Course Number
Instructor
Date

Section 8.5 Applications of Matrices and Determinants

Objective: In this lesson you learned how to use Cramer's Rule to solve systems of linear equations and how to use determinants and matrices to model and solve problems.

I. Cramer's Rule (Pages 619–621)

> ***What you should learn***
> How to use Cramer's Rule to solve systems of linear equations

Cramer's Rule states that if a system of n linear equations in n variables has a coefficient matrix A with a nonzero determinant $|A|$, the solution of the system is

$$x_1 = \frac{|A_1|}{|A|}, \quad x_2 = \frac{|A_2|}{|A|}, \ldots, x_n = \frac{|A_n|}{|A|}$$

where the ith column of A_i is ______________________________

____.

Cramer's Rule does not apply if the determinant of the coefficient matrix is ________________, in which case the system has either no solution or ___________________________________.

Example 1: Use Cramer's Rule to solve the system of linear equations.

$$\begin{cases} 2x + y + z = 6 \\ -x - y + 3z = 1 \\ \quad y - 2z = -3 \end{cases}$$

II. Area of a Triangle (Page 622)

> ***What you should learn***
> How to use determinants to find the areas of triangles

The area of a triangle with vertices (x_1, y_1), (x_2, y_2), and (x_3, y_3) is

$$\text{Area} = \pm\frac{1}{2}\left| \quad \right|$$

where the symbol ± indicates that the appropriate sign should be chosen to yield a positive area.

Example 2: Find the area of a triangle whose vertices are (− 3, 1), (2, 4), and (5, − 3).

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III. Lines in a Plane (Pages 623–624)

> ***What you should learn***
> How to use a determinant to test for collinear points and find an equation of a line passing through two points

Three points (x_1, y_1), (x_2, y_2), and (x_3, y_3) are collinear (lie on the same line) if and only if

$$\left| \quad \quad \quad \right| = 0.$$

Example 3: Determine whether the points $(-2, 4)$, $(0, 3)$, and $(8, -1)$ are collinear.

An equation of the line passing through the distinct points (x_1, y_1) and (x_2, y_2) is given by

$$\left| \quad \quad \quad \right| = 0.$$

Example 4: Find an equation of the line passing through the points $(-2, 9)$ and $(3, -1)$.

IV. Cryptography (Pages 625–627)

> ***What you should learn***
> How to use matrices to encode and decode messages

A cryptogram is . . .

To use matrix multiplication to encode and decode messages, . . .

Homework Assignment

Page(s)

Exercises

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