1. (a) Find the inverse of the matrix [A] (10%)
   (b) Find the eigenvalues and eigenvectors of the matrix [B] (10%)
   where:

$$[A]=\begin{bmatrix}3 & 1\\ 2 & 4\end{bmatrix} \qquad [B]=\begin{bmatrix}5 & 4\\ 1 & 2\end{bmatrix}$$

2. Find the unit normal vector $\boldsymbol{n}$ of
   (a) plane $4x+2y+4z = -7$ (8%)
   (b) cone of revolution $z^2 = 4(x^2+y^2)$ at the point P:(1,0,2) (Hint: using gradient) (12%)

3. Using least squares curve fitting to fit a straight line to the four data points
   (-1, 1), (-.1, 1.099), (0.2, 0.808), (1, 1)
   , that is, find the values of a and b in the straight line $y=ax+b$ such that q is minimized
   where $q = \sum_{j=1}^{4} (y_j - a - bx_j)^2$(Hint: $\frac{\partial q}{\partial a} = \frac{\partial q}{\partial b} = 0$) (20%)

4. Solve the first-order differential equations
   (a) $(2x-4y+5)\,y' + x - 2y + 3 = 0$ (10%)
   (b) $xy' + y + 4 = 0$ (10%)

5. (a) The random variable
   X = *number of heads in a single toss of a fair coin*
   has the possible values X=0 and X=1 with probabilities P(X=0)=1/2 and P(X=1)=1/2
   Find the mean and variance of X (10%)
   (b) Describe a method that you can **randomly** divide ten samples into two groups. (10%)