ECE110 - Quiz #4

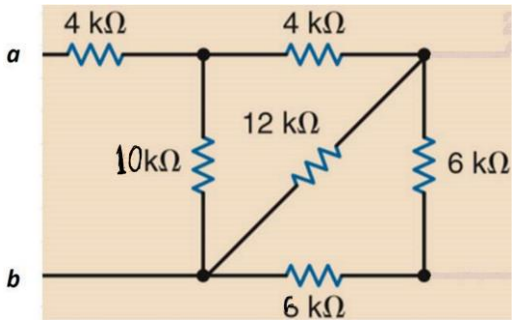
Only non-programmable calculators are allowed.
Duration: 45 Minutes

First Name: _____ *Last Name:* _____

*Student #:*_____ *Tutorial Room:* _____

Q1 [3 Marks] Clearly circle the correct answer.

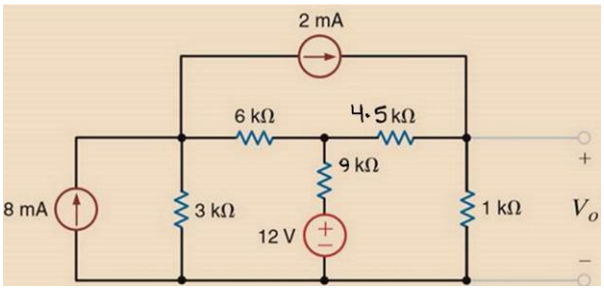
i. What is the equivalent resistance seen from nodes ***a*** and ***b*** in the following circuit?



a) 12 kΩ
b) 11 kΩ
c) 10 kΩ
d) 9 kΩ
e) None of the above.

Answer: d

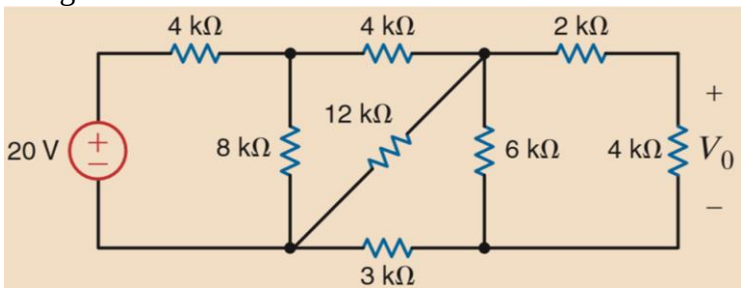
ii. In the following circuit, what is the equivalent resistance seen by the current source?



a) 800 Ω
b) 900 Ω
c) 1000 Ω
d) 999 Ω
e) None of the above.

Answer: b

iii. How many nodes are in the following circuit?



a) 5
b) 6
c) 7
d) 8
e) None of the above.

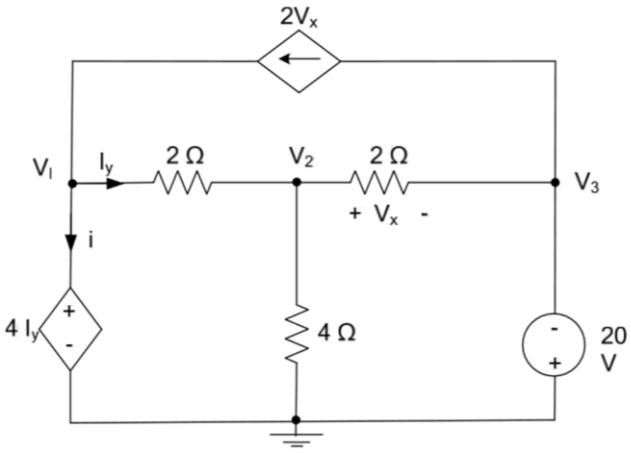
Answer: b

Q2 [7 Marks] In the circuit shown below apply Nodal Analysis to determine:

a) Voltages at nodes V_1, V_2, and V_3. [3.5 Marks]

b) Current $2V_X$. [1 Mark]

c) Power by dependent voltage source. Is this power absorbed or supplied? [2.5 Mark]



Part a)

$V_3 = -20$ (V)

$\begin{cases} V_1 = 4I_y \\ I_y = \frac{V_1 - V_2}{2} \end{cases} \Rightarrow V_1 = 2V_1 - 2V_2 \Rightarrow V_1 - 2V_2 = 0$ (1)

Apply KCL @ Node V_2 $\quad \sum I_{leaving} = 0$

$\Rightarrow \frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2} + \frac{V_2}{4} = 0$

times 4 $\Rightarrow -\frac{1}{2}V_1 + V_2\left(\frac{1}{2} + \frac{1}{2} + \frac{1}{4}\right) = \frac{V_3}{2}$

$-2V_1 + V_2(2+2+1) = 2V_3$

$-2V_1 + 5V_2 = -40$ (2)

$V_1 - 2V_2 = 0$ (1) $\Rightarrow \begin{cases} -2V_1 + 5V_2 = -40 \\ 2V_1 - 4V_2 = 0 \end{cases}$

$V_2 = -40$ (V)

$V_1 = 2V_2 = 2(-40) \Rightarrow V_1 = -80$ (V)

Part b)

$$V_x = V_2 - V_3 = -40 - (-20) = -20 \ (V)$$

$$\Rightarrow 2V_x = 2(-20) = -40 \ (A)$$

Part c) $P = VI \Rightarrow P = (4I_y)(i)$

Need I_y and i

$$I_y = \frac{V_1 - V_2}{2} = \frac{-80 - (-40)}{2} = \frac{-40}{2} = -20 \ (A)$$

Apply KCL @ Node V_1

$$2V_x = i' + I_y \Rightarrow i' = 2V_x - I_y$$

$$i' = (-40) - (-20) = -20 \ (A)$$

$$P = 4(-20)(-20) = 1600 \ (W)$$

Absorbing