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| 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 666–668)

> ***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 *i*th 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.

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

### II. Area of a Triangle (Page 669)

> ***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

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

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).

## III. Lines in a Plane (Pages 670–671)

**What you should learn**
How to use a determinant to 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

$$\begin{vmatrix} & & \\ & & \\ & & \end{vmatrix} = 0.$$

**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

$$\begin{vmatrix} & & \\ & & \\ & & \end{vmatrix} = 0.$$

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

## IV. Cryptography (Pages 672–674)

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

A cryptogram is . . .

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

**Homework Assignment**

Page(s)

Exercises