Name___________________________________

Algebra 2

Lesson 4-5/4-6

Determinants: 2x2 and 3x3 Matrices

Recall a square matrix has the same number of rows and columns. Just like fractions have a common denominator, the elements in a square matrix also have a common "denominator", called a **determinant.**

The determinant, abbreviated **det** and symbolized with | **|,** it is a nonzero quantity (when the der=0 we have another situation that we will look at in the next lesson). For a 2×2 matrix, its determinant is found by subtracting the products of its diagonals:

Given a matrix A=$\begin{vmatrix} a & b \\ c & d \end{vmatrix}$, where a, b, c, and d are real numbers $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$

det A = $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

Example: Compute the determinant of A=$\begin{vmatrix} -3 & 4 \\ 2 & -5 \end{vmatrix}$

det A = det $\begin{vmatrix} -3 & 4 \\ 2 & -5 \end{vmatrix}$

= (-3)(-5) – (4)(2)

=15 – 8

=7

One can also compute a determinant using a graphing calculator:

- Press **MATRIX** > > to **EDIT**. Down to **1:[A]. ENTER**
- Enter the matrix dimensions: # rows **ENTER** # columns **ENTER.** Enter the data for the 2x2 matrix in the matrix.
- Press **2nd MODE (QUIT)**
- Press **MATRIX** again. Go right once to **MATH.** Down to **1:det**.
- Press **MATRIX** again. Down to **1:[A]. ENTER**. Answer is diaplayed.

The computations for 3×3 determinants are messier than for 2×2's. Various methods can be used, but the simplest method is probably the following:

- Write down the determinant
- Expand the determinant by rewriting the first two columns of numbers
- Then multiply along the down-to-the-right-diagonals ↘
- and multiply along the down-to-the-left-diagonals ↙
- Add the down-right-diagonals and subtract the down-right-diagonals

Example:

A= $\begin{bmatrix} 4 & -2 & 0 \\ -3 & 10 & 1 \\ 2 & 6 & -1 \end{bmatrix}$ det A=$\begin{vmatrix} 4 & -2 & 0 \\ -3 & 10 & 1 \\ 2 & 6 & -1 \end{vmatrix}$ expand: $\begin{matrix} 4 & -2 & 0 & 4 & -2 \\ -3 & 10 & 1 & -3 & 10 \\ 2 & 6 & -1 & 2 & 6 \end{matrix}$

down to the right minus down to the left

(4)(10)(-1)+(-2)(1)(2)+(0)(-3)(6) — (0)(10)(2)+(4)(1)(6)+(-2)(-3)(-1)

-40-4+0 — 0+24-6

-44 – 18 **= - 62**

A 3x3 determinant may be calculated on a calculator using the same steps as those for a 2x2