1. Find all solutions of the linear system　　　　　　　　　　　　　　(20%)

$$3x_1 + x_2 + 4x_3 + 2x_4 = 2$$
$$2x_1 + x_2 + x_4 + x_5 = 3$$
$$x_1 + x_3 + 2x_5 = 4$$

2. Let $A = \begin{bmatrix} 2 & 1 & -1 \\ 1 & 2 & 1 \\ 3 & 1 & 2 \end{bmatrix}$. Express A as a product of elementary matrices.　　(20%)

3. In the inner-product space $P_{0,1}$ of all polynomial function with real coefficients and domain $0 \leq x \leq 1$, and with inner product defined by

$$\langle f, g \rangle := \int_0^1 x\, f(x)\, g(x)\, dx.$$

   Use the Gram-Schmidt process to find an orthogonal basis for the subspace

   $V = sp(1,\, x,\, x^2).$　　　　　　　　　　　　　　　　　　　　(20%)

4. Find an orthogonal substitution that diagonalizes the quadratic from $2xy + 2yz.$

   (20%)

5. Let v and w be vectors in $\mathbb{R}^n$. Show that $|v \cdot w| \leq \|v\|\, \|w\|.$　　(20%)