**Chapter 7: Matrices and Determinants**

7.1 – Matrices and Systems of Equations

In this section you will study a streamlined technique for solving systems of linear equations. This technique involves the use of a rectangular array of real numbers called a \_\_\_\_\_\_\_\_\_\_\_\_.

DEFINITION OF MATRIX

If $m$and $n$ are positive integers, an $m × n$ **matrix** (read $"m by n"$) is a rectangular array



in which each **element**, $a\_{ij}$, of a matrix is a number. An $m ×n$ matrix has $m$ **rows** (horizontal lines) and $n$ **columns** (vertical lines).

The entry in the $i$th row and $j$th column is denoted by the *double subscript* notation $a\_{ij}.$

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VOCABULARY

Elements: The numbers in the matrix are called the elements. Examples:

Order: A matrix having *m* rows and *n* columns is called a *m*×*n* (*m* by *n*) matrix.

$ \left[\begin{matrix}2&3&7\\1&3&5\end{matrix}\right]$ $\left[\begin{matrix}1&4\\6&8\end{matrix}\right]$ $\left[\begin{matrix}2&-4&0\end{matrix}\right]$ $\left[\begin{matrix}3&9.1\\-4&8\\π&0\end{matrix}\right]$

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Null or Zero Matrix: A null/zero matrix is a matrix with all elements zero.

Identity Matrix: An identity matrix is a square matrix in which the elements on the main diagonal are 1 and the elements outside the main diagonal are all zero.

Diagonal Matrix: A diagonal matrix is a square matrix in which the elements outside the main diagonal are all zero.

NOTATION

Use capital letters to denote matrices.

For example, $A=\left[\begin{matrix}a\_{11}&a\_{12}\\a\_{21}&a\_{22}\end{matrix}\right]$.

The identity matrix and zero matrix are represented as $I$ and $O$ respectively.

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1. In May, Suzanne bought 32 styrofoam cubes and decorated them as toy figurines. In June,

 she sold 12 figurines. In May, Carrie bought 36 styrofoam cubes to decorate and in June,

 she sold 22 figurines. Which matrix represents all of their May purchases and their June

 sales?

A.  B. 

C.  D. 

2. What are the dimensions of $\left[\begin{matrix}3\\\sqrt{5}\end{matrix}\right]$?

A. 1 × 2 B. 3 × 5

 C. 2 × 1 D. 5 × 3

3. Identify a31 in $\left[\begin{matrix}-13&-20&-17\\-21&5&-6\\10&20&21\end{matrix} \begin{matrix}4\\27\\14\end{matrix}\right]$.

A. 31 B. -17
C. 10 D. -6

4. What are the dimensions of $\left[\begin{matrix}19&16&13\\-9&-5&-10\\14&7&2\end{matrix} \begin{matrix}-11\\-18\\1\end{matrix} \begin{matrix}20\\15\\17\end{matrix}\right]$?

A. 5 x 3 B. 3 x 5

C. 4 x 5 D. 5 x 4

EQUALITY OF MATRICES

Two matrices are equal only if they fulfill both of the following conditions:

1. they have the same order;
2. all corresponding elements are equal.

Example: $\left[\begin{matrix}1&1\frac{1}{2}\\3.5&4\end{matrix}\right]=\left[\begin{matrix}1&1.5\\\frac{7}{2}&4\end{matrix}\right]$ but $\left[\begin{matrix}1&2\\0&0\end{matrix}\right]\ne \left(\begin{matrix}1&2\end{matrix}\right)$

PRACTICE: Evaluate the unknowns.

1. $\left[\begin{matrix}2&a&5\end{matrix}\right]=\left[\begin{matrix}b^{2}&7&\sqrt{c}\end{matrix}\right]$

2. $\left[\begin{matrix}3&4\\2x^{3}&z-2\end{matrix}\right]=\left[\begin{matrix}y\sqrt{3}&4\\54&3\end{matrix}\right]$

3. $\left[\begin{matrix}3x-y&x+2y\\2xy&4\end{matrix}\right]=\left[\begin{matrix}10&1\\-6&4\end{matrix}\right]$