Name: Ranjita
ID: COMETFWC055
Date: 29/01/2026

- Determinant of a matrix $A = [a_{11}]_{1\times 1}$ is given by

$$|A| = a_{11}$$

- Determinant of a matrix

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

is given by

$$|A| = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} = a_{11}a_{22} - a_{12}a_{21}$$

- Determinant of a 3×3 matrix is obtained by expanding along a row or a column.

- For any square matrix A, determinant satisfies the following properties:
  - $|A^T| = |A|$
  - Interchanging any two rows or columns changes the sign of determinant
  - If any two rows or columns are identical or proportional, then $|A| = 0$
  - If each element of a row or column is multiplied by k, then determinant is multiplied by k

- Area of a triangle with vertices (x_1, y_1), (x_2, y_2) and (x_3, y_3) is given by

$$\Delta = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

- Minor of an element a_{ij} is obtained by deleting the i^{th} row and j^{th} column.

- Cofactor of a_{ij} is defined as

$$A_{ij} = (-1)^{i+j} M_{ij}$$

- Adjoint of a square matrix is the transpose of the matrix of cofactors.
- A square matrix is singular if $|A| = 0$ and non-singular if $|A| \neq 0$.
- Inverse of a non-singular matrix A is given by

$$A^{-1} = \frac{1}{|A|}(\text{adj } A)$$

- For matrix equation $AX = B$:
  - If $|A| \neq 0$, unique solution exists
  - If $|A| = 0$ and $(\text{adj } A)B \neq 0$, no solution exists
  - If $|A| = 0$ and $(\text{adj } A)B = 0$, solution may or may not exist