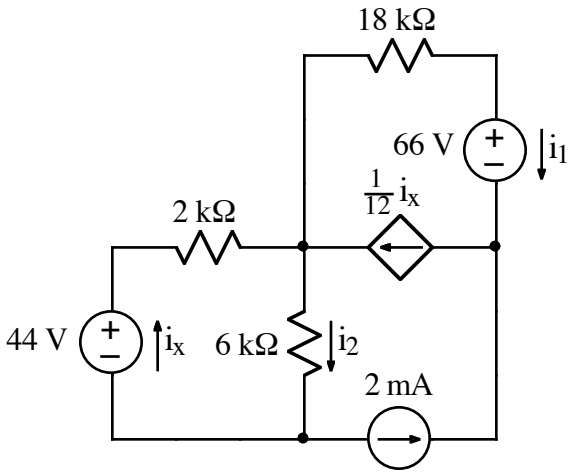
HOMEWORK #7 solution

Ex:



a) Use the mesh-current method to find i_1 and i_2.
b) Find the power dissipated by the dependent source.

sol'n: a) $i_b = -2\,mA$ from 2mA source on outside edge

$i_x = i_c$ (dependent source)

Super mesh for i_a and i_b loops.

i_a, i_b voltage loop for supermesh is not possible because of 2 mA source.

∴ we only have current eq'n for source between i_a and i_b loops:

$$\frac{1}{12} i_c \;(\leftarrow i_x) = i_a - i_b = i_a + 2\,mA$$

v-loop for i_c gives

$$+44\,V - i_c\,2k\Omega - i_c\,6k\Omega + i_b\,6k\Omega = 0\,V$$

or $+i_c(2k\Omega + 6k\Omega) = +44V + (-2mA)\,6k\Omega$

or $i_c = \dfrac{44V - 12V}{8K\Omega} = 4mA$

From earlier: $\dfrac{1}{12} i_c = i_a + 2mA$

or $i_a = \dfrac{i_c}{12} - 2mA = \dfrac{4mA}{12} - 2mA$

$i_a = -\dfrac{5}{3} mA$

Now we have $i_1 = i_a = -\dfrac{5}{3} mA$

$i_2 = i_c - i_b = 4mA - (-2mA) = 6mA$

b) $p = i \cdot v = \dfrac{1}{12} i_c \cdot V_{dep\,src}$

From i_a v-loop: $-i_a \cdot 18k\Omega - 66V - V_{dep\,src} = 0V$

or $V_{dep\,src} = -i_a \cdot 18k\Omega - 66V$

$= -\left(-\dfrac{5}{3}\right) \cdot 18k\Omega - 66V = -36V$

$p = \dfrac{1}{12} \cdot 4mA\,(-36V) = -12\,mW$