

Practice Problem 1

1: Matrices and Vectors.

(a) Consider the matrix A and the vectors \mathbf{b}_1 , \mathbf{b}_2 , defined as

$$A = \begin{bmatrix} 3 & 2 & -2 \\ 2 & 0 & -2 \\ -1 & 1 & 3 \end{bmatrix}, \quad \mathbf{b}_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}, \quad \mathbf{b}_2 = \begin{bmatrix} 3 \\ -1 \\ 4 \end{bmatrix}$$

Use Matlab to compute $[A*\mathbf{b}_1, A*\mathbf{b}_2]$ and $A*B$, where $B = [\mathbf{b}_1, \mathbf{b}_2]$. Compare the results and explain.

(b) Consider the matrices

$$A = \begin{bmatrix} 1 & 7 \\ 0 & -3 \end{bmatrix}, \quad B = \begin{bmatrix} -3 & 2 \\ 3 & -2 \end{bmatrix}, \quad C = \begin{bmatrix} 3 & 4 & 1 \\ -2 & -1 & -2 \\ 0 & -4 & 3 \end{bmatrix}$$

as well as the vectors

$$\mathbf{v} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}, \quad \mathbf{w} = \begin{bmatrix} 2 \\ -9 \end{bmatrix}, \quad \mathbf{x} = [-4, 3], \quad \mathbf{y} = [0, 6, -3].$$

Try the following combinations:

$$\mathbf{w}' * A, A * A, A * B, A * C, A. * A, A./C, A * \mathbf{x}, \mathbf{v} * A, \mathbf{y} * C$$

Which are defined and which are not? Where a combination is not defined, explain why.

(c) Consider the matrix

$$A = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 8 \\ -1 & -2 & 5 \end{bmatrix}$$

Form a diagonal matrix with the command $D = \text{diag}([2, 3, 4])$. Explain what happens when you multiply A *on the right* and *on the left* by D .

2: **Plotting a family of functions.** Consider the one parameter family of functions

$$y(x) = (2a + 1)e^{-x} - (a + 1)e^{-2x}.$$

Generate a plot showing the graphs of $y(x)$ in the range $-2 \leq x \leq 4$ for all integer values of a between -3 and 3 .