

**Lab 6 - Resonance**

A spring oscillates with a natural frequency of  $\lambda/2\pi$ . If we drive the spring with a sinusoidal force  $C \sin(\omega t)$ , where  $\omega \neq \lambda$ , then the spring oscillates according to:

$$y(t) = \frac{C}{\lambda^2 - \omega^2} (\lambda \sin(\omega t) - \omega \sin(\lambda t))$$

1. Use L'Hopital's Rule to determine  $y(t)$  in the limit as  $\omega \rightarrow \lambda$ . Show your work.

2. Define the result of 1. as follows:

$$y_o(t) = \lim_{\omega \rightarrow \lambda} y(t)$$

(a) Is  $y_o(t)$  periodic? If so, give the period. If not, state how you know.

(b) Find the amplitude as  $t \rightarrow \infty$ .

3. Plot  $y(t)$  for  $C = 1$ ,  $\lambda = 1$  and  $\omega = 0.5, 0.8, 0.9, 0.99$  and  $0.999$ . How do the graphs change? Do they confirm your work in part 2.?