Handwritten Homework #5 (HW05)

Problem #1

A voltage signal, $v(t)$, is zero for all time less than t = 0. At t = 0 the voltage abruptly increases to 100V and begins to decay toward a final value of 20V with a time constant of 200 ms. Then, at t = 400 ms, the voltage abruptly changes to -50V and proceeds to decay toward zero with a time constant of 100 ms.

a) (1 pt) Accurately plot $v(t)$ from t = -100ms to t = 1s.

b) (1 pt) Accurately plot the derivative, $dv(t)/dt$, over this same time interval.

c) (1 pt) Write a single equation for $v(t)$, grouping terms by step function in ascending order of when the step function fires. In other words, your function should be of the form:

$$v(t) = (...)u(t - T_0) + (...)u(t - T_1) + (...)u(t - T_2) + \cdots$$

d) (1 pt) Similarly write a single equation for $dv(t)/dt$.
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e) (2 pt) Find $\mathscr{L}\{v(t)\}$?

f) (2 pt) Find $\mathscr{L}\{ dv(t)/dt \}$ starting from the result from part (d).

g) (2 pt) Find $\mathscr{L}\{ dv(t)/dt \}$ starting from the result from part (e).