Online Math Center

MATRICES

A **matrix** is a rectangular arrangement of elements.
The elements can be real or complex numbers, variables, or other symbols that are arranged in a rectangular format.

A matrix is arranged in **horizontal rows** and **vertical columns.**

2 rows and 3 columns of integers

$$\begin{bmatrix} 2 & -7 & 1 \\ -5 & 4 & 9 \end{bmatrix}$$

3 rows and 4 columns of variable expressions

$$\begin{bmatrix} x & y+1 & z & w+1 \\ x+1 & y & z+1 & w \\ x+2 & y+2 & z-1 & w-1 \end{bmatrix}$$

2 rows and 2 columns of complex numbers

$$\begin{bmatrix} 2+3i & 5+1i \\ 5-1i & 2-3i \end{bmatrix}$$

The "**size**" of a matrix depends on the **number of rows** and the **number of columns** and is called the "**order"** of the matrix. *Rows always come first.*

In the above examples, the orders are: **2 by 3**, **3 by 4**, and **2 by 2**.

When a matrix has the **same number of rows as it has columns**, it is called a **square matrix.**

Example of a 3 by 3 square matrix of integers:

$$\begin{bmatrix} -5 & 21 & 17 \\ 35 & -3 & -10 \\ 9 & 45 & -2 \end{bmatrix}$$

A system of equations is one source of three separate matrices:

For example, consider the system of 3 equations and 3 unknowns:

$$\begin{aligned} 1x + 4y + 18z &= 87 \\ 9x + 21y + 8z &= 97 \\ 1x + 15y + 49z &= 56 \end{aligned}$$

The **coefficient matrix** which consists of all of the coefficients from the right hand side of the system.

$$\begin{bmatrix} 1 & 4 & 18 \\ 9 & 21 & 8 \\ 1 & 15 & 49 \end{bmatrix}$$

This is a 3 by 3 square matrix: 3 rows and 3 columns

The **variable matrix** which is a 3 row by 1 column matrix consisting of all of the variables in the system.

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

The **constant matrix** which is a 3 row by 1 column matrix created from all of the constants on the left-hand side of the system.

$$\begin{bmatrix} 87 \\ 97 \\ 56 \end{bmatrix}$$

Thus the system

$$\begin{aligned} 1x + 4y + 18z &= 87 \\ 9x + 21y + 8z &= 97 \\ 1x + 15y + 49z &= 56 \end{aligned}$$

written as three matrices is

$$\begin{bmatrix} 1 & 4 & 18 \\ 9 & 21 & 8 \\ 1 & 15 & 49 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 87 \\ 97 \\ 56 \end{bmatrix}$$

Other related FAQ topics:

Matrix Operations
Inverse Matrix
Matrix Equations
Augmented Matrix
Determinant of a Matrix
Matrix minors/cofactors
Matrix Applications