

Remember that your work is graded on the quality of your writing and explanation as well as the validity of the mathematics.

- (1) (10 Points) The given set is a basis for a subspace W , use the Gram-Schmidt process to produce an orthogonal basis for W .

$$\mathbf{x}_1 = \begin{bmatrix} 1 \\ 1 \\ -1 \\ 0 \end{bmatrix}, \mathbf{x}_2 = \begin{bmatrix} 3 \\ -1 \\ -1 \\ 2 \end{bmatrix}, \mathbf{x}_3 = \begin{bmatrix} 1 \\ 2 \\ 0 \\ -2 \end{bmatrix}$$

Here from the first two vectors $\mathbf{x}_1, \mathbf{x}_2$, we already have

$$\mathbf{v}_1 = \begin{bmatrix} 1 \\ 1 \\ -1 \\ 0 \end{bmatrix}, \mathbf{v}_2 = \begin{bmatrix} 2 \\ -2 \\ 0 \\ 2 \end{bmatrix}$$

Find the third vector of the basis.

- (2) (10 Points) find a least-squares solution of $A\mathbf{x} = \mathbf{b}$.

$$A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \\ 1 & 0 \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 2 \\ 0 \\ 5 \end{bmatrix}$$