**Prob6.1:** Using the Laplace Transform to solve the differential equation:

\[ y' + 2y = e^{-t} + e^{-2t} \]

With boundary conditions: \( y(0) = 1 \).

**Prob6.2:** Using the Laplace Transform to solve the differential equation:

\[ y' - y = e^{-t}u(t-3) \]

With boundary conditions: \( y(0) = 0 \).
**Prob6.3:** Using the Laplace Transform to solve the differential equation:

\[ y'' + 4y = 9t \]

With boundary conditions: \( y(0) = 0, y'(0) = 7 \).

**Prob6.4:** Using the Laplace Transform to solve the differential equation:

\[ y'' - y = 8 \cos t \]

With boundary conditions: \( y(0) = 1, y'(0) = -1 \).
**Prob6.5:** Using the Laplace Transform to solve the differential equation:

\[ y'' - 3y' + 2y = 4t + 12e^{-t} \]

With boundary conditions: \( y(0) = 6, \ y'(0) = -1 \).

**Prob6.6:** Using the Laplace Transform to solve the differential equation:

\[ y'' - 4y' + 5y = 125t^2 \]

With boundary conditions: \( y(0) = 0, \ y'(0) = 0 \).
Prob6.7: Using the Laplace Transform to solve the differential equation:

\[ y'' + 4y = u(t - 2) \]

With boundary conditions: \( y(0) = 0, \ y'(0) = 1 \).

Prob6.8: Using the Laplace Transform to solve the differential equation:

\[
y'' + 4y = \begin{cases} 1 & (0 < t < 1) \\ 0 & (1 < t) \end{cases}
\]

With boundary conditions: \( y(0) = 0, \ y'(0) = 1 \).
**Homework 6: Application Laplace Transform to DE**

**Prob 6.9:** Using the Laplace Transform to find \( x \) and \( y \):

\[
\begin{align*}
    x' &+ y' = t \\
    x'' &- y = e^{-t}
\end{align*}
\]

With boundary conditions: \( x(0) = 0, \ x'(0) = -2, \ y(0) = 0 \).

**Prob 6.10:** Using the Laplace Transform to find \( x \) and \( y \):

\[
\begin{align*}
    x' &- y' - 2x + 2y = 1 \\
    x'' &+ 3x + y = 0
\end{align*}
\]

With boundary conditions: \( x(0) = 0, \ x'(0) = 0, \ y(0) = 0 \).