Instructions for preparing the solution script:

- Write your name, ID#, and Section number clearly in the very front page.
- Write all answers sequentially.
- Start answering a question (not the part of the question) from the top of a new page.
- Write legibly and in orderly fashion maintaining all mathematical norms and rules. Prepare a single solution file.

A. Answer the following questions:

1. (2 marks) Prove that the set, $S = \{\frac{1}{\sqrt{5}}(2,-1,0)^T, \frac{1}{\sqrt{30}}(1,2,-5)^T, \frac{1}{\sqrt{24}}(2,4,2)^T\}$ is orthonormal.
2. (4 marks) Consider the values of $f(x) = \frac{7}{20}x^3 - \frac{3}{2}x^2 - \frac{17}{20}x + 3$ at the points $x_0 = 0, x_1 = 4, x_2 = -1$. Now, evaluate the best fit straight line using Discrete Square Approximation for the given function.
3. (3+6+1+2+2 marks) Consider the coordinates: $(x, f(x)) = (0,3), (4,-2), (-1,2), (1,1)$.
   In the following, you are asked to find the best fit ploynomial of degree 2 by QR decomposition method showing the following steps:
   (i) find out the linearly independent column matrices, (ii) using Gram-Schmidt process construct the orthonomal column matrices (or vectors) from the the linearly independent column vectors, (iii) write down the matrices Q and R. Finally, find the coeffcients, let $x = (a_0, a_1, a_2)^T$, and write down the polynomial $p_2(x)$.