Unit 5 · Matrix Based System of Linear Equations

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

argument	**augmented**	**coefficient**	**consistent**	**Cramer's**	**elementary**	**inconsistent**
inverse	**linear**	**telescoping**				

An equation in which each unknown appears only to the first power is _____. In $AX = B$, A is the _____ matrix, and A with B written as an extra column is the _____ matrix. A system with at least one solution is _____; a system with none is _____. Solving with $x = \frac{D_x}{D}$ is _____ rule. When $|A| \neq 0$, the solution is $X = A^{-1}B$, using the _____ of A. Swapping two rows, multiplying a row by a non-zero number and adding a multiple of one row to another are the _____ row operations.

2 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Correct the false ones.

i. Two linear equations in two unknowns can never have exactly two solutions. ☐

ii. If $|A| = 0$, the system $AX = B$ has no solution. ☐

iii. Swapping two rows of an augmented matrix doesn't change the solutions. ☐

iv. If $AX = B$ and $|A| \neq 0$, then $X = BA^{-1}$. ☐

v. In Cramer's rule, D_x is D with its first **row** replaced by the constants. ☐

vi. If row operations give a row $(0\ 0\ 0 \mid 5)$, the system has no solution. ☐

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. In the matrix form $AX = B$ of a system of linear equations, B is the matrix of: [1]

a. coefficients **b.** unknowns
c. constants **d.** cofactors

ii. The system $x + 2y = 4$, $3x + 6y = 12$ has: [1]

a. exactly one solution **b.** no solution
c. infinitely many solutions **d.** exactly two solutions

iii. For $2x + 3y = 8, x - y = -1$, Cramer's rule gives y equal to: **[1]**

a. 2 **b.** -2

c. $\frac{1}{2}$ **d.** 10

iv. For which k does the system $kx + 3y = 5, 4x + 6y = 9$ have no solution? **[1]**

a. 2 **b.** -2

c. 3 **d.** for no value of k

v. A system of three equations in three unknowns has $D = D_x = D_y = D_z = 0$. Then the system: **[1]**

a. has infinitely many solutions **b.** has no solution

c. may have no solution or infinitely many **d.** has exactly one solution

4 Short answers **[9]**

Write short answers to the following questions.

a. Explain why multiplying a row of an augmented matrix by 5 is an elementary row operation, but multiplying it by 0 is not. **[2]**

b. For $x + y = 2, 2x + 2y = 4$, Suman found $D = 0$ and wrote "no solution". Is he right? Explain. **[2]**

c. Solve $3x + 2y = 12, 5x - 3y = 1$ by Cramer's rule. **[2]**

d. Find the inverse of $A = \begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$, and use it to solve $2x + y = 7, 5x + 3y = 18$. **[3]**

5 Long answers [13]

Write long answers to the following questions. Show your working.

a. Solve by the row-equivalent method: $x + y + z = 6$, $2x + y - z = 1$, $x - y + 2z = 5$. **[5]**

b. Pasang buys rice, lentils and sugar at fixed prices per kilogram. 2 kg of rice, 1 kg of lentils and 1 kg of sugar cost Rs 470; 1 kg of rice, 2 kg of lentils and 1 kg of sugar cost Rs 520; and 3 kg of rice, 1 kg of lentils and 2 kg of sugar cost Rs 690. (The prices are made up.) **[8]**

i. Write the three equations as a matrix equation $AX = B$.
ii. Find $|A|$.
iii. Find A^{-1} by the adjoint.
iv. Hence find the price of each.

Answer:

6 Think [3]

For which values of k does the system $x + y + z = 1, x + 2y + 3z = 2, x + 3y + kz = 3$ have exactly one solution? Show that it never has no solution.

7 Activity: Lines and determinants (not marked)

Draw each pair of lines on squared paper, and work out D, D_x and D_y for it.

System	D	D_x	D_y	What the lines do	Solutions
$x + y = 4, x - y = 2$					
$x + y = 4, 2x + 2y = 6$					
$x + y = 4, 2x + 2y = 8$					

What must D be for the lines to meet at exactly one point?