ES 250 First Midterm Practice Exam 1

1. a. To cause $v_o = 17.07 \text{ V}$ choose $R = \underline{\phantom{0000}} \Omega$.

   b. To cause $v_o = 9.143 \text{ V}$ choose $R = \underline{\phantom{0000}} \Omega$.

   c. If $R = 14 \Omega$ then $v_o = \underline{\phantom{0000}} \text{ V}$

   d. If $v_o = 14.22 \text{ V}$ the voltage source supplies $\underline{\phantom{0000}} \text{ W}$ of power.

2. The voltage source supplies 4.8 W of power and the current source supplies 3.6 W of power.

   $R_1 = \underline{\phantom{0000}} \Omega$ and $R_2 = \underline{\phantom{0000}} \Omega$

3. The input this circuit is the current of the current source, $i_s$. The output is the voltage measured by the meter, $v_m$. The output is proportional to the input, that is $v_m = k i_s$, where $k$ is the constant of proportionality.

   a. When $i_s = 3 \text{ A}$, $R = 12 \Omega$ and $r = 10 \text{ V/A}$, then $i_a = \underline{\phantom{0000}} \text{ A}$ and $v_m = \underline{\phantom{0000}} \text{ V}$.

   b. When $R = 12 \Omega$, then $r = \underline{\phantom{0000}} \text{ V/A}$ is required to cause $v_m = 2 i_s$.

   c. When $r = 10 \text{ V/A}$ then $R = \underline{\phantom{0000}} \Omega$ is required to cause $v_m = 2 i_s$.

   d. When $R = 12 \Omega$ and $i_s = 5 \text{ A}$, then $r = \underline{\phantom{0000}} \text{ V/A}$ is required to cause $v_m = 12 \text{ V}$.

4. The input to this circuit is the source current, $i_s$. The output is the current measured by the meter, $i_o$. A current divider connects the source to the meter.

   Given these observations:

   A. The input $i_s = 5 \text{ A}$ causes the output to be $i_o = 2 \text{ A}$. 
B. When $i_s = 2$ A the source supplies 48 W.

The values of the resistances are $R_1 =$ _______ Ω and $R_2 =$ _______ Ω.

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5. 

\[ -v_3 + \]

\[ R_a \]

\[ v_2 \]

\[ 3.4 \text{ A} \]

\[ v_2 \]

\[ \frac{10}{R_b} \]

\[ \begin{array}{c}
+i_4 \\
\end{array} \]

\[ v_2 \]

\[ 3.4 \text{ A} \]

\[ 24 \Omega \]

\[ \frac{10}{R_b} \]

\[ 75 \Omega \]

original circuit

equivalent circuit

The equivalent circuit on the right is obtained from the original circuit on the left by replacing series and parallel combinations of resistors by equivalent resistors. The original circuit contains 3 equal resistances labeled $R_a$ and another 3 equal resistances labeled $R_b$. Determine the values of $R_a$ and $R_b$. Given that $v_2 = -81.6$ V, determine the values of $v_3$ and $i_4$.

$R_a =$ _______ Ω, $R_b =$ _______ Ω, $v_3 =$ _______ V and $i_4 =$ _______ A.

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6. Given that $v_a = 8$ V,

Determine the values of $R_1$ and $v_o$:

$R_1 =$ _______ Ω,

and

$v_o =$ _______ V

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7. 

The encircled numbers are node numbers. The corresponding node voltages are

$v_1 = 12$ V, $v_2 = 21$ V and $v_3 = -3$ V,

a. The 0.5 A current source supplies _______ W of power.

b. The 2 A current source supplies _______ W of power.

c. $R_1 =$ _______ Ω and $R_2 =$ _______ Ω

d. The voltage source supplies _______ W of power.