

### Associative law for matrix multiplication

Let  $A =$  be  $m \times n$  matrix,  $B =$  be  $n \times p$  matrix and  $C =$  be  $p \times q$  matrix, then  $A(BC) = (AB)C$

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

$$AB = , (AB)C =$$

$$BC = , A(BC) =$$

### Distribution law for matrix multiplication

Let  $A =$  be  $m \times n$  matrix,  $B =$  be  $n \times p$  matrix and  $C =$  be  $n \times q$  matrix, then  $A(B+C) =$

$$AB+AC$$

Let  $A =$  be  $m \times n$  matrix,  $B =$  be  $m \times n$  matrix and  $C =$  be  $n \times q$  matrix, then  $(A+B)C =$

$$AC+BC$$

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

$$B+C = , A(B+C) =$$

$$AB = , AC = , AB+AC =$$

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

$$A+B = , (A+B)C =$$

$$AC = , BC =$$

$$AB+AC =$$

If  $AB = 0$  then  $A=0, B=0$

**Example** Let  $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}, AB = \begin{pmatrix} 8 & 10 \\ 25 & 28 \end{pmatrix}$ . But  $A \neq 0, B \neq 0$

If  $AB = AC, A \neq 0$ , then  $B=C$

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

$$AB = AC = \begin{pmatrix} 8 & 10 \\ 25 & 28 \end{pmatrix}. \text{ But } B \neq C$$

### The transpose of matrix

Let  $A = (a_{ij})$  be  $m \times n$  matrix the transpose of  $A$  ( denoted by  $A^T$  )

$$A^T = (a_{ji}), \quad 1 \leq i \leq m, \quad 1 \leq j \leq n$$

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

$$= \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix} \quad B = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$$

$$C = \begin{pmatrix} 3 & 2 \\ 4 & 3 \end{pmatrix}, C^T = \begin{pmatrix} 3 & 4 \\ 2 & 3 \end{pmatrix}$$

### Properties of transpose

$$1) (A^T)^T = A$$

2) = +

3) =

4) =