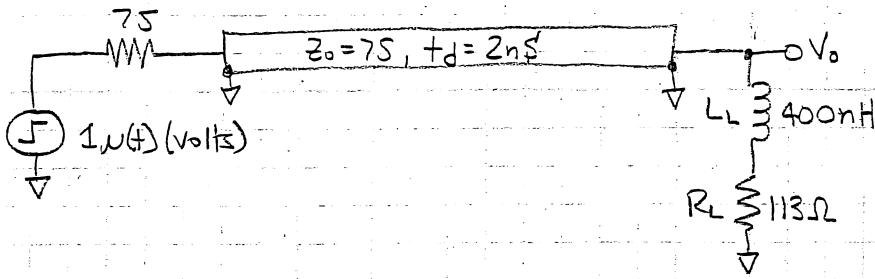


2. Consider the circuit below:

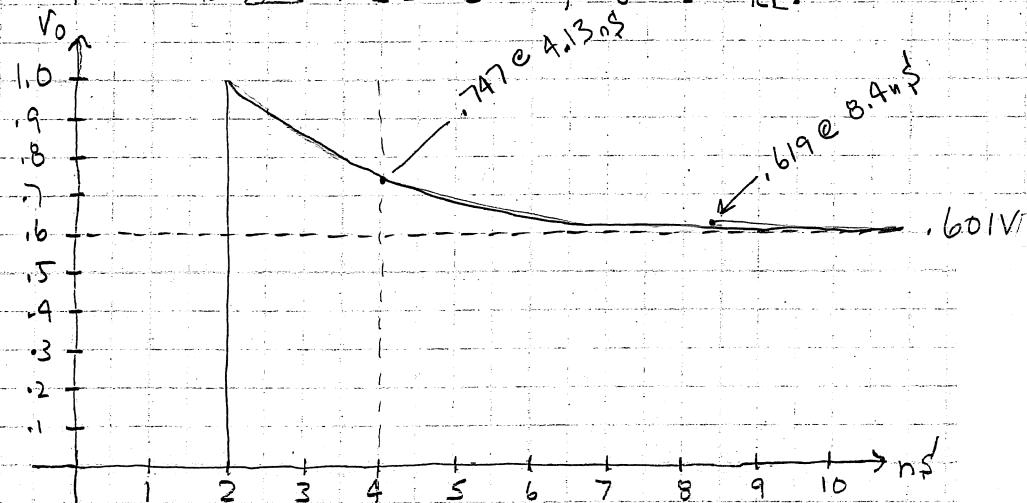


a) On the graph below, plot  $V_o$  for  $t=0$  to  $t=10\text{ns}$ . Clearly label voltages.

b) Indicate on your plot the voltage and time at:

- i)  $t=1\text{ns}$
- ii)  $t=3\text{ns}$

Hint: Note that  $V_o$  is not the voltage across the inductor but across both inductor and resistor. So,  $V_o = V_L + V_{RL}$ .



• Equivalent circuit :

$$\boxed{\begin{array}{c} \frac{1}{75\Omega} \\ \parallel \\ \frac{1}{113\Omega} \end{array}} \parallel \frac{1}{3400\text{nH}} \Rightarrow \tau = \frac{L}{R} = \frac{400 \times 10^{-9}}{113\Omega} = 2.13\text{ns}$$

$$3\tau = 6.4\text{ns}$$

• Final voltage at  $V_o$  is a voltage divider,  $\left(\frac{113}{113+75}\right) 1 = 0.601\text{V}$

• Waveform will open circuit at the inductor & have full-sized positive reflection followed by decay as current builds in the inductor.

$$\bullet V_o = V_L + I_L R_L ; V_o \text{ is found using } V_o(t) = [V_o(\infty) + [V_o(t_d^+) - V_o(\infty)] e^{-(t-t_d)/\tau}] u(t-t_d)$$

(with  $t > t_d$ )

$$V_o(t) = 0.601 + [1 - 0.601] e^{-(t-t_d)/\tau}$$

$$= 0.601 + .399 e^{-(t-t_d)/\tau}$$

$$e^{t-T} : V_o(t) = 0.601 + .399 e^{-1}$$

$$= \underline{\underline{0.747\text{V}}}$$

$$e^{t-3T} : V_o(3T) = 0.601 + .399 e^{-3}$$

$$= \underline{\underline{0.621\text{V}}}$$