MATRICES

A matrix stores mathematical information in a concise way. The information in written down in a rectangular array of rows and columns of terms, called **elements** or **entries**, each of which has its own precise position in the array.

Notation: We normally represent matrices by capital letters. For example A, B, M, etc.

The order of a matrix is its shape.

- ⇨ When stating the order of a matrix, we must always give first the number of rows, followed by the number of columns.
- ⇨ $\begin{pmatrix} 4 \\ 8 \\ 7 \end{pmatrix}$ is a **column** matrix and has order 3 x 1, since its elements are arranged in three rows and only one column.
- ⇨ the matrix $(4 \ \ 8 \ \ 7)$ has order 1 x 3 and is a **row** matrix.
- ⇨ when the number of rows and the number of the columns are equal, the matrix is called a square matrix, i.e. it has order n x n.

Addition and Subtraction of Matrices

We can add or subtract two matrices only when they are of the *same order*. We add or subtract an element from matrix A with that element from matrix B, which is on the same position.

Multiplication of matrices

- ⇨ To multiply a matrix by any real number **k** we multiply every element of the matrix by **k**.
- ⇨ To multiply a matrix by another one we have to take into account the following rule: The number of columns in the first matrix must be the same as the number of rows in the second matrix.

To multiply **A** by **B**, we start by taking the first row of matrix **A** $(2 \ 3 \ 1)$ and the first column of matrix **B** $\begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$.

We then multiply the first element of the row by the 1^{st} element of the column, the 2^{nd} element of the row by the 2^{nd} element of the column, and the 3^{rd} element of the row by the last element of the column. We then add up these three products. This gives the element in the top left-hand corner of the matrix **AB**, which is 2.1 + 3.1 + 1.0 = 5

Next we take the first row of matrix A and the second column of matrix B, which gives us the 2nd element of the first row of matrix **AB**.

Generally, the product **AB** produces a matrix which has the same number of rows as **A**, and the same numbers of columns as **B**. Hence, if **A** has order *a x t* and **B** has order *t x b*, then **AB** has order *a x b*.

- ⇨ Multiplication of two matrices is **not commutative**. That is, **AB** $\neq$ **BA.** Therefore we must ensure that we write matrices in the correct sequence.
- ⇨ Multiplication of any three matrices **A, B** and **C** is associative, i.e. **A(BC) = (AB)C**