

**Exercise E2**

Plot the following functions, as described.

- (a) *Truncated power series*:  $f(x) = a_0 + a_1x + a_2x^2$ , from  $x = -2$  to  $x = 2$ , with  $a_0 = 2$ ,  $a_1 = -6$ , and  $a_2 = 4$ . Make the line dotted and make the line thickness equal to “3pt”.

- (b) *Three dampings for parallel RLC*:

Consider the three voltage functions shown to the right where  $t$  is in seconds. Plot all three on one pair of axes, from  $t = 0$  to  $t = 50\text{ms}$ . Make them red, green, and blue. Use a legend. (The first is “overdamped”, the second is “critically damped”, and the third is “underdamped”.) Use  $s_1 = -500\text{Hz}$ ,  $s_2 = -300\text{Hz}$ ,  $A_1 = 10\text{V}$ , and  $A_2 = -5\text{V}$ ;  $\alpha_2 = 400\text{Hz}$ ,  $A = 10\text{V}$ , and  $B = -5000\text{V/s}$ ; and  $\alpha_3 = 150\text{Hz}$ ,  $\omega = 450\text{rad/s}$ ,  $a = 10\text{V}$ , and  $b = 4\text{V}$ .

$$v_1(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t}$$

$$v_2(t) = A e^{-\alpha_2 t} + B t e^{-\alpha_2 t}$$

$$v_3(t) = a e^{-\alpha_3 t} \cos(\omega t) + b e^{-\alpha_3 t} \sin(\omega t)$$

You will need 2 sheets and 2 charts (in Excel) to complete this exercise.

On each sheet, set up the dependent variable ( $x$  or  $t$ ) in column A, with the parameters you need and their labels directly above it (e.g., xmin, xmax, N (intervals), and dx). Then set up the dependent variables ( $f$  or  $v_1$ ,  $v_2$ , and  $v_3$ ) in the next column(s), again, with the parameters you need and their labels above the appropriate columns of calculated values. Each label should be directly above the value(s) it is labeling. You will need at least 400 points in each to make a smooth graph.

Move each chart onto its own special “Chart” sheet, so that it is easier to edit and print.

Set the upper and lower X limits to be what is given, i.e.,  $[-2, 2]$  for part (a) and  $[0, 50]$  for part (b).

Use \$ to suppress the automatic cell referencing, as needed. One point will be taken off for each extra or missing \$.

Each title should be 22pts, each axis label should be 18pts, and the numbers along each axis should be 15pts. The legend for part (b) should be 18pts. (Remove the legend for part (a), if there is one.)

For part (a), to make a dotted line, you will need to choose “Smooth Line (XY) Scatter” as the chart type. Use Smooth Line (XY) Scatter for both parts.

For part (b), note that you will need two columns of time values, one in seconds and the other in ms. (Think about how to create the second one efficiently.) Create the list of time values in ms first, as the time frame is given in ms. You will need to compute the values of the functions in seconds, but plot using ms. This means the list of time values in ms should be immediately to the left of the first column of voltage values. Also, whenever there is a common exponential function in each term, pull it out to make the expression you write more efficient and compact. (The column of time values in seconds can be either to the left of the time values in ms, or on the far right.)

Make sure each label and the axis labels have appropriate unit abbreviations.

Submit exactly 6 pages in all: For each part, submit only the first page of formulas, the first page of values, and the chart. To maximize the size of the first page, use “Scale” and choose “Fit to 1 page(s) wide by Automatic page(s) tall”. Landscape orientation works well for everything, especially the formulas and the charts.

Further, for part (a), set up your column of  $x$  values such that the value of  $f(x)$  at  $x = -1.95$  is visible on the first page. Similarly, for part (b), set up your column of  $t$  values such that the three voltages at  $t = 0.5\text{ms}$  are visible on the first page. You might need to think about what value of N (intervals) will make this work.