Using Matrices

An Introduction to Matrices

matrix - A rectangular array of variables or numbers arranged in horizontal rows and vertical columns usually enclosed in brackets.
transformation - Functions that map points of a shape onto its image.
dilation - When a geometric figure is enlarged or reduced.
scalar multiplication - When you multiply a matrix by a constant. (example below)

The data in the matrix is organized so that each position has a purpose. Each value in the matrix is called an *element*. A matrix is usually named using a capital letter such as D. A matrix can also be named by using the matrix *dimensions* with the letter name. The dimensions tell how many rows and columns, in that order, there are in the matrix. *Matrix logic* is a method that can be used to solve some problems. To use matrix logic you create a matrix that organizes all the information in the problem then you eliminate one possibility after another until you finally arrive at a solution. The matrices importance extends to another branch of mathematics call *discrete mathematics.* Discrete mathematics deal with finite or discontinuous quantities.

Scalar Multiplication of a Matrix	$k\begin{bmatrix} a\,b\,c \\ d\,e\,f \end{bmatrix} = \begin{bmatrix} ka\;kb\;kc \\ kd\;ke\;kf \end{bmatrix}$

Adding and Subtracting Matrices

translation - When a figure is moved from one location to another on the coordinate plane without changing it's size, shape, or orientation.

Addition of Matrices	If A and B are two m x n matrices , then $A + B$ is an m x n matrix in which each element is the sum of the corresponding elements of A and B. $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} + \begin{bmatrix} j & k & l \\ m & n & o \\ p & q & r \end{bmatrix} = \begin{bmatrix} a+i & b+k & c+i \\ d+m & e+n & f+o \\ g+p & h+q & j+r \end{bmatrix}$

Multiplying Matrices

rotation - When a figure is moved around a center point.

Multiplying Matrices	The product of Am x n and Bn x r is $(AB)m$ x r. The element in the ith row and the ith column of AB is the sum of the products of the corresponding elements in the ith row of A and the ith column of B.

Matrices and Determinants

determinant - Square array of numbers or expressions enclosed between two parallel vertical bars.
third-order determinants - Determinants of 3 x 3 matrices.
expansion by minors - Method of evaluating third order determinants.

Expansion of a Third-Order Determinant	$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$

Identity and Inverse Matrices

Identity Matrix - A square matrix that, when multiplied by another matrix, equals that same matrix.

Identity Matrix for Multiplication	The identity matrix for multiplication, I, is a square matrix with 1 for every element of the principal diagonal and 0 in all other positions. For any square matrix A of the same order as I, $A \times I = I \times A = A$.

Inverse of a 2 x 2 Matrix	Any matrix $M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ will have an inverse of M^-1 if and only if $\begin{vmatrix} a & b \\ c & d \end{vmatrix} \neq 0$. Then M^-1= $\dfrac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$.

Using Matrices to Solve Systems of Equations

matrix equation - An equation of the form $AX = C$, where A is the coefficient matrix for a system of linear equation, X is the column matrix consisting of the variables of th system, and C is the column matrix consisting of the constant terms of the system.

Using Augmented Matrices

augmented matrix - The augmented matrix of a system of equations contains the coefficient matrix of the system with an extra column consisting of the constant terms of the system.
row operations - Operations performed on rows of an augmented matrix to find the solution to a system of linear equations.
reducing a matrix - The process of performing row operations to get the desired matrix.
reduced matrix - The matrix you get after you have reduced all the way.

ERO's (row operations)

1. multiply a row by a constant
2. multiply a row by a constant and then add to another row
3. swap rows

Integration: Statistics (Box-and-Whisker Plots)

range - The range of a set in data is the difference between the greatest and least values in the set.
quartiles - The values in a set that separate the data into four sections, each containing 25% of the data.
box-and-whisker plot - A pictorial representation of the variability of a set of data that summarizes the data set using its quartiles and extreme values.
outlier - Any value in the set of data that is a least 1.5 interquartile ranges beyond the upper or lower quartiles.