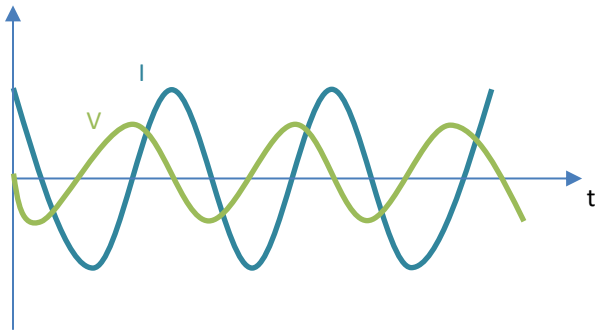
CONCEPT: INDUCTORS IN AC CIRCUITS

- Remember! The current in an AC circuit at any time is
  - $i(t) =$ _____
- Remember! The voltage across an inductor is $v_L =$ _____
  - Using calculus, one can show $\frac{\Delta i}{\Delta t}(t) = i_{MAX}\omega \cos\left(\omega t + \frac{\pi}{2}\right)$

- The VOLTAGE ACROSS AN INDUCTOR in an AC circuit is
  - $v_L(t) =$ _____

- This means, if current and voltage across the capacitor are plotted, the voltage of a capacitor LEADS the current by 90°:



- The MAXIMUM voltage across the inductor is $V_L =$ _____
  - This result looks A LOT like Ohm's Law, if we have some resistance-like quantity ωL

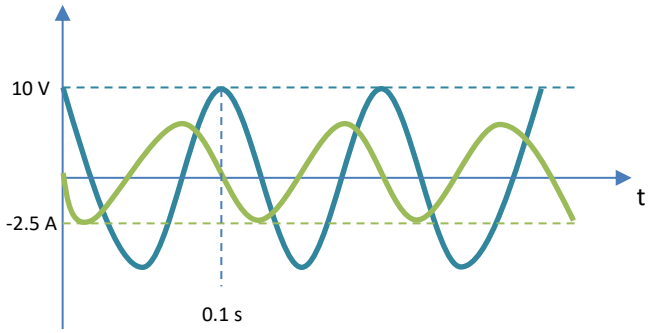
→ We define the INDUCTIVE REACTANCE as $\boldsymbol{X_L = \omega L}$

EXAMPLE: An AC power source delivers a maximum voltage of 120 V at 60 Hz. If an unknown inductor is connected to this source, and the maximum current in the circuit is found to be 5 A, what is the inductance of the inductor?

EXAMPLE: INDUCTORS AND GRAPHS

The voltage across, and the current through, an inductor connected to an AC source are shown in the following graph. Given the information in the graph, answer the following questions:

a) What is the peak voltage of the AC source?
b) What is the frequency of the AC source?
c) What is the inductive reactance of the circuit?



PRACTICE: CURRENT IN INDUCTOR AC CIRCUITS AT DIFFERENT FREQUENCIES

Will a frequency $f = 60\ Hz$ or $\omega = 75\ s^{-1}$ produce a larger max current in an inductor connected to an AC source?