

Section 8.3 Multivariable Linear Systems

Objective: In this lesson you learned how to solve a system of equations by Gaussian elimination, how to recognize linear systems in row-echelon form and to use back substitution to solve the system, how to solve nonsquare systems of equations, and how to use a system of equations to model and solve real-life problems.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Row-echelon form

Ordered triple

Gaussian elimination

Nonsquare system of equations

Three-dimensional coordinate system

Graph of an equation in three variables

Partial fraction

Partial fraction decomposition

Basic equation

I. Row-Echelon Form and Back-Substitution (Page 587)

When elimination is used to solve a system of linear equations, the goal is . . .

What you should learn

How to recognize linear systems in row-echelon form and use back-substitution to solve the systems

Example 1: Solve the system of linear equations.

$$\begin{cases} x + y - z = 9 \\ y - 2z = 4 \\ z = 1 \end{cases}$$

II. Gaussian Elimination (Pages 588–590)

To solve a system that is not in row-echelon form, . . .

What you should learn
How to use Gaussian elimination to solve systems of linear equations

List the three elementary row operations that can be used on a system of linear equations to produce an equivalent system of linear equations.

- 1.
- 2.
- 3.

The solution(s) of a system of linear equations in more than two variables must fall into one of the following three categories:

- 1.
- 2.
- 3.

Example 2: Solve the system of linear equations.

$$\begin{cases} x + y + z = 3 \\ 2x - y + 3z = 16 \\ x - 2y - z = 1 \end{cases}$$

A consistent system having exactly one solution is _____.
A consistent system with infinitely many solutions is _____.

Example 3: The following equivalent system is obtained during the course of Gaussian elimination. Write the solution of the system.

$$\begin{cases} x + 2y - z = 4 \\ y + 2z = 8 \\ 0 = 0 \end{cases}$$

III. Nonsquare Systems (Page 591)

In a square system of linear equations, the number of equations in the system is _____ the number of variables.

If a system has more variables than equations, the system cannot have a(n) _____.

Example 4: Solve the system of linear equations.

$$\begin{cases} x + y + z = 1 \\ x - 2y - 2z = 4 \end{cases}$$

What you should learn
How to solve nonsquare systems of linear equations

IV. Graphical Interpretation of Three-Variable Systems (Page 592)

To sketch the graph of a plane, . . .

What you should learn
How to graphically interpret three-variable systems

The graph of a system of three linear equations in three variables consists of _____ planes. When these planes intersect in a single point, the system has _____ solution(s). When the planes have no point in common, the system has _____ solution(s). When the planes intersect in a line or a plane, the system has _____ solution(s).

V. Partial Fraction Decomposition and Other Applications

Suppose the rational expression $N(x)/D(x)$ is an improper fraction. Before the expression can be decomposed into partial fractions, you must . . .

What you should learn
How to use systems of linear equations to write partial fraction decompositions of rational expressions and to use systems of linear equations in three or more variables to model and solve real-life problems

To decompose a proper rational expression into partial fractions, completely factor the denominator into factors of the form _____ and _____, where _____ is irreducible.

Describe how to deal with both linear factors and quadratic factors in the next step of a partial fraction decomposition.

To find the **basic equation** of a partial fraction decomposition, . . .

To solve the basic equation, . . .

Example 5: Write the form of the partial fraction decomposition for $\frac{x-4}{x^2-8x+12}$.

Example 6: Solve the basic equation $5x+3 = A(x-1) + B(x+3)$ for A and B .

Homework Assignment

Page(s)

Exercises