1. Suppose you have a spring of mass 1 kg with spring constant $k = 81 \text{ N/m}$. At $t = 0$, the spring is stretched 2 m from its equilibrium position and released.

(a) (2 points) Assuming that there is no damping and no forcing, write the equations that model this physical system.

(b) (5 points) Assume that from $t = 0$ to $t = 5$, a force $F(t) = t$ is applied to the spring, and after that time, there is no force. Write the model for this modified system.

(c) (3 points) Describe how you would solve this system of equations. In particular, how would you handle the change in physics at time $t = 5$?

2. (5 points) Suppose you have the differential equation

$$y'' + 7ty' + y = 0.$$ 

Find the recurrence relations to solve this differential equation.