

Property - 6

6. The value of a determinant is not changed by adding to the elements of any row (or column) the same multiples of the corresponding elements of any other row (or column).

5. Special Determinants

$$1. \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (x - y)(y - z)(z - x)$$

$$2. \begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} = (x - y)(y - z)(z - x)(x + y + z)$$

$$3. \begin{vmatrix} 1 & x^2 & x^3 \\ 1 & y^2 & y^3 \\ 1 & z^2 & z^3 \end{vmatrix} = (x - y)(y - z)(z - x)(xy + yz + zx)$$

$$4. \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 3abc - a^3 - b^3 - c^3$$

$$= -(a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$= -\frac{1}{2}(a + b + c) \cdot \{(a - b)^2 + (b - c)^2 + (c - a)^2\}$$

6. Factor Theorem

If by putting $x = a$ the value of a determinant vanishes then, $(x - a)$ will be a factor the determinant.

This is known as FACTOR THEOREM.

7. Multiplication of Determinants

Introduction

$$D_1 = \begin{vmatrix} a & b \\ c & d \end{vmatrix} \quad D_2 = \begin{vmatrix} p & q \\ r & s \end{vmatrix}$$

$$D = D_1 \times D_2$$

$$D = \begin{vmatrix} \boxed{ap + br} & \boxed{aq + bs} \\ \boxed{cp + dr} & \boxed{cq + ds} \end{vmatrix}$$

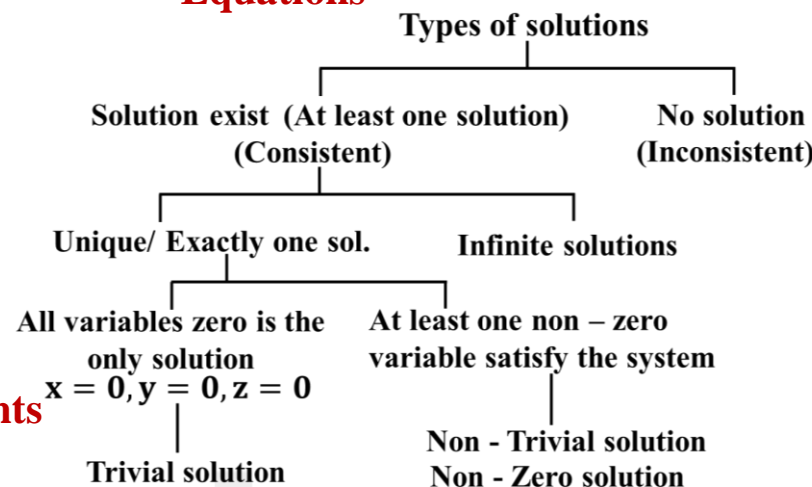
(Row by column multiplication)

Note

Multiplication can also be done

- 1) Row by Row
- 2) Column by Row
- 3) Column by Column

8. Cramer's Rule System of Linear Equations



9. Non-Homogeneous System

$$a_1x + b_1y + c_1z = d_1 \dots (i)$$

$$a_2x + b_2y + c_2z = d_2 \dots (ii)$$

$$a_3x + b_3y + c_3z = d_3 \dots (iii)$$

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} \quad D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}$$

$$D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix} \quad D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$

$$\text{Then, } x = \frac{D_x}{D} \quad y = \frac{D_y}{D} \quad z = \frac{D_z}{D}$$

This is known as the CRAMER'S RULE



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