Birzeit University
Faculty of Engineering & Technology
Electrical & Computer Engineering Department
Network Analysis I – ENEE 2301
Midterm Exam 2nd Semester 2016/2017
Date: 02.05. 2017

25/25

Student Name:	
Student ID:	Dr. Ali Abdo Instructor:

Question 1 - B: Superposition Theorem **[25 Points]**

If the circuit in Fig (2) has been operated for long time with dc source. Use the principle of Superposition to find V_o ?

$V_o = V_o' + V_o''$ (3)
10A 28V

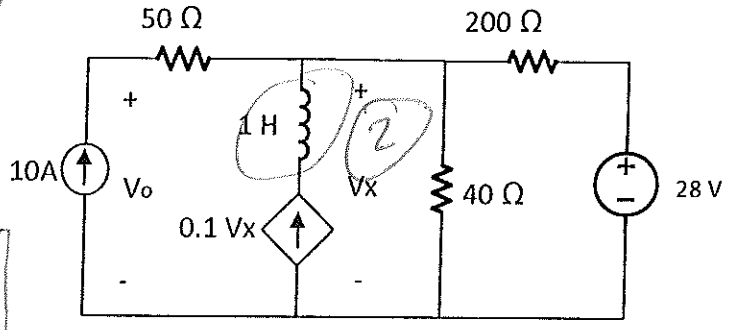
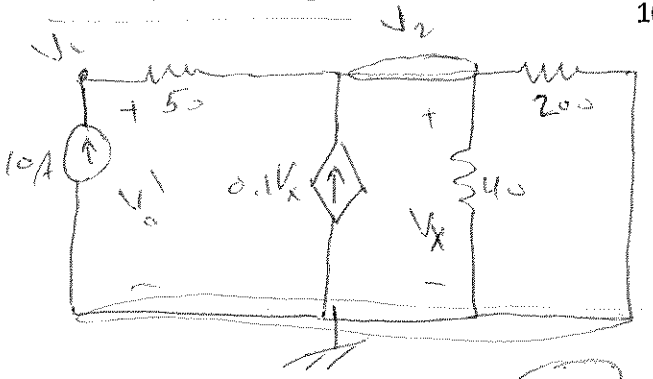


Fig (2)

To find V_o';



$-10 + \frac{V_1 - V_2}{50} = 0$ (1)

$V_1 - V_2 = 500$ ——— (1)

$\frac{V_2 - V_1}{50} - 0.1V_x + \frac{V_2}{40} + \frac{V_2}{200} = 0$

$V_2 = V_x$

$V_2\left(\frac{1}{50} - \frac{1}{10} + \frac{1}{40} + \frac{1}{200}\right) - \frac{V_1}{50} = 0$

$V_2\left(-\frac{1}{20}\right) - \frac{V_1}{50} = 0$

$5V_2 + 2V_1 = 0$ ——— (2)

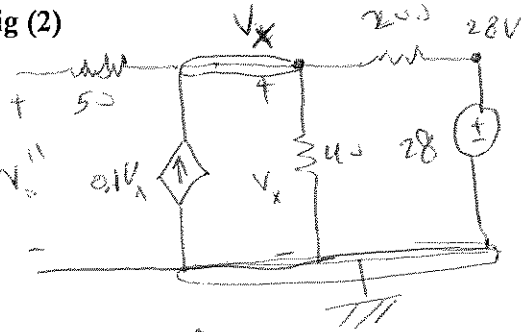
Solve (1) & (2):

$5(V_1 - 500) + 2V_1 = 0$

$7V_1 = 2500$

$V_1 = \frac{2500}{7}$ Volt $= V_o'$ $= 357.14$ V

To find V_o''; (10)



$-0.1V_x + \frac{V_x}{40} + \frac{V_x - 28}{200} = 0$

$V_x\left(-\frac{1}{10} + \frac{1}{40} + \frac{1}{200}\right) = \frac{28}{200}$

$V_x\left(-\frac{7}{100}\right) = \frac{28}{200}$

$V_x = V_o'' = -2$ Volt

$V_o = V_o'' + V_o' = 355.14$ Volt

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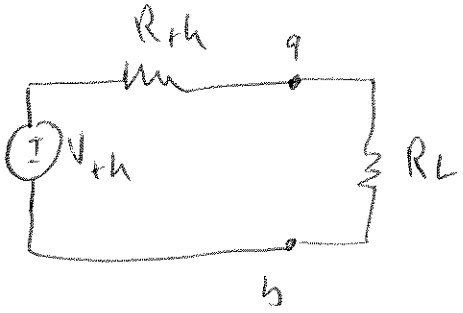
Question 1 - A: Maximum Power Transfer [15 Points]

Find the maximum power transfer to RL in Fig (1)?



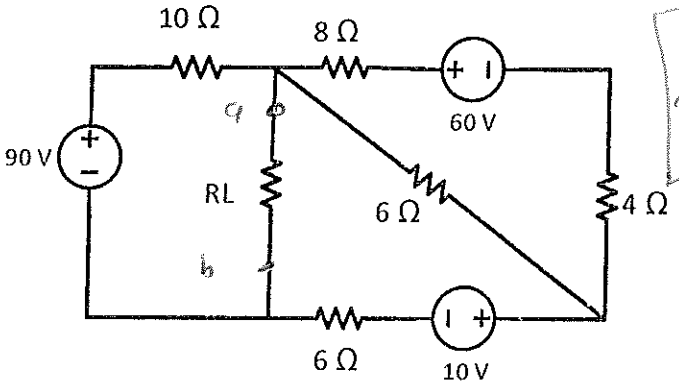
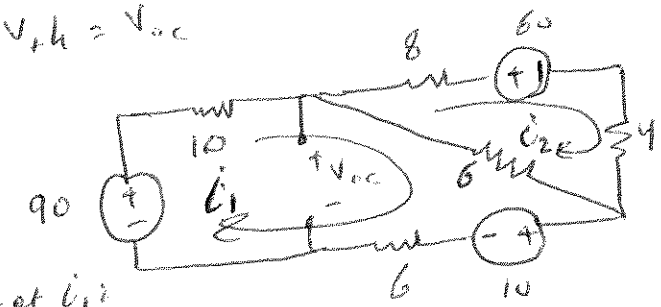


Fig (1)

15
15

To Find Vth:

$V_{th} = V_{oc}$



KVL at i_1:

$-90 + 10i_1 + 6(i_1 - i_2) + 10 + 6i_1 = 0$

$22i_1 - 6i_2 = 80$ ——— (1)

KVL at i_2:

$8i_2 + 60 + 4i_2 + 6(i_2 - i_1) = 0$

$18i_2 - 6i_1 = -60$ ——— (2)

(1) X 3: $66i_1 - 18i_2 = 240$

+ (2) $-6i_1 + 18i_2 = -60$

$60i_1 = 180$

$i_1 = 3A$

$i_2 = \frac{-60 + 6(3)}{18} = -2.33A$

$-90 + 10i_1 + V_{oc} = 0$

$V_{oc} = 90 - 10(3) = 60 V_{oltage}$

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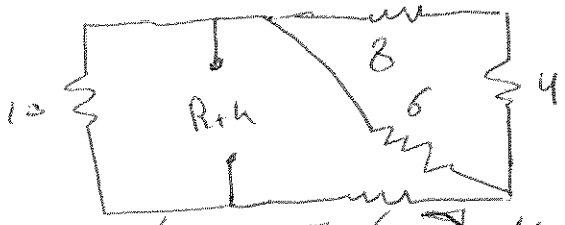
To find Rth:



$R_{th} = \left([(8+4) // 6] + 6 \right) // 10$

$R_{th} = 5\,\Omega$

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Maximum Power

$R_L = R_{th} = 5\,\Omega$ 5

$P_{L\max} = \frac{V_{th}^2}{4R_L} = \frac{(60)^2}{4(5)} = 180$ W