

Using Matrices to Solve Systems of Equations Video Lecture

Section Appendix E

Course Learning Objective:

Solve systems of linear equations using matrices.

Weekly Learning Objectives:

- 1) Use matrices to solve a system of two equations.**
- 2) Use matrices to solve a system of three equations.**

Using Matrices to Solve Systems of Equations

A matrix is a rectangular array of numbers. We use matrices to help solve systems of equations.

Use a matrix to write the linear system: $x + 2y = 7$
 $x - y = -2$

Our goal for solving a system of equations having 2 equations with two variables is to get the matrix into the following reduced row echelon form:

$$\left(\begin{array}{cc|c} 1 & \# & \# \\ 0 & 1 & \# \end{array} \right)$$

Our goal for solving a system of equations having 3 equations with three variables is to get the matrix into the following reduced row echelon form:

$$\left(\begin{array}{ccc|c} 1 & \# & \# & \# \\ 0 & 1 & \# & \# \\ 0 & 0 & 1 & \# \end{array} \right)$$

In general, we want the matrix to be reduced to:

$$\left(\begin{array}{ccc|c} 1 & & & \\ & 1 & & \\ & & \ddots & \\ 0 & & & \# \end{array} \right)$$

Matrix Row Operations:

1) Any two rows of the matrix may be interchanged.

$$\begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix} \rightarrow \begin{bmatrix} 2 & 2 \\ 1 & 1 \end{bmatrix}$$

2) The numbers in any row may be multiplied by any non zero real number.

$$-3 \cdot \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix} \rightarrow \begin{bmatrix} -3 & -3 \\ 2 & 2 \end{bmatrix}$$

3) Any two rows may be added or subtracted.

$$r_1 + r_2 \quad \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 1 \\ 3 & 3 \end{bmatrix} \text{ or } \begin{bmatrix} 3 & 3 \\ 2 & 2 \end{bmatrix}$$

4) Any row may be changed by adding to the numbers of the row, the product of a real number and the corresponding numbers of another row.

$$-2 \cdot r_1 + r_2 \quad \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$$

Use matrices to solve the system: $x + 2y = 7$

$$x - y = -2$$

Solve: $4x + 5y = -7$
 $x - y = 5$

Solve: $5x + 2y = 8$
 $3x - y = 7$

$$\begin{aligned}2x - 4y &= 7 \\ -3x + 6y &= 5\end{aligned}$$

$$\begin{aligned}9x - 3y &= 6 \\ -18x + 6y &= -12\end{aligned}$$

$$2x + 4y - 3z = -18$$

$$3x + y - z = -5$$

$$x - 2y + 4z = 14$$

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

$$x + y - 2z = -8$$

$$-x - 2y + 3z = 13$$

$$2x + 3y + 2z = 100$$

$$2x + y + 3z = 100$$

$$x + y + 2z = 65$$

$$3x + y + 2z = 31$$

$$x + y + 2z = 19$$

$$x + 3y + 2z = 25$$

$$3x - 2y + 2z = 18$$

$$-x + 3y + 4z = -6$$

$$5x - 5y + 6z = 45$$

$$3x-6y+3z=-9$$

$$2x+y+3z=1$$

$$-3x+y-2z=-4$$