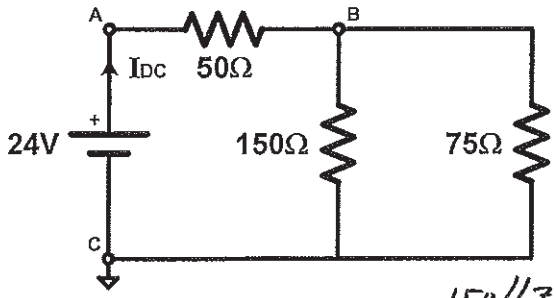
$I_{75} = 1.6\left(\frac{30}{75}\right) = 0.64\ A$

$R_{EQparallel} =$ 30 (Ω)

$I_{DC} =$ 1.6 (A)

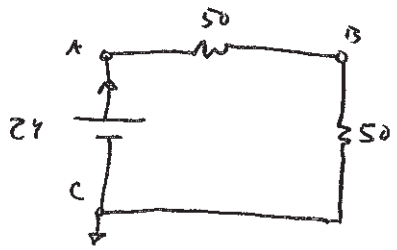
$I_{75} =$ 0.64 (A)

Problem #5) Given the following circuit:



a) Determine the **source current I_{DC}** and the individual **node voltages V_A, V_B,** and V_C.

$150 // 75 = 50\ \Omega$



$I_{DC} = \frac{24}{100} = 0.24\ A$

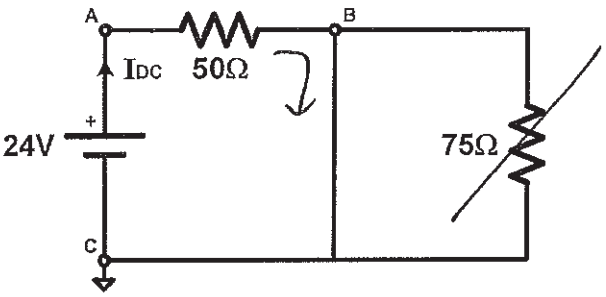
$I_{DC} =$ 0.24 (A)

$V_A =$ 24 (V)

$V_B =$ 12 (V)

$V_C =$ 0 (V)

b) If the 150Ω resistor is removed and replaced by an "ideal wire", determine the new values for the **source current I_{DC}** and the individual **node voltages V_A, V_B,** and V_C.



$I_{DC} = \frac{24}{50} = 0.48\ A$

$I_{DC} =$ 0.48 (A)

$V_A =$ 24 (V)

$V_B =$ 0 (V)

$V_C =$ 0 (V)

Problem #6) Determine the resistance value of a resistor that will consume 100W of power when supplied by a 120V source.

$P = \frac{V^2}{R} \rightarrow R = \frac{V^2}{P} = \frac{(120)^2}{100} = 144\ \Omega$

$R =$ 144 (Ω)