

Solve these equations. Plot the independent and dependent variables over appropriate time intervals.

$$1. \quad 0.3y - 0.8x = -\frac{dy}{dt} \quad y(0) = -1 \quad x(t) = \begin{cases} 0 & t < 2 \\ -2 & t \geq 2 \end{cases}$$

$$2. \quad \frac{d^2y}{dt^2} = -0.6\frac{dy}{dt} - 1.2y \quad y(0) = 1, \left. \frac{dy}{dt} \right|_0 = -0.2$$

$$3. \quad \begin{aligned} \frac{dy_1}{dt} + y_1 &= 1 & y_1(0) &= 0 \\ \frac{dy_2}{dt} + y_2 &= y_1(t-2) & y_2(0) &= 0 \end{aligned}$$

Please view these as dynamic systems. That is, consider how the response variable is constrained by some initial condition, and how it may relax from that state toward equilibrium. Observe how the disturbance affects the transient response, as well as the equilibrium state.