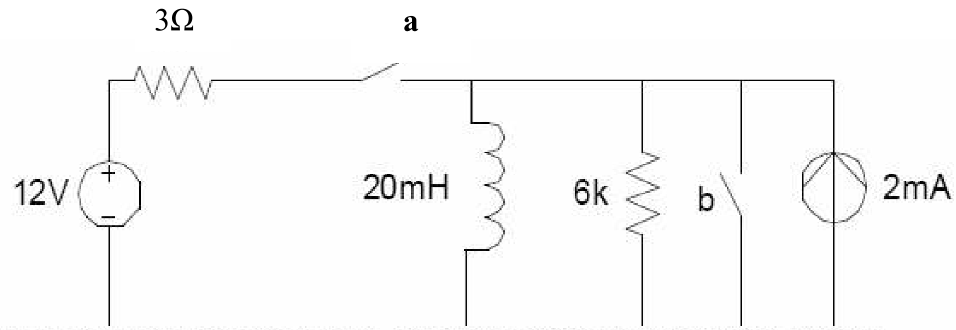
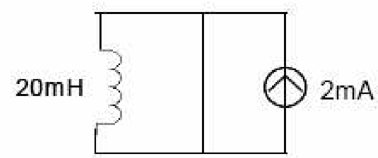


Assume switch a has been open, and b closed for a very long time. Then at time t=0, switch a closes and b opens.
We will solve for the inductor current i_L (going from top to bottom) in two ways:
a. Norton equivalent:
(1)Draw a Norton equivalent for the circuit before time t=0 and find the value of i_L(0-).

Before t=0, a is open and b is closed.
Regard the inductor as a load,

$R_{th} = 6k \,//\, 0 = 0$

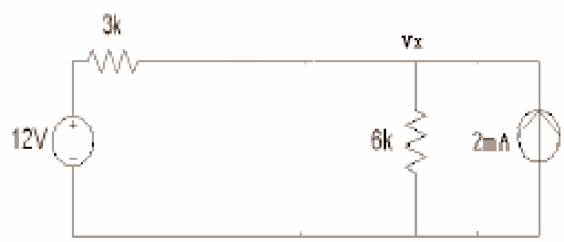
Isc=2mA



[2 points]

(2)Draw a Norton equivalent for the circuit after time t=0 and use this to solve for i_L(t) for t>0. (Notice that we could not just draw one Norton equivalent for all times, because we can't include the switches.)

After t=0, a is closed and b is open.
To get Rth, the current source is treated as a open circuit and the voltage source is treated as a short circuit



$R_{th} = 6k \,//\, 3k = 2k$

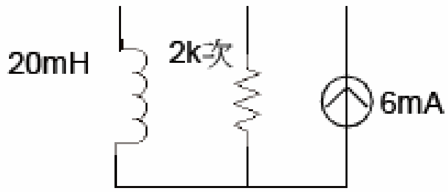
Apply KCL to the node of Vx,

$$\frac{12 - V_x}{3k} + 2mA = \frac{V_x}{6k} \quad =>$$

Vx=12V=Voc=Vth

$$I_{sc} = \frac{V_{oc}}{R_{th}} = 6mA$$

and Norton equivalent circuit is shown below.



[2 points]

Apply KVL,

$$L\frac{di_L}{dt} = i_R R = (6mA - i_L)2k \qquad (2)$$

Solve this differential equation and we get,

$i_L(t) = 6mA - (6mA - I_0)\exp(-100000t)$ [3 points]

Note for this case, the initial current, I_0, through the inductor could be arbitrary between 0 and 2mA.