1. Find the solution to \[ \frac{d^2 y}{dx^2} + 5 \frac{dy}{dx} + 6y = 18x + 3 + 2e^{-2x}, \quad y(0) = -2, \quad y'(0) = 6. \]
2. Find the general solution to $y'' + 4y = \sec^2(2x)$.

3. Given $y_1 = x$ is a solution of $x(x + 1)y'' - xy' + y = 0$, find the general solution of this differential equation.
4. Find the general solution to \( x^2 y'' - 6y = x^3 \).

5. Find the solution to the system of equations:

\[
\begin{align*}
\frac{dx}{dt} & = 3x + y \\
\frac{dy}{dt} & = -x + y,
\end{align*}
\]

where \( x(0) = 2 \), \( y(0) = 0 \).
6. A 2 kg mass stretches a spring \( g/10 \) m. There is damping in this system that is equal to 4 times the instantaneous velocity, and a forcing term of size \( 2 \cos(t) \).

(a) Write down the governing differential equation for the motion of the mass. DO NOT SOLVE THE EQUATION.

(b) The general solution to the above differential equation is

\[
x(t) = c_1 e^{-t} \cos(3t) + c_2 e^{-t} \sin(3t) + \frac{9}{85} \cos(t) + \frac{2}{85} \sin(t)
\]

At \( t = 0 \) seconds, the mass is \( 9/85 \) below equilibrium, with velocity 0. Find \( c_1 \) and \( c_2 \).

(c) Find the position and velocity for the mass at time \( t = \pi \).