1) In the circuit below the switch has been closed for a long time and then is opened.  
Determine for the circuit after the switch is opened,  
   a) The initial current in the inductor.  4mA  
   b) The final current in the inductor.  0mA  
   c) The time constant.  
      Time constant = \frac{10\mu H}{2k} = 5ns  
   d) The equation for the current in the inductor with the values found above placed properly.  
      i(t) = 4mAe^{-t/5ns}  

With the inductor changed to 10mH the time constant is 5us and the transient response is plotted below:
2) A sinusoidal voltage source is connected to a component. The voltage and current waveforms have been captured and are displayed in the figure below. The amplitude of the voltage waveform is less than the current waveform.

The scales are,
- Horizontal: 0.1 msec per division
- Vertical: 1 volt and 1 amp per division

Determine the following,

a) The period of the waveforms. 1 ms  6 pts
b) The radian frequency. $2000\pi$  6 pts
c) The sinusoidal equation for the voltage waveform. $4\sin(2000\pi t)$ volts  6 pts
d) The sinusoidal equation for the current waveform. $6.3\sin(2000\pi t - 90^\circ)$ amps  6 pts
e) The reactance of the component. $\frac{4}{6.3}$  6 pts
f) Is the component a capacitor or an inductor? inductor  4 pts
3) Determine the following, 30pts

a) What is the value of an inductor if,
\[ X_L = 50 \text{ ohms} \]
\[ \omega = 4000 \]
\[ L = \frac{50}{4000} = 12.5 \text{ mH} \] 7pts

b) What is the radian frequency if,
\[ X_C = 4 \text{ ohms} \]
\[ C = 2 \text{ microfarads} \]
\[ X_C = \frac{1}{\omega C} \]
\[ \omega = \frac{1}{X_C C} = \frac{1}{(4 \times 2 \text{u})} = 125,000 \text{ radians per second} \] 7pts

c) What is the phase difference between two waveforms if,
The period is 8ms.
The separation between peaks is 1.5ms.
\[ \text{phase diff} = 360 \times \frac{1.5}{8} \] 7pts

d) Make a rough sketch of these two waveforms,
\[ v_1(t) = \sin(5t + 30) \]
\[ v_2(t) = \sin(5t + 60) \]
v2(t) is shifted left by 30 degrees so as to lead v1(t). 9pts

Scores
1. ______
2. ______
3. ______
Total ______