Omit: 1 2 3 4

Desk Copy

ECE 301
Spring Semester, 2004
Test #1

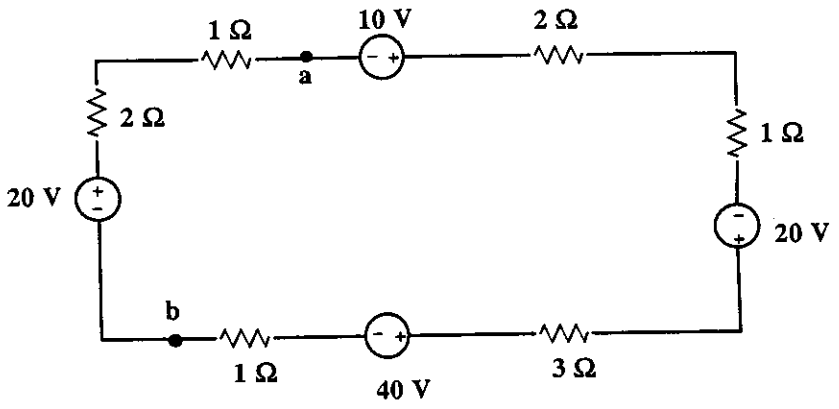
wlg Version A

Name W. Green
Last, First

Work the exam on your own engineering paper. Work on one side of your paper only. Attach your work to the back of this exam sheet and staple in the top left hand corner. . You may omit one problem: either problem 1, 2, 3 or 4. Indicate at the top of the exam cover sheet which problem you omit.

(1) Consider the following circuit.

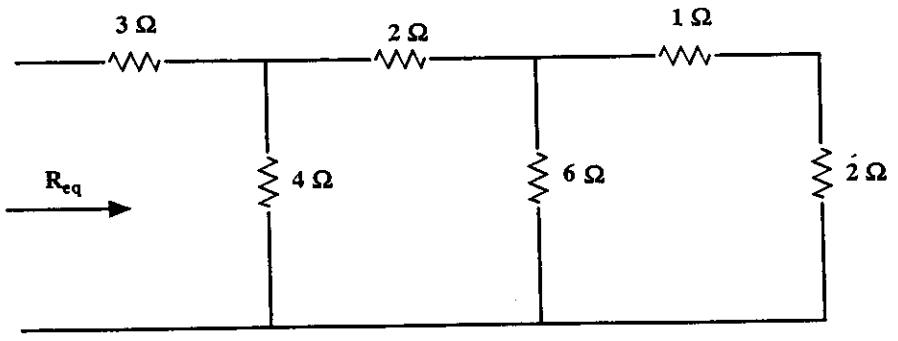
15%



(a) Find V_{ab},
(b) How much power is supplied by the 40 source?

(2) Consider the following circuit. Find R_{eq}.

15%



(3) Consider the following circuit. Find the current I using the current division rule.

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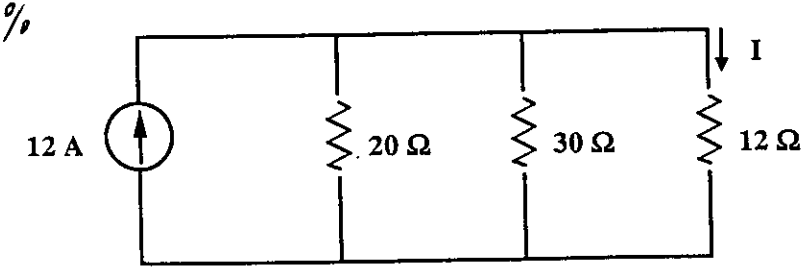

(4) Consider the following circuit.

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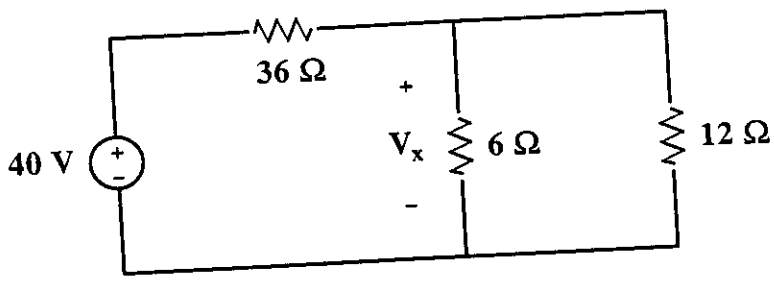
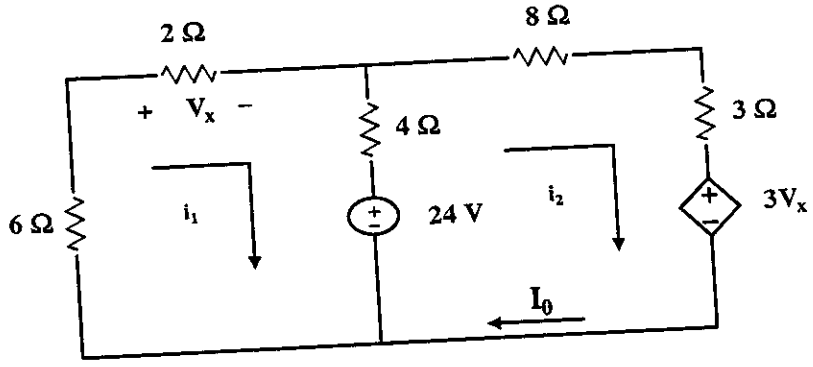


(a) Determine the voltage V_x using the voltage divider rule.
(b) How much power is absorbed by the 12 Ω resistor?

(5) Consider the circuit below. Find I_0 in the circuit using mesh analysis.

15%



(6) Use nodal analysis to find V_x in the following circuit.

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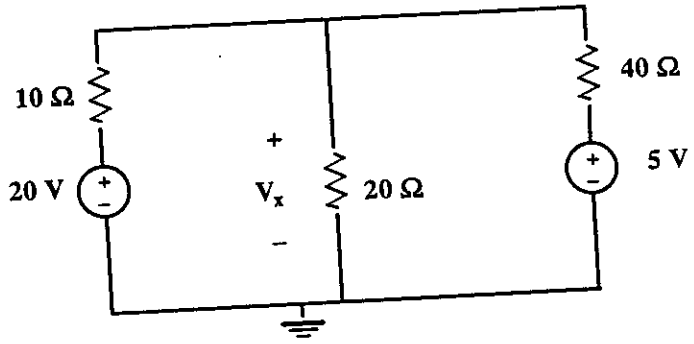
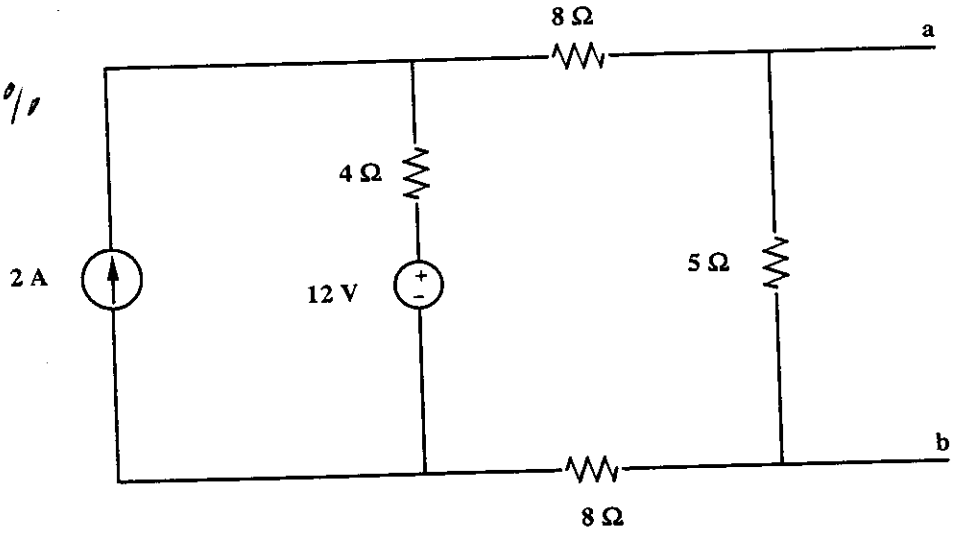


(7) You are given the following circuit.

25%

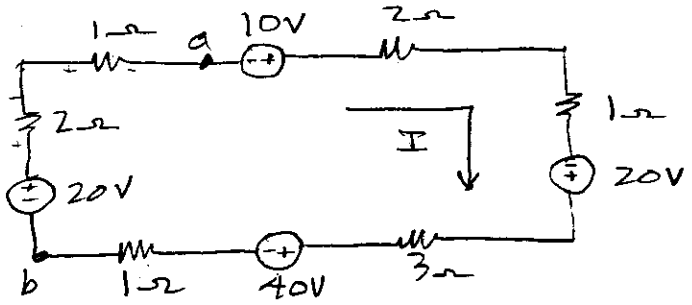


(a) Find the Thevenin equivalent circuit to the left of terminals a-b.
(b) Draw the Thevenin equivalent circuit.
(c) What value of resistance, placed between a-b, will cause the circuit to deliver maximum power to the resistor? What is the value of this power?

ECE 301
Test #1
Fall Semester, 04

Version A
W47

(1)



(a)

$$-20 + 2I + I - 10 + 2I + I + 3I + 40 + I = 0$$

$$10I = 10$$

$$\boxed{I = 1\,A}$$

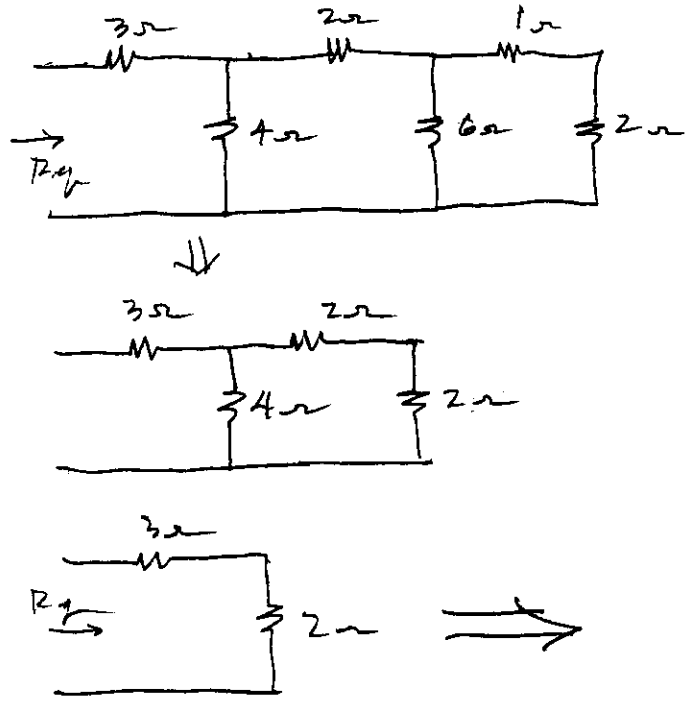
$$-V_{ab} - I - 2I + 20 = 0$$

$$V_{ab} = 20 - 3I = 17\,V$$

$$\boxed{V_{ab} = 17\,V}$$

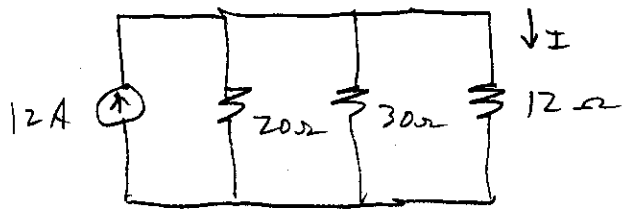
(b) $P_{\substack{sup \\ 40}} = -40I = \underline{\underline{-40\,W}}$

(2)



Va. A

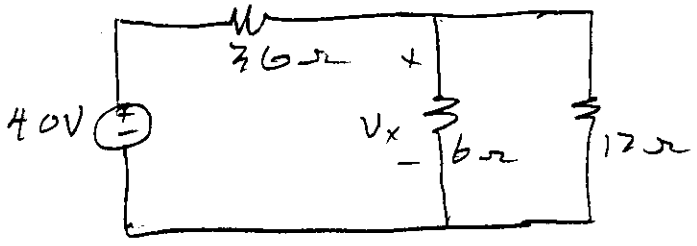
(3)



$$30 \parallel 20 = \frac{600}{50} = 12\,\Omega$$

$$I = \frac{12 \times 12}{24} = 6\,A$$

(4) Determine V_x using voltage division



$$6 \parallel 12 = \frac{6 \times 12}{18} = 4\,\Omega$$

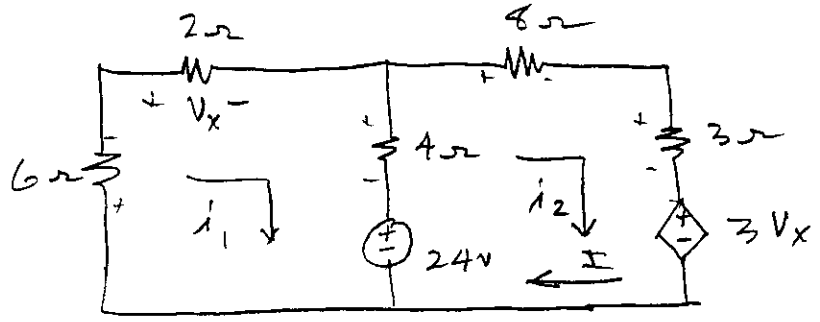
$$V_x = \frac{40 \times 4}{36 + 4} = 4\,V$$

$$\boxed{V_x = 4\,V}$$

(6) $$P_{12} = \frac{V_{12}^2}{12} = \frac{16}{12} = \frac{4}{3}.$$

$$\boxed{P_{12} = 1{,}33\,W}$$

(5)



$$6i_1 + 2i_1 + 4(i_1 - i_2) + 24 = 0$$

$$\boxed{12i_1 - 4i_2 = -24}$$

$$-24 - 4(i_1 - i_2) + 11i_2 + 3V_x = 0$$

but $V_x = 2i_1$

$$-24 - 4(i_1 - i_2) + 11i_2 + 3(2i_1) = 0$$

$$\boxed{2i_1 + 15i_2 = 24}$$

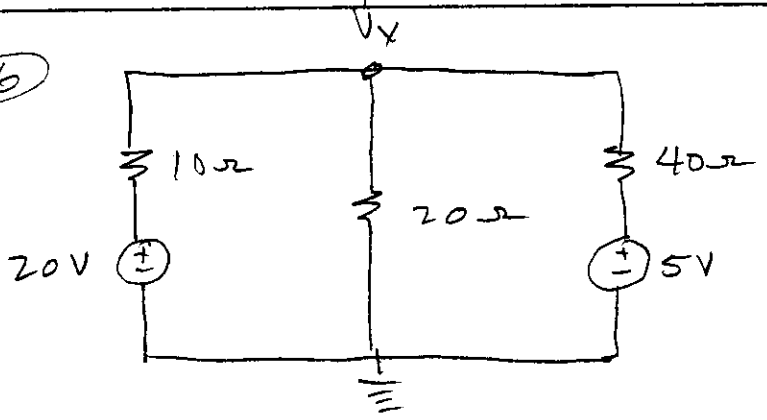
$$\begin{bmatrix} 12 & -4 \\ 2 & 15 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} -24 \\ 24 \end{bmatrix}$$

$i_1 = -1.4\ A$ $\quad$ $i_2 = 1.79\ A$

$$\boxed{I = i_2 = 1.79\ A}$$

VA

(6)



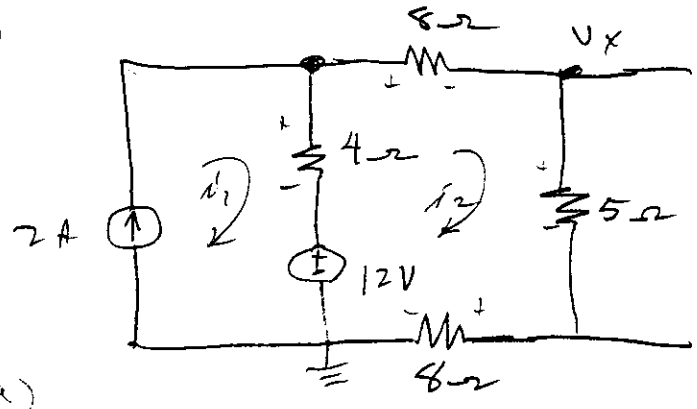
$$\frac{V_x - 20}{10} + \frac{V_x}{20} + \frac{V_x - 5}{40} = 0$$

$$4V_x - 80 + 2V_x + V_x - 5 = 0$$

$$7V_x = 85$$

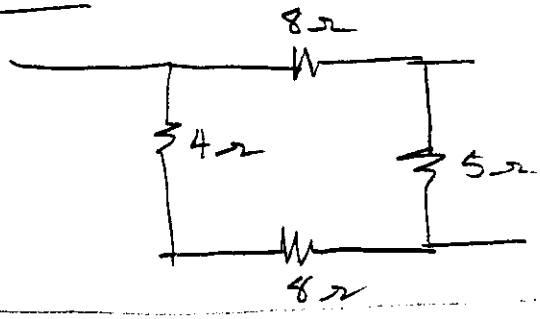
$$V_x = \frac{85}{7} = 12.14\ V$$

(7)



(a)

FOR R_{TH}



$$R_{TH} = \frac{5 \times 20}{25} = 4\Omega$$

FOR V_{TH}

$$-12 - 4(i_1 - i_2) + 21i_2 = 0$$

$$i_1 = 2$$

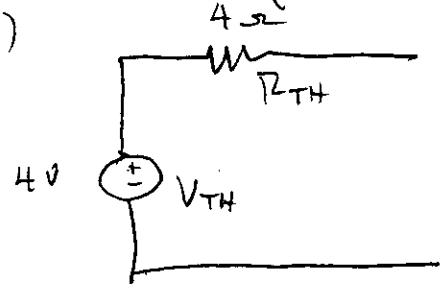
$$-12 - 4(2 - i_2) + 21i_2 = 0$$

$$25i_2 = 20$$

$$i_2 = \frac{20}{25} = \frac{4}{5} = 0.8\ A$$

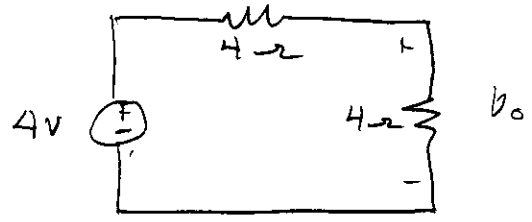
$$V_x = V_{TH} = .8 \times 5 = 4V$$

(b)



7)

(c) 4Ω



$$P_o = \frac{v_o^2}{4} = \frac{2^2}{4} = 1\ W$$

$P_o = 1\ W$