Pre-Calculus
Unit 1: Matrices

References

Textbook Connection: Glencoe PreCalculus Text: Chapter 6

Every student will receive a text copy and access to the online textbook resource:
http://www.connected.mcgraw-hill.com

Helpful Links:

- ☐ Matrices
- ☐ Add/Subtract Matrices
- ☐ Multiplying Matrices
- ☐ Systems & Matrices
- ☐ Real-world Cryptography

Dear Parents,

In this unit students will:

- represent and manipulate data using matrices
- define the order of a matrix as the number of rows by the number of columns
- add and subtract matrices and know these operations are possible only when the dimensions are equal
- recognize that matrix addition and subtraction are commutative
- multiply matrices by a scalar and understand the distributive and associative properties apply to matrices
- multiply matrices and know when the operation is defined
- recognize that matrix multiplication is not commutative
- understand and apply the properties of a zero matrix
- understand and apply the properties of an identity matrix
- find the determinant of a square matrix and understand that it is a nonzero value if and only if the matrix has an inverse
- use 2 X 2 matrices as transformations of a plane and determine the area of the plane using the determinant
- write a system of linear equations as a matrix equation and use the inverse of the coefficient matrix to solve the system
- write and use vertex-edge graphs to solve problems

Concepts Students will Use & Understand

- Commutative Property
- Associative Property
- Distributive Property
- Identity Properties of Addition and Multiplication
- Inverse Properties of Addition and Multiplication
- Solving Systems of Equations Graphically and Algebraically

Vocabulary

- **Determinant:** the product of the elements on the main diagonal minus the product of the elements off the main diagonal
- **Dimensions or Order of a Matrix:** the number of rows by the number of columns
- **Identity Matrix:** the matrix that has 1's on the main diagonal and 0's elsewhere
- **Inverse Matrices:** matrices whose product (in both orders) is the Identity matrix
- **Matrix:** a rectangular arrangement of numbers into rows and columns
- **Scalar:** in matrix algebra, a real number is called a scalar
- **Square Matrix:** a matrix with the same number of rows and columns
- **Zero Matrix:** a matrix whose entries are all zeros

For further help:

http://www.teachers.ash.org.au/jeather/maths/dictionary.html
http://intermath.coe.uga.edu/dictnary/homepg.asp
http://www.amathsdictionaryforkids.com/

Properties

Let a, b, and c be real numbers

	ADDITION PROPERTIES	MULTIPLICATION PROPERTIES
COMMUTATIVE	$a + b = b + a$	$ab = ba$
ASSOCIATIVE	$(a + b) + c = a + (b + c)$	$(ab)c = a(bc)$
IDENTITY	There exists a unique real number zero, 0, such that $a + 0 = 0 + a = a$	There exists a unique real number one, 1, such that $a * 1 = 1 * a = a$
INVERSE	For each real number a, there is a unique real number - a such that $a + (-a) = (-a) + a = 0$	For each nonzero real number a, there is a unique real number $\frac{1}{a}$ such that $a(\frac{1}{a}) = (\frac{1}{a})a = 1$

Sample Problems

1. Find the dimensions:

$$\begin{bmatrix} -3 & 5 \\ 4 & 1/4 \\ -\pi & 0 \end{bmatrix}$$

3 rows, 2 columns; Dimensions: 3 x 2

2. Two stores carry small, medium, and large sweatshirts. The table shows the inventory at the stores. Arrange the data in a matrix. Give the dimensions of the matrix.

Sweatshirt Inventory			
	Small	Medium	Large
Store A	6	21	13
Store B	16	32	28

$$\begin{bmatrix} 6 & 21 & 13 \\ 16 & 32 & 28 \end{bmatrix}$$ The dimensions are 2 x 3

3. Multiply the following matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \times \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix}$$

$$\begin{bmatrix} 58 & 64 \\ 139 & 154 \end{bmatrix}$$

4. Find the inverse of the following matrix:

$$\begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 9 \\ 0 & 1 & 9 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & -1 \\ -1 & 9 & -8 \\ 1 & -1 & 1 \end{bmatrix}$$ The inverse exists!

5. What system of equations is represented by the matrix equation?

$$\begin{bmatrix} -41 & 1 & 0 \\ 1 & 50 & 1 \\ 67 & 4 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 7 \\ -29 \end{bmatrix}$$

$$-41x + y = 1$$
$$x + 50y + z = 7$$
$$67x + 4y = -29$$