Solution

EE101 Quiz 7, February 26, 2019

Name_____ Student ID Number_____

*6.7 For the circuit in **Fig. P6.7**, determine $i_1(0)$ and $i_2(0)$.

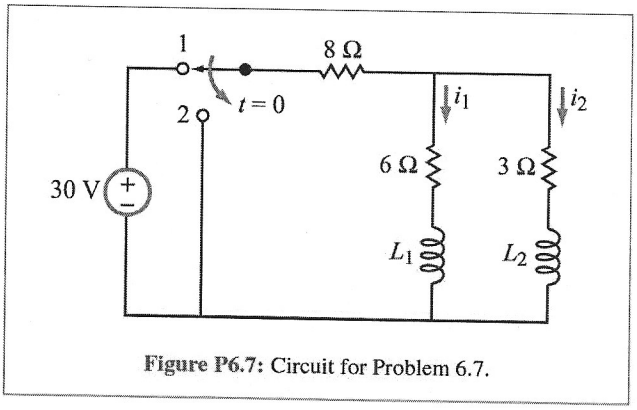
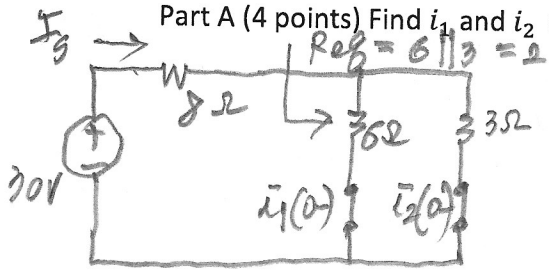


Figure P6.7: Circuit for Problem 6.7.

Part A (4 points) Find i_1 and i_2 at t = 0_, namely initial conditions for two inductors.

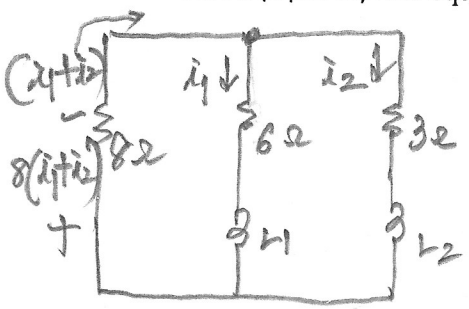


$$I_s = \frac{30}{8+2} = 3\,A$$

$$i_1(0) = 3\,\frac{3}{6+3} = 1\,A$$

$$i_2(0) = 3\,\frac{6}{6+3} = 2\,A$$

Part B (6 points) Find equations for $i_1(t)$ and $i_2(t)$ for t > 0.



$$-8(i_1+i_2) = 6i_1 + L_1\frac{di_1}{dt} = 3i_2 + L_2\frac{di_2}{dt}$$

$$i_1(0) = i_1(0-) = 1\,A,\quad i_2(0) = i_2(0-) = 2\,A = 2i_1(0)$$

$$\Rightarrow i_2(t) = 2i_1(t)$$

$$-8(3i_1) = 6i_1 + L_1\frac{di_1}{dt} = 3(2i_1) + L_2\left(2\frac{di_1}{dt}\right)$$

$$\Rightarrow \boxed{L_1 = 2L_2}$$

and

$$L_1\frac{di_1}{dt} + 30\,i_1 = 0 \Rightarrow L_1(sI_1(s) - i_1(0)) + 30\,I_1(s) = 0$$

$$I_1(s) = \frac{i_1(0)}{s+(30/L_1)} = \frac{1}{s+(30/L_1)}$$

$$i_1(t) = e^{-(30/L_1)t}u(t)$$

$$i_2(t) = 2i_1(t) = 2e^{-(30/L_1)t}u(t) = 2e^{-(15/L_2)t}u(t)$$