

## Section 8.4 The Determinant of a Square Matrix

**Objective:** In this lesson you learned how to find determinants of square matrices.

Course Number

Instructor

Date

### Important Vocabulary

Define each term or concept.

**Determinant****Minors****Cofactors**

### I. The Determinant of a Matrix (Pages 591–592)

The **determinant** of the  $2 \times 2$  matrix  $A = \begin{bmatrix} a_1 & b_1 \\ a_2 & b_2 \end{bmatrix}$  is given by

$$\det(A) = |A| = \begin{vmatrix} & \\ & \end{vmatrix} = \underline{\hspace{2cm}}$$

#### *What you should learn*

How to find the determinants of  $2 \times 2$  matrices

The determinant of a matrix of order  $1 \times 1$  is defined as . . .

**Example 1:** Find the determinant of the matrix  $A = \begin{bmatrix} -4 & 3 \\ 1 & -2 \end{bmatrix}$ .

### II. Minors and Cofactors (Page 593)

Complete the sign patterns for cofactors of a  $3 \times 3$  matrix, a  $4 \times 4$  matrix, and a  $5 \times 5$  matrix:

#### *What you should learn*

How to find minors and cofactors of square matrices

#### Sign Pattern for Cofactors

3 × 3 matrix

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}$$

4 × 4 matrix

$$\begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

5 × 5 matrix

$$\begin{bmatrix} & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \end{bmatrix}$$

**Example 2:** Use the matrix  $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & 0 \\ 0 & 2 & 3 \end{bmatrix}$  to find:

- (a) the minor  $M_{13}$ , and (b) the cofactor  $C_{21}$ .

### III. The Determinant of a Square Matrix (Page 594)

Applying the definition of the determinant of a square matrix to find a determinant is called \_\_\_\_\_.

*What you should learn*  
How to find the  
determinants of square  
matrices

**Example 3:** Find the determinant of the matrix:

$$A = \begin{bmatrix} -1 & 0 & 4 \\ 3 & -2 & 0 \\ 1 & -1 & 1 \end{bmatrix}$$

**Example 4:** Describe a strategy for finding the determinant of the following matrix, and then find the determinant of the matrix.

$$B = \begin{bmatrix} -2 & 4 & 0 & 5 \\ 0 & 2 & -1 & 0 \\ 3 & 1 & -4 & -1 \\ -5 & 0 & -2 & 3 \end{bmatrix}$$

**IV. The Determinant of a Square Matrix** (Page 595)

A **triangular matrix** is . . .

A square matrix is \_\_\_\_\_ if it has all zero entries below its main diagonal and is \_\_\_\_\_ if it has all zero entries above its main diagonal.

A **diagonal matrix** is . . .

To find the determinant of a triangular matrix, . . .

**Example 5:** Find the determinant of the following matrix:

$$A = \begin{bmatrix} 3 & -1 & 2 & 5 & -6 & -2 \\ 0 & -1 & 3 & -4 & 2 & 1 \\ 0 & 0 & 2 & -2 & -2 & 5 \\ 0 & 0 & 0 & 1 & -3 & -1 \\ 0 & 0 & 0 & 0 & 4 & 8 \\ 0 & 0 & 0 & 0 & 0 & -2 \end{bmatrix}$$

***What you should learn***

How to find the determinants of square matrices

**Additional notes****Homework Assignment**

Page(s)

Exercises