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University of Jordan
Electrical Engineering Department
First Exam.
Electrical Engineering (0903203)

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Student Number: 0084469

Section:

1	2	3	4
12.00 – 1.00	11.00 – 12.00	1.00 – 2.00	9.30 – 11.00

Date: Nov. 9th, 2009

Time allowed: 60 Min.

	point	
Problem 1	20	20
Problem 2	40	33
Problem 3	40	40
Total	100 Pts.	93

Problem 1:
Find R_{in} for the circuit of Fig. (1)

R_{eq}

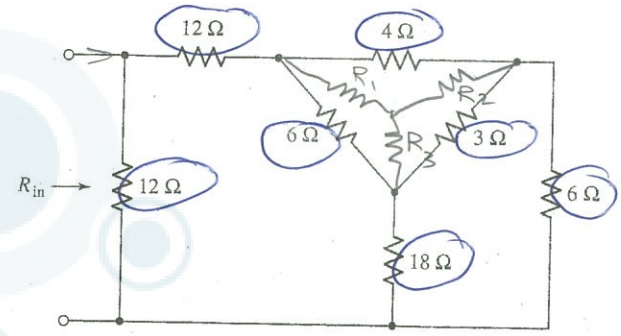


Fig.(1)

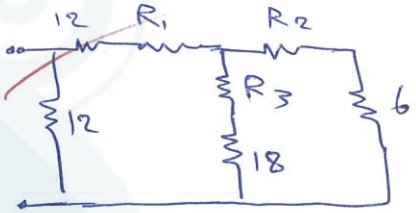
Solution

$\Delta \rightarrow Y$

$$R_1 = \frac{(4)(6)}{4+3+6} = 1.85\ \Omega$$

$$R_2 = \frac{(4)(3)}{4+3+6} = 0.92\ \Omega$$

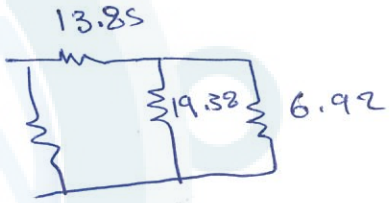
$$R_3 = \frac{(3)(6)}{4+3+6} = 1.38\ \Omega$$



$12 + R_1 = 12 + 1.85 = 13.85$

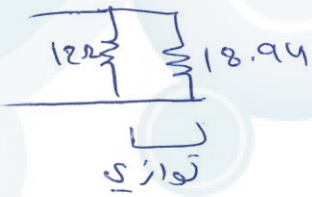
$6 + R_2 = 6.92\ \Omega$

$R_3 + 18 = 19.38\ \Omega$



$(19.38 \,//\, 6.92) = 5.09\ \Omega$

$5.09 + 13.85 = 18.94\ \Omega$



$R_{eq} = 7.349\ \Omega$

Problem 2:

The variable resistor in the circuit in Fig. (2) is adjusted for maximum power transfer to R_o.
What is the value of this max. power?

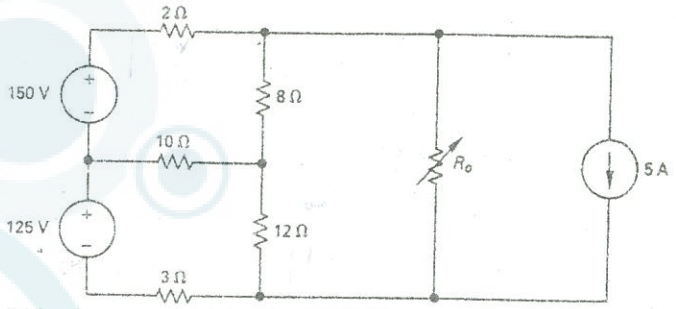
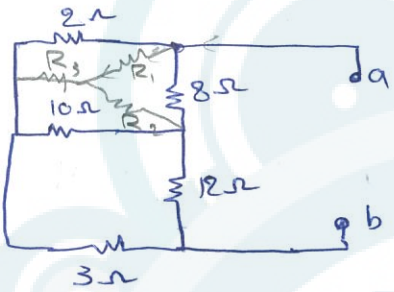


Fig. (2)

Solution

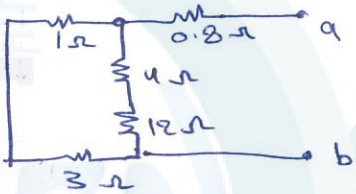
①



$R_1 = \frac{(8)(2)}{20} = 0.8\,\Omega$

$R_2 = \frac{(8)(10)}{20} = 4\,\Omega$

$R_3 = \frac{(2)(10)}{20} = 1\,\Omega$



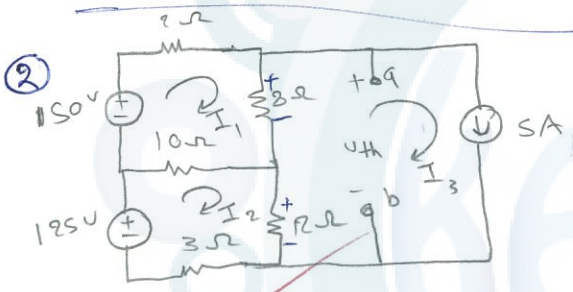
$R_{th} = (4 \,//\, 16) + 0.8$

$= 4\,\Omega$

to have max power

$R_L = R_{th} = 4\,\Omega$

②



mesh → $I_3 = 5A$

mesh ①

$-150 + 2I_1 + 8[I_1 - 5] + 10[I_1 - I_2] = 0$

$-150 + 2I_1 + 8I_1 - 40 + 10I_1 - 10I_2 = 0$

$20I_1 - 10I_2 = 190$ ... ①

mesh ②

$-125 + 10[I_2 - I_1] + 12[I_2 - 5] + 3I_2 = 0$

$-125 + 10I_2 - 10I_1 + 12I_2 - 60 + 3I_2 = 0$

$-10I_1 + 34I_2 = 185$ ... ②

بالتعويض

$20I_1 - 10I_2 = 190$

$-20I_1 + 68I_2 = 370$

$58I_2 = 560$

$I_2 = 9.65$ A

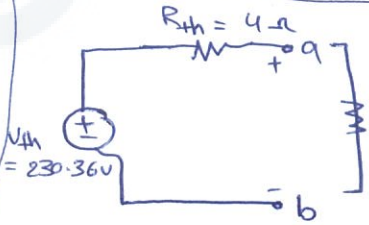
$I_1 = 14.32$ A

KVL →

$-(12)(9.65) - (8)(14.32) + V_{ab} = 0$

$V_{ab} = 230.36$ V

$\hookrightarrow = V_{th}$



$P_{max} = \frac{(V_{th})^2}{4(R_{th})} = \frac{(230.36)^2}{4(4)}$

$= 3316.6$ W

Problem 3:

Use the principle of superposition to find the voltage v_o in the circuit in Fig. (3).

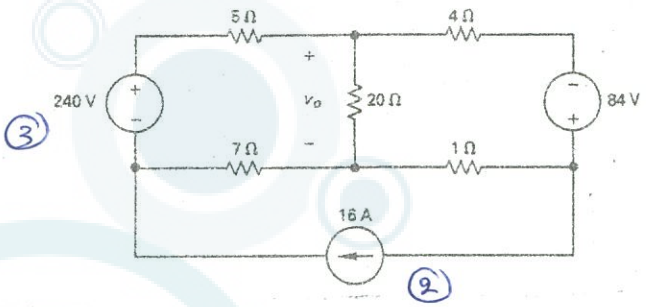


Fig. (3)

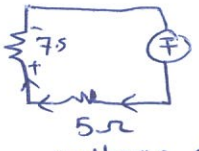
40/40

Solution

→ Kill ② + ③

$(5+7)\,//\,20 = 7.5\ \Omega$

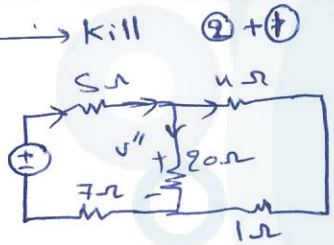
$v_{7.5\Omega} = \frac{(7.5)(84)}{(7.5)+(15)} = 50.4$ volt



بالتجزئة ← $v_{20\Omega} = 50.4$ V

$V' = 50.4$ V, 20Ω

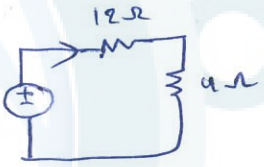
→ Kill ① + ③



$(4+1)\,//\,20 = 4\ \Omega$

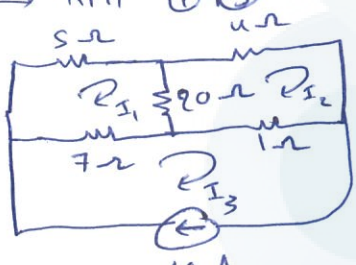
$v_{4\Omega} = \frac{(4)(240)}{4+12} = 60$ V

$v_{4\Omega} = 60\ V = v_{20\Omega}$ (بالتجزئ)



$V'' = 60$ V, 20Ω

→ Kill ① + ②



$I_3 = 16$ A

mesh ①:

$5I_1 + 20[I_1 - I_2] + 7[I_1 - 16] = 0$

$5I_1 + 20I_1 - 20I_2 + 7I_1 - 112 = 0$

$32I_1 - 20I_2 = 112$ ... ①

mesh ②:

$20[I_2 - I_1] + 4I_2 + 1[I_2 - 16] = 0$

$20I_2 - 20I_1 + 4I_2 + I_2 - 16 = 0$

$-20I_1 + 25I_2 = 16$ ... ②

$640I_1 - 400I_2 = 2240$ (من ①)

$-640I_1 + 800I_2 = 512$ (من ②)

$400I_2 = 2752$

$I_2 = 6.88$ A

$I_1 = 7.8$ A ← بالتعويض في معادلة ①

كمل الصفحة البعد