Name : Solution Section:________ CWRU e-mail:____________

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 6 **2/25/05**

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE. BE SURE TO STATE ANY ASSUMPTIONS

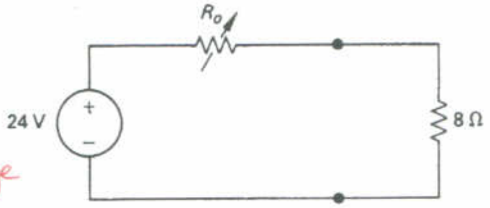
MAXIMUM SIGNAL TRANSFER

Problem 1 (10 points)

(4) (a) Find the value of the variable resistor Ro in the circuit below that will result in maximum power dissipation in the 8-Ω load resistor.

either you got it or you didn't

2 points for 8Ω



for max power $R_o = 0\Omega$

$R_o = 0\Omega$

two points for correct voltage

two points for correct power

(4) (b) What is the maximum power that can be delivered to the 8-Ω load resistor. $P = 72W$

(2) (c) If R_o increases from 10Ω to 25Ω, the power dissipated by the 8Ω load will (circle one)

same as part A

(i) increase

(ii) remain the same

(iii) decrease.

(B) $P = \frac{V^2}{R} = \frac{(24V)^2}{8\Omega} = \frac{576V}{8\Omega} = 72W$ $P = 72W$

(C) Decrease, P_{max} occurs when $R_o = 0\Omega$, therefore going from 10Ω to 25Ω will decrease the power.

* Note, if you wrote down 8Ω for part A, and subsequently got 18V for part B, you were given 6 points out of 8. Most people did this.

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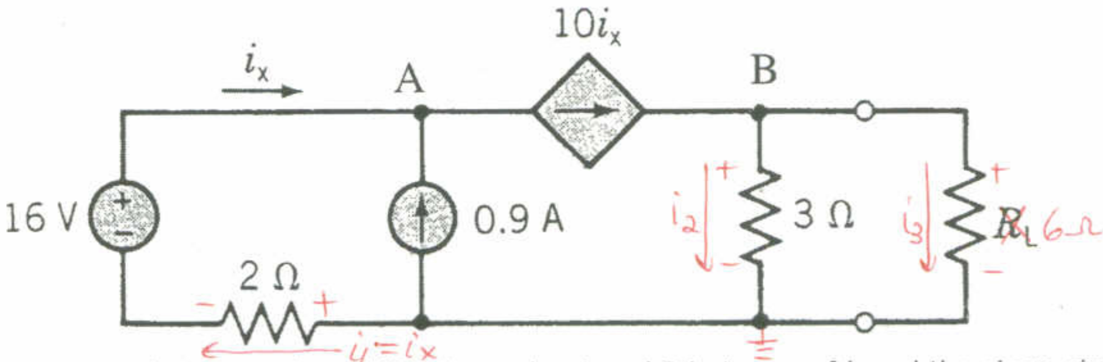
LINEAR DEPENDENT SOURCES

Problem 2 (10 points)

Consider this active circuit with a dependent source. Assume $R_L=6\Omega$



(4) **a)** Write node analysis equations (KCL) for nodes A and B in terms of i_x and the given circuit parameters. These are the connection equations. Do not write i_x in terms of other circuit variables for this part of your answer.

Node	Node-Voltage Equation				
(2) A	$-1/2$	$\cdot V_A$	$+\cdot$ 0	$\cdot V_B$	$= -8.9 + 10i_x$
(2) B	0	$\cdot V_A$	$+\cdot$ $1/2$	$\cdot V_B$	$= 10i_x$

(3) **b)** Now write an expression for i_x in terms of V_A, V_B and the given circuit parameters. (This is a constraint equation.)

two points for correct substitution & one point for answer

$-1/2 V_A = -8.9 + 10i_x \longrightarrow -1/2 V_A = -8.9 - 10\left(\frac{V_A-16-0}{2}\right) \longrightarrow 1/2 V_A = 8.9 + 5V - 80$ → $4.5V_A = 71.1$

$1/2 V_B = 10i_x \longrightarrow 1/2 V_B = 10\left(\frac{V_A-16-0}{2}\right) \longrightarrow 1/2 V_B = 5V_A - 80$ → $5V_A - 1/2 V_B = 80$

(3) **c)** Using your equations from parts (a) and (b) determine the node voltages for the above circuit values.

note: if one answer is correct (2)

V_A	15.8V	V_B	2.0V

(A) Node A $-\left(\frac{V_A-16-0}{2}\right) + 0.9 - 10i_x = 0$ $\quad -\frac{V_A}{2} = -8.9 + 10i_x$

Node B $10i_x - \frac{V_B-0}{3} - \frac{V_B-0}{6} = 0$ $\quad \frac{V_B}{2} = 10i_x$

(C) $4.5V_A = 71.1$ $\quad$ $V_A = 15.8V$ $\quad$ $5V_A - 1/2 V_B = 80$ $\quad$ $5(16.2) - 1/2 V_B = 80$

$1 = 1/2 V_B$ $\quad$ $V_B = 2V$