1) A circuit has a 12 V emf, a 10 ohm resistor and a 0.1 H inductor, as shown. When the switch is closed, how long will it take for the current thru the resistor to reach 99% of its peak value? [10 pts]

\[ I = I_{\text{max}} \left( 1 - e^{-t/\tau} \right) \]

\[ \tau = \frac{L}{R} = \frac{0.1}{10} = 0.01 \]

\[ 0.99I_{\text{max}} = I_{\text{max}} \left( 1 - e^{-t/\tau} \right) \]

\[ 0.99 = 1 - e^{-t/0.01} \]

\[ t = 0.01 \times \ln(0.01) \]

\[ t = 0.046 \text{ s} \]

2) What is the natural frequency of a circuit containing only a 5 mF charged capacitor and a 10 mH inductor? [6 pts]

\[ \omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(10 \times 10^{-3}) \cdot (5 \times 10^{-3})}} \]

\[ \omega = 141.42 \text{ rad/s} \]