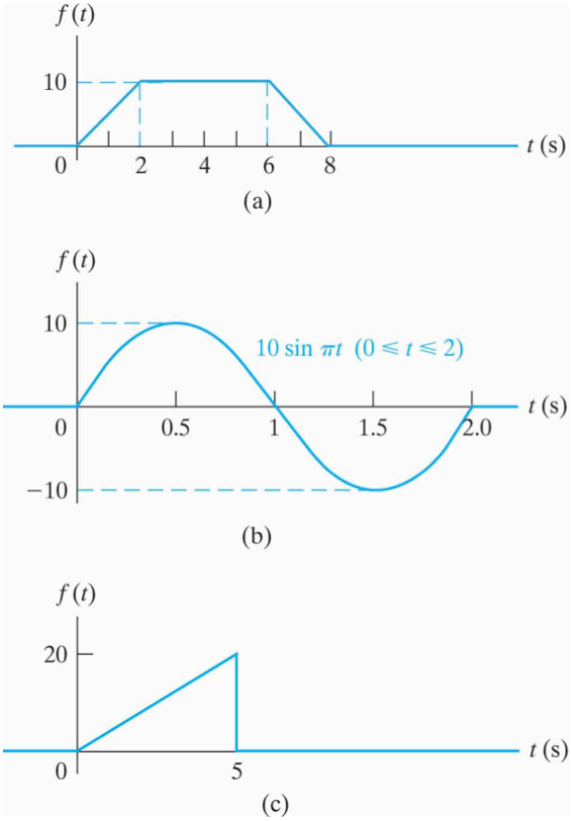
Problem # 1

Use step functions to write the expression for each function shown below:



Problem #2

a) Show that

$$\int_{-\infty}^{\infty} f(t)\delta'(t - a)\,dt = -f'(a).$$

(*Hint:* Integrate by parts.)

b) Use the formula in (a) to show that

$$\mathcal{L}\{\delta'(t)\} = s.$$

Problem #3

Find the Laplace transform of each of the following functions:

a) $f(t) = te^{-at}$;

b) $f(t) = \sin \omega t$;

c) $f(t) = \sin(\omega t + \theta)$:

d) $f(t) = t$;

e) $f(t) = \cosh(t + \theta)$.

Problem #4

The switch in the circuit has been open for a long time. At $t = 0$, the switch closes.

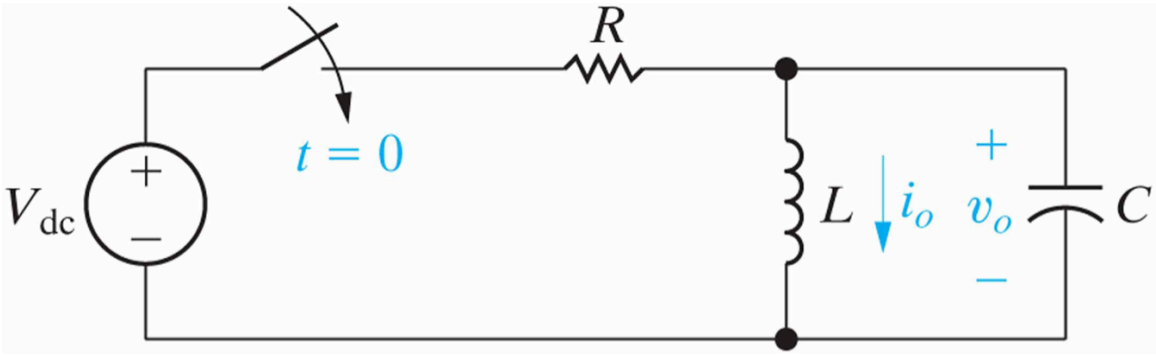
a) Derive the integrodifferential equation that governs the behavior of the voltage v_o for $t > 0$.

b) Show that

$$V_o(s) = \frac{V_{dc}/RC}{s^2 + (1/RC)s + (1/LC)}.$$

c) Show that

$$I_o(s) = \frac{V_{dc}/RLC}{s[s^2 + (1/RC)s + (1/LC)]}$$



Problem #5

Find $f(t)$ for each of the following functions.

a) $F(s) = \dfrac{100}{s^2(s + 5)}$.

b) $F(s) = \dfrac{50(s + 5)}{s(s + 1)^2}$.

c) $F(s) = \dfrac{100(s + 3)}{s^2(s^2 + 6s + 10)}$.

d) $F(s) = \dfrac{5(s + 2)^2}{s(s + 1)^3}$.

e) $F(s) = \dfrac{400}{s(s^2 + 4s + 5)^2}$.