1. Find the matrix of the following quadratic forms:

   a) $4x_1x_2 + 6x_1x_3 - 8x_1x_3$ b) $5x_1^2 - x_2^2 + 7x_3^2 + 5x_1x_2$

2. Make a change of variable, $x = Py$, that transforms the following quadratic form into a quadratic form with no crss product:

   a) $x_1^2 + 10x_1x_2 + x_2^2$ b) $9x_1^2 + 7x_2^2 + 11x_3^2 + 8x_1x_3 - 8x_1x_2$

3. What is the largest and smallest value of the quadratic form $5x_1^2 - 3x_2^2$ if $x^t x = 1$.

4. Classifying the following quadratic forms:

   a) $9x_1^2 + 7x_2^2 + 11x_3^2 + 8x_1x_3 - 8x_1x_2$ b) $9x_1^2 - 8x_1x_2 + 3x_2^2$

5. Let A be a 2×2 symmetric matrix and $\det(A) < 0$. Show that A quadratic form $x^t Ax$ is indefinite. What can you say if $\det(A) > 0$?

6. Suppose x is a unit eigenvector of A corresponding to eigenvalue 3. What is the value of $x^t Ax$?

7. Find the singular values of the following matrices:

   a) $\begin{bmatrix} 1 & 2 \\ -1 & 1 \\ -1 & 4 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 3 \\ -1 & -3 \\ 0 & 2 \end{bmatrix}$

8. Find the SVD of the following matrices:

   a) $\begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$ b) $\begin{bmatrix} -1 & 6 \\ -3 & -8 \\ 1 & -2 \end{bmatrix}$

9. Let A be $m \times n$ matrix. Using SVD, write the basis for the null space of A^T.

10. Find a SVD for an invertible matrix A in terms of the SVD of A.