

The objective of this homework is to test your understanding of the content of Module 3. Due date of the homework is: **Tuesday, February 11th, 2020 at 1pm.**

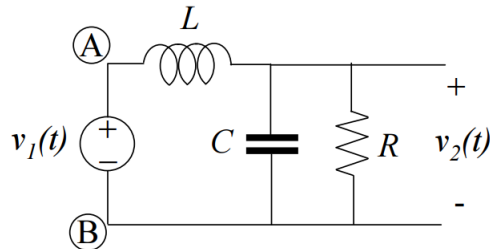
You have to upload a scanned version of your solutions on Blackboard. If you don't have a scanner around you, you can use Cam Scanner—a mobile app that scans images in a neat way, as if they're scanned through a copier. Here's the link for Cam Scanner: <https://www.camscanner.com/user/download>.

1. Linearize the following equations:

(a)  $f(x) = x^{1/3} + \cos(x)$  around  $x_0 = \pi/2$ .

(b)  $g(x) = -3x^3 + \sin(4x^2)$  around  $x_0 = 2$ .

2. For this circuit:



find

(a)  $\frac{V_2(s)}{V_1(s)}$  for any  $R, L, C$ .

(b)  $v_2(t)$  if  $R = 1, L = 1, C = 1$ , and

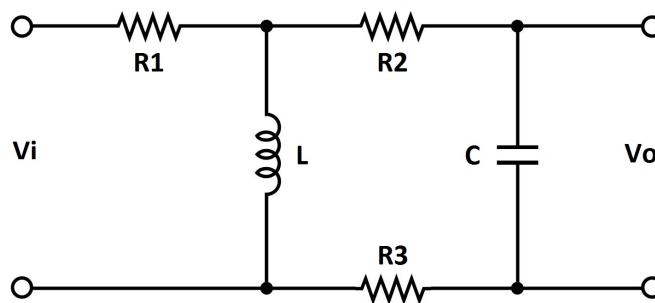
i.  $v_1(t) = \delta(t)$ , or

ii.  $v_1(t) = 5$ .

This means that you have two different input voltage signals. Each signal will give a different output  $v_2(t)$  or  $V_2(s)$ .

After you analytically compute your answers, verify your solutions via MATLAB.

3. For the following circuit:



find

(a) the transfer function  $\frac{V_o(s)}{V_i(s)}$ .

(b) the poles of the transfer function given that  $R_1 = 1, R_2 = 1, R_3 = 1, L = 1, C = 1$ .

(c) the output  $v_o(t)$  if  $v_i(t) = u(t)$  ( $u(t)$  is the Heaviside step function).