1. (15%)　Solve $e^y + (xe^y - 1)y' = 0;\ y(5) = 0$.

2. (15%)　Solve $y'' - 4y' + 4y = 6e^{2x};\ y(0) = 1,\ y'(0) = -1$.

3. (15%)　Use the Laplace transform to solve

$$y'' + 2y' + 2y = \delta(t - 4);\ y(0) = 0,\ y'(0) = 0.$$

4. (15%)　Evaluate the surface integral $\iint_\Sigma f(x, y, z)\, d\sigma$, where $f(x, y, z) = xyz$ and

Σ is the part of the plane $z = x + y$ with (x, y) lying in the square with

vertices $(0,0)$, $(1,0)$, $(0,1)$ and $(1,1)$.

5. (20%)　Solve the system

$$\begin{Bmatrix} x_1' \\ x_2' \\ x_3' \end{Bmatrix} = \begin{bmatrix} 0 & 0 & \sqrt{2} \\ 0 & -1 & 0 \\ \sqrt{2} & 0 & 1 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \end{Bmatrix}.$$

6. (20%)　Solve the partial differential problem.

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \quad for\ 0 \le x \le 2,\ 0 \le y \le 2,$$

$u(0, y) = 0 \quad for\ 0 \le y \le 2,$

$u(2, y) = 4 \quad for\ 0 \le y \le 2,$

$u(x, 0) = 0 \quad for\ 0 \le x \le 2,$

$u(x, 2) = 0 \quad for\ 0 \le x \le 2.$