2.6 Problem 13: Determine a particular solution $\psi(t)$ of $my'' + cy' + ky = F_0 \cos \omega t$ of the form $\psi(t) = A\cos(\omega t - \phi)$. Show that the amplitude A is a maximum when $\omega^2 = \omega_0^2 - \frac{1}{2}(c/m)^2$. This value of ω is called the *resonant frequency* of the system. What happens when $\omega_0^2 < \frac{1}{2}(c/m)^2$?

2.10 Problem 20: Solve the following initial-value problem by the method of Laplace Transforms.

$$y'' + y = t \sin t, \quad y(0) = 1,\ y'(0) = 2$$

2.12 Problem 1: Let a be a fixed constant. Show that every solution of the differential equation $\frac{d^2y}{dt^2} + 2\alpha\frac{dy}{dt} + \alpha^2 y = 0$ can be written in the form

$$y(t) = [c_1 + c_2(t-a)]e^{-\alpha(t-a)}$$

2.13 Problem 17: Use Theorem 9 to find a solution $y(t)$ to the following equation.

$$y'(t) = 2y + \int_0^t y(u)e^{-(t-u)}du, \quad y(0) = 0$$