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## Question 1 (6 marks)

The voltage $v_L(t)$ across the inductor of inductance $\frac{1}{2}H$ is shown in Figure 1 below. Determine the current through the inductor. Also plot the current for $-2 \leq t \leq 5$.
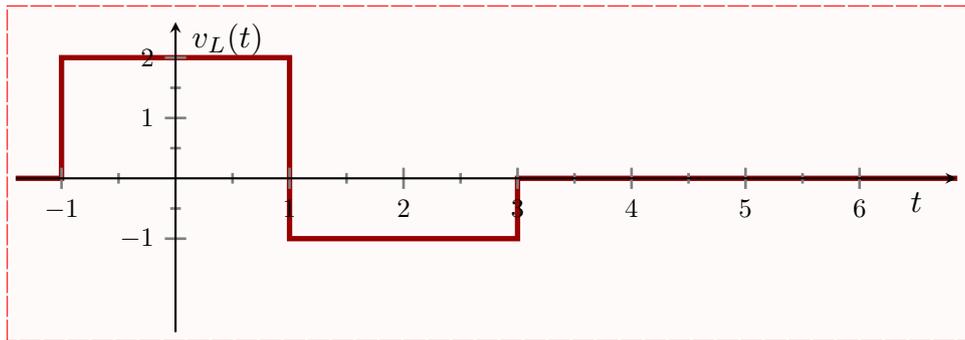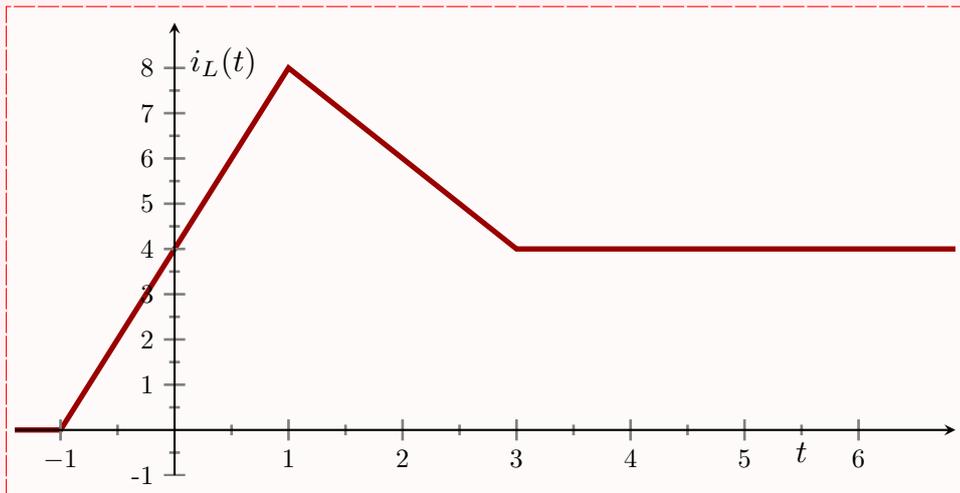


**Figure 1:** Voltage across the Inductor.

**Solution:** Current through inductor is given by

$$i_L = \frac{1}{L}\int_{-\infty}^{t} v_L(\tau)d\tau = 2\int_{-\infty}^{t} v_L(\tau)d\tau dt$$

$$i_L = \begin{cases} 0 & t \leq -1 \\ 2\int_{-1}^{t}(2)dt = 4(t+1) = 4t+4 & -1 < t \leq 1 \\ 2\int_{-1}^{1}(2)dt + 2\int_{1}^{t}(-1)dt = -2t+10 & 1 < t \leq 3 \\ 2\int_{-1}^{1}(2)dt + 2\int_{1}^{3}(-1)dt = 4 & 3 < t \end{cases}$$

The plot is given below:



## Question 2 (4 marks)

Draw a circuit with voltage source ($10\,\mathrm{V}$), switch, inductor ($1\,\mathrm{H}$) and resistor ($2\,\Omega$) in series. The switch is initially open and closed at $t = 0$. Label the voltages across resistor and inductor as $v_R(t)$ and $v_L(t)$ respectively and plot the waveforms of the voltages.

**Solution:** Plots given below:



Circuits I