

## Matrices

An  $m \times n$  matrix  $A$  is a rectangular array of  $mn$  numbers arranged in  $m$  rows and  $n$  columns.

$A =$

$a_{ij}$  th components of  $A$  (denoted  $a_{ij}$ ) is the number appearing in the  $i$  th row and  $j$  th column of  $A$ .

**Example**  $A =$  ,  $B =$  ,  $C =$

An  $m \times n$  matrix with all components equal zero is called the  $m \times n$  zero matrix

**Example**  $A =$

If  $A$  is  $m \times n$  matrix with  $m = n$  then  $A$  is called square matrix.

$A =$

$a_{11}, a_{22}, \dots, a_{nn}$ , form the main diagonal of  $A$ .

**Example**  $A =$  ,  $B =$

A square matrix is called diagonal matrix if all terms off the main diagonal are zero.

**Example**  $A =$  ,  $B =$

A square matrix is called scalar matrix if all terms on the main diagonal are equal.

**Example**  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

A square matrix is called identity matrix if every terms in the main diagonal equal one.

**Example**  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

A square matrix is called upper triangular if  $a_{ij} = 0 \text{ } i > j$ .

A square matrix is called lower triangular if  $a_{ij} = 0 \text{ } i < j$ .

**Example**  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  lower,  $B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  upper

### Equality of matrices

Let  $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}, B = \begin{pmatrix} x & y \\ z & w \end{pmatrix}$  be  $m \times n$  matrices . A is equal to B( denoted by  $A = B$ ) if  $a = x, b = y, c = z, d = w$  ,  $1 \leq i \leq m, 1 \leq j \leq n$

**Example**  $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

$A = B$  iff  $x=2, y = 5, z = 0, w = 2$

### Operation on matrices

#### 1) Addition matrices

Let  $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}, B = \begin{pmatrix} x & y \\ z & w \end{pmatrix}$  be  $m \times n$  matrices. The sum of A and B(denoted by  $A + B$ ) defined to the

matrix  $C = \begin{pmatrix} a+x & b+y \\ c+z & d+w \end{pmatrix}$ , where  $a, b, c, d, x, y, z, w$  are real numbers. Example  $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}, A+B = \begin{pmatrix} 3 & 5 \\ 7 & 9 \end{pmatrix}$