

Mathematics 110 — Assignment 1

Reading: Lecture Notes Chapter 1, Section 2.1, Section 2.2

Question 1.

Let \mathbf{X} , \mathbf{Y} and \mathbf{Z} be the vectors

$$\mathbf{X} = \begin{bmatrix} 2 \\ 3 \\ -5 \\ -9 \end{bmatrix} \quad \mathbf{Y} = \begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \end{bmatrix} \quad \mathbf{Z} = \begin{bmatrix} 3 \\ 0 \\ 1 \\ 0 \end{bmatrix}.$$

- What is the dimension of these vectors?
- Find the components X_1 , Y_3 and Z_5 .
- Calculate $\mathbf{X} + \mathbf{Y}$ and $\mathbf{X} + \mathbf{Y} - \mathbf{Z}$.
- Calculate $3\mathbf{Y} + \mathbf{X}$ and $3\mathbf{Y} - 2\mathbf{Z}$.
- Calculate the inner products $\langle \mathbf{X}, \mathbf{Y} \rangle$ and $\langle \mathbf{X} + \mathbf{Y} - \mathbf{Z}, 3\mathbf{Y} - 2\mathbf{Z} \rangle$.

Question 2.

Let \mathbf{A} , \mathbf{B} , \mathbf{C} and \mathbf{D} be the matrices

$$\mathbf{A} = \begin{bmatrix} 1 & 0 & 2 \\ -1 & 0 & 4 \\ 0 & -1 & 0 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} -1 & 2 & 0 \\ 0 & 2 & -1 \\ 1 & 0 & 1 \end{bmatrix}$$
$$\mathbf{C} = \begin{bmatrix} 1 & 1 & 0 & -1 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -1 \end{bmatrix} \quad \mathbf{D} = \begin{bmatrix} 1 \\ 0 \\ 2 \\ 0 \end{bmatrix}.$$

- Write down the size of each of these matrices.
- Find the components A_{13} , A_{31} and whichever of C_{24} and C_{42} is defined.
- Calculate $3\mathbf{A} - 2\mathbf{B}$.
- Calculate \mathbf{AB} and \mathbf{BA} .
- Calculate \mathbf{BC} or \mathbf{CB} , whichever is defined.

Question 3.

A computer sales firm markets 3 models of computer; Basic, Extra and Super. The firm has two shops, the sales at each shop in 2004 being

	Basic	Extra	Super
Shop 1	216	355	262
Shop 2	453	648	503

In 2005 the corresponding sales figures are

	Basic	Extra	Super
Shop 1	145	338	302
Shop 2	333	624	646

Let \mathbf{A} be the matrix representing the sales data for 2004 and \mathbf{B} be the matrix representing the sales data for 2005.

(a) Write down a matrix expression for the total sales over the two years 2004 and 2005.

(b) Write down and evaluate a matrix expression for the average sales over the two years.

The profit margins on the three models are: basic \$ 180, extra \$ 220 and super \$ 230. Let \mathbf{P} be the vector representing this data.

(c) Write down and evaluate a matrix expression for the profit made at each shop in 2004.