

MATH 311

Topics in Applied Mathematics

**Lecture 4:**

**Matrix multiplication.**

**Diagonal matrices.**

**Inverse matrix.**

# Matrices

*Definition.* An **m-by-n matrix** is a rectangular array of numbers that has  $m$  rows and  $n$  columns:

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

*Notation:*  $A = (a_{ij})_{1 \leq i \leq n, 1 \leq j \leq m}$  or simply  $A = (a_{ij})$  if the dimensions are known.

## Matrix algebra: linear operations

**Addition:** two matrices of the same dimensions can be added by adding their corresponding entries.

**Scalar multiplication:** to multiply a matrix  $A$  by a scalar  $r$ , one multiplies each entry of  $A$  by  $r$ .

**Zero matrix  $O$ :** all entries are zeros.

**Negative:**  $-A$  is defined as  $(-1)A$ .

**Subtraction:**  $A - B$  is defined as  $A + (-B)$ .

As far as the linear operations are concerned, the  $m \times n$  matrices can be regarded as  $mn$ -dimensional vectors.