

3. Consider the quadratic form

$$q(x_1, x_2, x_3) := x_1^2 + x_3^2 + 2x_1x_2 - 4x_1x_3 + 2x_2x_3, \quad (x_1, x_2, x_3) \in \mathbb{R}^3.$$

- (a) Find the symmetric matrix  $A$  representing  $q$ .
- (b) Find a corresponding orthogonal matrix  $P$  of eigenvectors of  $A$ .
- (c) Write down the maximum and minimum values taken by  $q$  over the unit vectors in  $\mathbb{R}^3$ .

4. Compute the matrix norms of

$$A = \begin{pmatrix} 2 & 2 \\ -1 & 2 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & 0 \\ 3 & -1 \end{pmatrix}.$$