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MATHEMATICS

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**XIth, XIIth, TARGET IIT-JEE
(MAIN + ADVANCE) & COMPETITIVE EXAM.
FOR XII (PQRS)**

**SOLUTIONS OF SMULTANEOUS LINEAR EQUATIONS
& Their Properties**

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THINGS TO REMEMBER

1. A set of values of the variable x_1, x_2, \dots, x_n satisfying all the equations simultaneously is called a solution of the system.
2. If a system of equations has one or more solutions, then it is said to be a consistent system of equations, otherwise it is an inconsistent system of equations.
3. A system of equations $AX = B$ is called a homogeneous system, if $B = O$. Otherwise, it is called a non-homogeneous system of equations.
4. A system $AX = B$ of n linear equations in n equations has a unique solution given by $X = A^{-1}B$, if $|A| \neq 0$.
If $|A| = 0$ and $(\text{adj } A)B = 0$, then the system is consistent and has infinitely many solutions.
If $|A| = 0$ and $(\text{adj } A)B \neq 0$, then the system is inconsistent.
5. A homogeneous system of n linear equation in n unknowns is expressible in the form $AX = O$.
If $|A| \neq 0$, then $AX = O$ has unique solution $X = 0$ i.e. $x_1 = x_2 = \dots = x_n = 0$. This solution is called the trivial solution.
If $|A| = 0$, then $AX = O$ has infinitely many solutions.

EXERCISE-1

1. If A is a non-singular matrix, then the system of equations given by $AX = B$ has the unique solution given by $X = A^{-1}B$.
2. Use matrix method to solve the following system of equations :
$$5x - 7y = 2$$
$$7x - 5y = 3$$
3. Solve the following system of equations, using matrix method :
$$x + 2y + z = 7, x + 3z = 11, 2x - 3y = 1$$
4. Show that the following system of equations is consistent.
$$2x - y + 3z = 5, 3x + 2y - z = 7, 4x + 5y - 5z = 9$$
5. Solve the following system of equations by matrix method :
 - (i) $x + y + z = 3$
 $2x - y + z = -1$
 $2x + y - 3z = -9$
 - (ii) $\frac{2}{x} - \frac{3}{y} + \frac{3}{z} = 10$
 $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 10$
 $\frac{3}{x} - \frac{1}{y} + \frac{2}{z} = 13$
 - (iii) $3x + 4y + 2z = 8$
 $2y - 3z = 3$
 $x - 2y + 6z = -2$

(iv) $8x + 4y + 3z = 18$
 $2x + y + z = 5$
 $x + 2y + z = 5$

(v) $x + y + z = 6$
 $x + 2z = 7$
 $3x + y + z = 12$

6. Show that each one of the following of linear equations is inconsistent :

$2x + 5y = 7$
 $6x + 15y = 13$

7. If $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ are two square matrices, find AB and hence solve the

system of linear equations :

$x - y = 3, 2x + 3y + 4z = 17, y + 2z = 7$

8. If $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & 1 & 3 \\ 0 & -2 & 1 \end{bmatrix}$, find A^{-1} . Using A^{-1} , solve the system of linear equations :

$x - 2y = 10, 2x + y + 3z = 8, -2y + z = 7$

9. Solve the following systems of homogeneous linear equations by matrix method :

(i) $x + y + z = 0$
 $x - y - 5z = 0$
 $x + 2y + 4z = 0$

(ii) $2x + 3y - z = 0$
 $x - y - 2z = 0$
 $3x + y + 3z = 0$

EXERCISE-2

1. The number of solutions of the system of equations :

$2x + y - z = 7$
 $x - 3y + 2z = 1$
 $x + 4y - 3z = 5$

- (a) 3 (b) 2 (c) 1 (d) 0

2. Consider the system of equations :

$a_1x + b_1y + c_1z = 0$
 $a_2x + b_2y + c_2z = 0$
 $a_3x + b_3y + c_3z = 0$

If $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$, then the system has

- (a) more than two solutions
(c) no solution

- (b) one trivial and one non-trivial solutions
(d) only trivial solution (0, 0, 0)

3. The system of equations :

$$x + y + z = 5$$

$$x + 2y + 3z = 9$$

$$x + 3y + \lambda z = \mu$$

has a unique solution, if

(a) $\lambda = 5, \mu = 13$

(b) $\lambda \neq 5$

(c) $\lambda = 5, \mu \neq 13$

(d) $\mu \neq 13$