Assignment 1
The answers to the problems of this assignment do not require any calculations but can be inferred from the information given (provided you have the relevant knowledge!)

$$\text{Let } A = \begin{bmatrix} 2 & 3 & 5 & -7 & -2 \\ 4 & -5 & 3 & 1 & -3 \\ 3 & 7 & -2 & 4 & 5 \\ 2 & 2 & -7 & 3 & 4 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 9 & 5 & 1 \\ 0 & -3 & 1 & 4 \\ 0 & 0 & 0 & -7 \end{bmatrix}$$

a) Explain why the columns of *A* are not linearly independent
b) Explain why $A\boldsymbol{x} = \boldsymbol{0}$ has a non-trivial solution
c) Explain why $B\boldsymbol{x} = \boldsymbol{b}$ is consistent for every $\boldsymbol{b}$ in $\mathbb{R}^3$
d) Explain whether or not AB^T is well-defined

Assignment 2

$$\text{Let } A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & -4 & -1 \\ -1 & -3 & 2 \end{bmatrix} \text{ and } b = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$$

a) Find the inverse of *A* using elementary row operations on the augmented matrix $[A \quad I]$
b) Use the inverse of A to solve $A\boldsymbol{x} = \boldsymbol{b}$

Assignment 3
Find the value(s) of α for which the determinant of the following matrix is -18 by co-expanding on the second row

$$\begin{bmatrix} 1 & 5 & -a \\ a & -a & a \\ 2 & 13 & -7 \end{bmatrix}$$

Assignment 4
Let

$$u_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \\ 1 \end{bmatrix}, u_2 = \begin{bmatrix} -2 \\ 1 \\ -1 \\ 1 \end{bmatrix}, u_3 = \begin{bmatrix} 1 \\ 1 \\ -2 \\ -1 \end{bmatrix}, u_4 = \begin{bmatrix} -1 \\ 1 \\ 1 \\ -2 \end{bmatrix}, and\ v = \begin{bmatrix} 4 \\ 2 \\ -1 \\ 0 \end{bmatrix},$$

a) Show that $\{u_1, u_2, u_3, u_4\}$ is an orthogonal basis for $\mathbb{R}^4$ using the inner product.
b) Write *v* as the sum of two vectors, one in $span\{u_1, u_2\}$ and the other in $span\{u_3, u_4\}$.

Assignment 5
Measurements of the deflection (mm) of particleboard from stress levels of relative humidity are displayed below.

Stress level (%)	Deflection (mm)
54	16.473
54	18.693
61	14.305
61	15.121
68	13.505
68	11.640
75	11.168
75	12.534
75	11.224

a) Find the best fitted least-squares line to describe the data above
b) Determine the least-squares error of the least squares line found in (a).

Assignment 6

Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 3 & -4 & -1 \\ -1 & -3 & 2 \end{bmatrix}$, $v_1 = \begin{bmatrix} -2 \\ 2 \\ 1 \end{bmatrix}$ and $v_2 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$

a) Show that v_1 and v_2 are eigenvectors of A with associated eigenvalues λ_1 and λ_2, respectively
b) Determine the eigenspaces of λ_1 and λ_2
c) Orthogonally diagonalize A where $A = PDP^{-1}$ and the columns of P are normalized