

Name: _____

1. Solve the initial value problem $x'' + 4x' + 4x = 1 + \delta(t - 2)$; $x(0) = x'(0) = 0$.

2. Consider a mass on a spring with $m = 1$, $k = 2$ and $x(0) = x'(0) = 0$. At each of the instants $t = 0, 2\pi, 4\pi, \dots$, the mass is struck a hammer blow with an impulse of $p = 4$. Determine the resulting motion.

3. Consider an initially passive RC circuit (no inductance) with a battery supplying e_0 volts. If the switch to the battery is closed at time $t = a$ and opened at time $t = b > a$ and left open, show that the current in the circuit satisfies the initial value problem

$$Ri' + \frac{1}{C}i = e_0\delta(t - a) - e_0\delta(t - b); i(0) = 0.$$

Then solve this problem for $R = 100 \Omega$, $C = 10^{-4}$ F, $e_0 = 100$ V, $a = 1$ (s), and $b = 2$ (s). Show that $i(t) > 0$ if $1 < t < 2$ and that $i(t) < 0$ if $t > 2$.