

## §3. MA TRẬN NGHỊCH ĐẢO

Trong bài này, bạn sẽ học

- Khái niệm ma trận khả nghịch và ma trận đảo của một ma trận vuông;
- Các tính chất ma trận khả nghịch;
- Điều kiện cần và đủ để một ma trận vuông khả nghịch;
- Hai cách cơ bản tìm ma trận đảo của một ma trận khả nghịch;
- Ứng dụng ma trận đảo để giải phương trình ma trận và hệ phương trình tuyến tính.

### 3.1. Định nghĩa

Ma trận vuông  $A = [a_{ij}]_{n \times n}$  gọi là *khả nghịch* nếu có ma trận  $B = [b_{ij}]_{n \times n}$  sao cho

$$AB = I_n = BA.$$

Khi đó  $B$  gọi là *ma trận nghịch đảo* hay *ma trận đảo* của  $A$ , ký hiệu là  $A^{-1}$ .

Vậy  $A$  khả nghịch khi và chỉ khi tồn tại  $A^{-1}$  và  $AA^{-1} = I_n = A^{-1}A$ .

**Ví dụ 1** Với  $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ ,  $B = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix}$ . Ta có

$$AB = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = BA.$$

Vậy  $A$  khả nghịch và  $A^{-1} = \begin{pmatrix} -3 & 2 \\ 2 & -1 \end{pmatrix} = B$ ;  $B$  khả nghịch và  $B^{-1} = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = A$ .

**Lưu ý** Với  $A = [a_{ij}]_{n \times n}$ ,  $B = [b_{ij}]_{n \times n}$ :  $AB = I_n$  khi và chỉ khi  $BA = I_n$ .

### 3.2. Tính chất

- Ma trận đảo của ma trận  $A$  (nếu có) thì duy nhất và  $(A^{-1})^{-1} = A$
- Nếu  $A$  khả nghịch thì  $A^T$  cũng khả nghịch và  $(A^T)^{-1} = (A^{-1})^T$
- Nếu  $A = [a_{ij}]_{n \times n}$ ,  $B = [b_{ij}]_{n \times n}$ ,  $C = [c_{ij}]_{n \times n}$  khả nghịch thì tích  $AB$ ,  $ABC$  cũng khả nghịch và  $(AB)^{-1} = B^{-1}A^{-1}$ ;  $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

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**Terry C. Jones**

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