Electrical Engineering Department
School of Engineering
University of Jordan

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Electrical Circuits (1) (EE211)
First Exam
3rd Term, 2016-2017
June 19th, 2017. 13:00 – 14:00

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Reg. No.: 0140754

Problem 1: (6 points)

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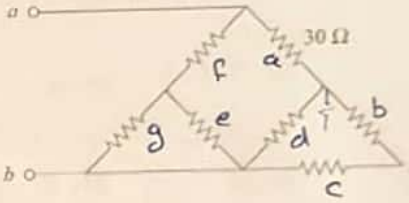
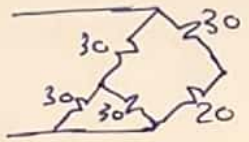
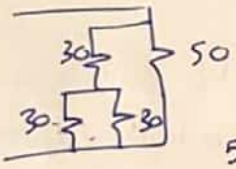
a) Find the equivalent resistor (R_{ab}) if all the resistors have a value of 30 Ω.



$(b+c)//d \Rightarrow 20\,\Omega$





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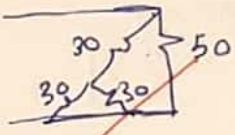
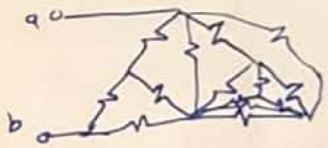


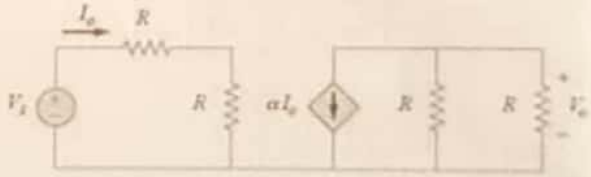
$50 // (30 + 30//30)$

$R_{ab} = 23.68\,\Omega$



~~$R_{ab} = 34\,\Omega$~~

b) Find the value of α such that $|V_o/V_s| = 10$



$I_o = \frac{V_s}{2R}$

$\alpha I_o + V_o\left(\frac{2}{R}\right) = 0$

$\alpha I_o = -2\frac{V_o}{R}$

$I_o = -2\frac{V_o}{\alpha R}$

$V_o = \frac{R\alpha I_o}{-2}$

$V_o = \frac{\alpha V_s}{-4R}$

~~$\frac{1}{40}$~~ useless

$\frac{V_s}{2R} = -\frac{2V_o}{\alpha R}$

$\alpha = -4\frac{V_o}{V_s}$

~~$\frac{1}{40}$~~

$\alpha = -40$

$\left|\frac{V_o}{V_s}\right| = 10$

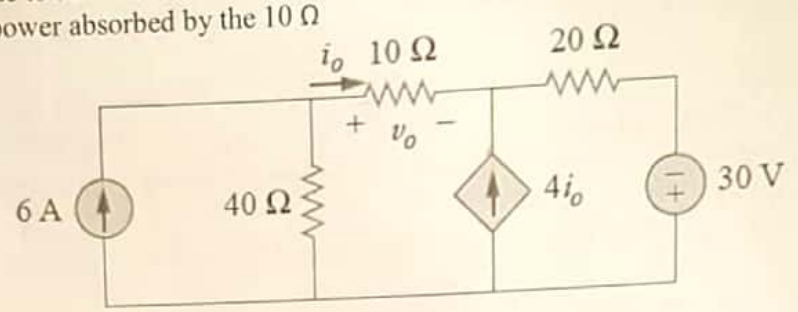
~~$\frac{1}{40}$~~

Problem 2: (3 points)

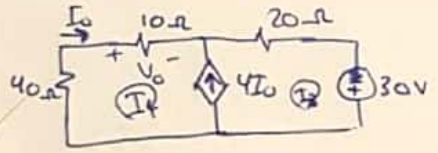
In the circuit shown, if i_o due to 6 A source only is 1.6 A

a) Find v_o due to 30 V source active alone

b) Find the power absorbed by the 10 Ω



a) 30V active alone



$V_o' = 10 I_o'$

Super mesh 1-2

$\boxed{I_1 = I_o}$

$I_2 - I_1 = 4I_o$

$\boxed{I_2 = 5I_1}$

$50I_1 + 20I_2 - 30 = 0$

$5I_1 + 2I_2 = 3$

$15I_1 = 3$

$\boxed{I_1 = 0.2A}$

Answer

$\boxed{V_o' = 2\ V}$ ⇝ V_o due to 30V source active alone.

b) $P_{10\Omega} = 10\, I_o^2$

$I_o = I_o' + I_o''$

$I_o' = 0.2A$ ⇝ by 30V

$I_o'' = 1.6A$ ⇝ by 6A

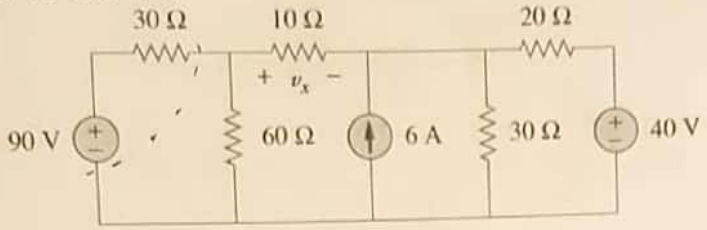
$I_o = 1.8A$

$P_{10\Omega} = 10(1.8)^2$

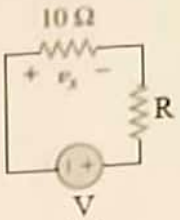
$\boxed{P_{10\Omega} = 32.4 \text{ watt (absorbed)}}$

Problem 3: (5 points)

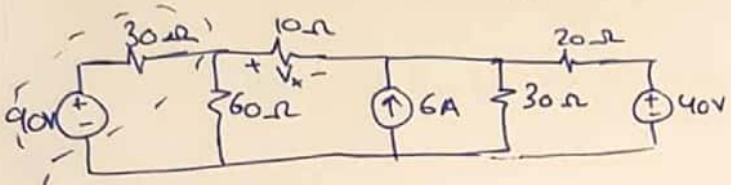
Simplify the circuit in Fig. (a) to look like the circuit in Fig. (b) using source transformation then find the value of 'R' and 'V'.



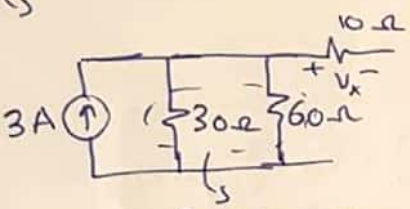
(a)



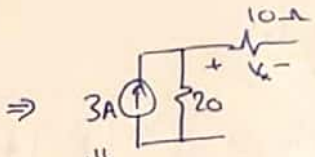
(b)

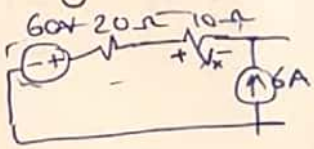


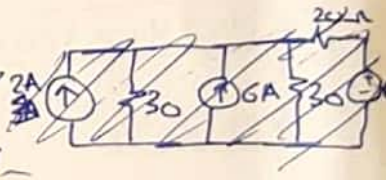
=IR

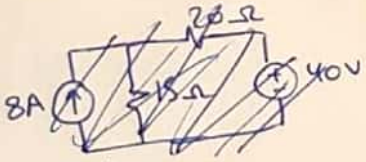


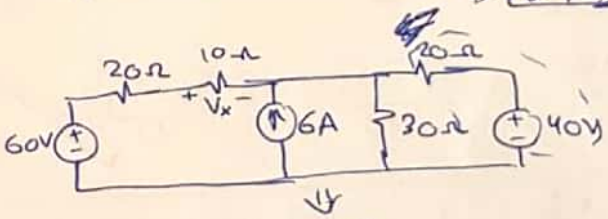
30//60 = 20

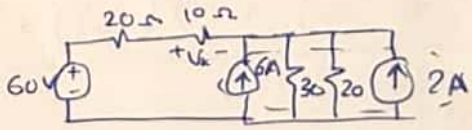


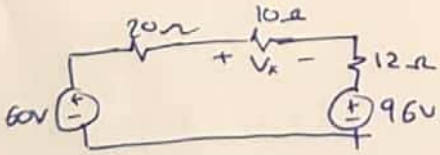


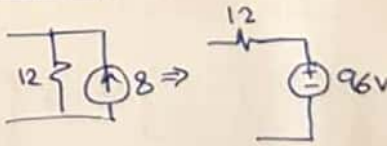


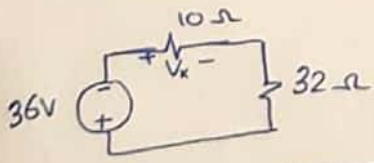




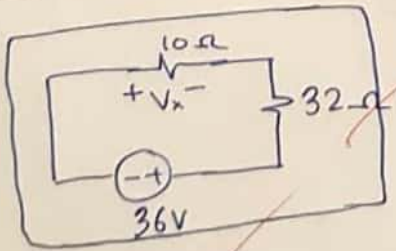








R = 32Ω
V = 36V

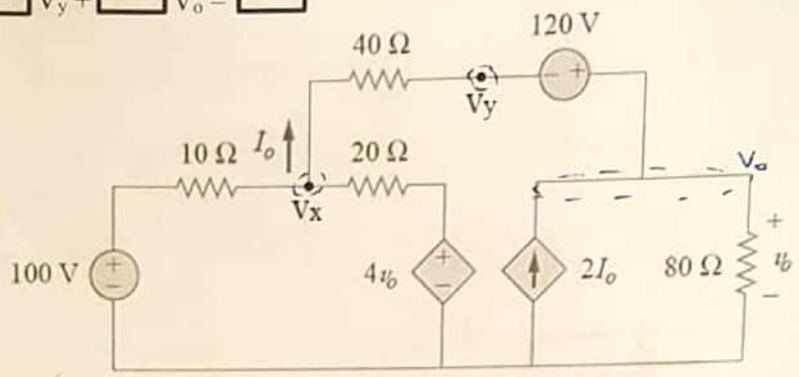


answer

Problem 4: (6 points)

Write all the nodal equations in terms of v_x, v_y and v_o only as the following form:

$\square V_x + \square V_y + \square V_o = \square$



$I_o = \frac{V_x - V_y}{40}$

KCL @ V_o, V_y (Super Node)

$\frac{V_o}{80} - 2I_o + \frac{V_y - V_x}{40} = 0 \Rightarrow$ $\boxed{V_o\left(\frac{1}{80}\right) + V_y\left(\frac{3}{40}\right) + V_x\left(-\frac{3}{40}\right) = 0}$

$\frac{V_o}{80} + 3\left(\frac{-V_x + V_y}{40}\right)$

$I_o = \frac{V_x - V_y}{4}$

$\boxed{V_o - V_y = 120V}$

KCL @ V_x

$\frac{V_x - 4V_o}{20} + \frac{V_x - 100}{10} + \frac{V_x - V_y}{40} = 0$

$\boxed{V_x\left(\frac{1}{20} + \frac{1}{10} + \frac{1}{40}\right) + V_y\left(-\frac{1}{40}\right) + V_o\left(-\frac{4}{20}\right) = 10}$

3 equations

$\boxed{\frac{-3}{40}} V_x + \boxed{\frac{3}{40}} V_y + \boxed{\frac{1}{80}} V_o = \boxed{0}$

$\boxed{0} V_x + \boxed{-1} V_y + \boxed{1} V_o = \boxed{120}$

$\boxed{\frac{7}{40}} V_x + \boxed{\frac{-1}{40}} V_y + \boxed{\frac{-1}{5}} V_o = \boxed{10}$