1. Find the general solution of \( X' = \begin{pmatrix} -2 & 6 \\ 0 & 1 \end{pmatrix} X \) (20%)

2. Find the general solution of \( y'' - 3y' + 2y = xe^{2x} \) (20%)

3. Find the solution of the system by using Laplace Transform:
   \[
   \begin{align*}
   y_1'(t) + y_1(t) + y_2(t) &= 1 \\
   y_2'(t) - y_1(t) - y_2(t) &= 0
   \end{align*}
   \]
   \( y_1(0) = y_1'(0) = y_2(0) = 0 \) (20%)

4. Verify Gauss theorem: given a vector field
   \[ \vec{F} = x\vec{i} + y\vec{j} + z\vec{k} \]
   and region \( M \) bounded by the hemisphere \( x^2 + y^2 + z^2 = 1, z \geq 0 \) (20%)
   Hint: calculate each side of Gauss theorem, respectively, and show that both results are identical.

5. Use Fourier Transform to solve the equation:
   \[ \frac{\partial^2 y}{\partial x^2} = \frac{\partial^2 y}{\partial t^2} \] \( (-\infty < x < \infty, t \geq 0) \) with the given conditions:
   \( y(x, 0) = 4[H(t - 2) - H(t - 10)] \) and \( \frac{\partial y}{\partial t}(x, 0) = 0 \) (20%)