Name: ________________________

Aim: How do we find the determinant of a square matrix?

I. Do Now:

1. Solve by Gauss-Jordan:

$$\left[\begin{array}{cc|c} 2 & 0 & 6 \\ 3 & 5 & 34 \end{array}\right]$$

2. Given:

$$A=\begin{bmatrix} 2 & 0 \\ 3 & 5 \end{bmatrix} \qquad B=\begin{bmatrix} 6 \\ 34 \end{bmatrix}$$

Find: (a) A^{-1} (b) $A^{-1}\cdot B$

What do you notice?

II. Every square matrix has a determinant, a real number that has many uses and applications. If a matrix is not square, then it does not have a determinant. To find the determinant of a 2×2 matrix, find the difference of the product of the diagonals.

Definition: If $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then the **determinant** is defined as $\det(A)=ad-cb$.

Notation: $\det(A)=|A|$ or $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$

Practice: Find the determinant of each matrix.

3. $A=\begin{bmatrix} 2 & -3 \\ 1 & 2 \end{bmatrix}$ 4. $A=\begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}$ 5. $A=\begin{bmatrix} 0 & -5 \\ -\frac{2}{5} & 4 \end{bmatrix}$

III. For 1×1 matrices, the determinant is the value of the only entry.

Examples:

$A=\begin{bmatrix} 3 \end{bmatrix}$ $\det(A)=3$

$B=\begin{bmatrix} -4 \end{bmatrix}$ $\det(B)=-4$

$C=\begin{bmatrix} 0 \end{bmatrix}$ $\det(C)=0$

$D=\begin{bmatrix} 1 & 0 \end{bmatrix}$ $\det(D)$ is undefined

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IV. For 3×3 or larger (4×4, 5×5, etc.) matrices, the procedure is slightly more complicated.

If $A=\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$, then $|A|=a\begin{vmatrix} e & f \\ h & i \end{vmatrix}-b\begin{vmatrix} d & f \\ g & i \end{vmatrix}+c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$

Example: Given $A=\begin{bmatrix} 1 & 4 & -2 \\ 3 & 2 & 0 \\ -1 & 4 & 3 \end{bmatrix}$, find $|A|$.

V. Applications: Find the determinant of each matrix (if it exists). Use your graphing calculator to check your results.

6. $\begin{bmatrix} 1 & 4 & -2 \\ 3 & 2 & 0 \\ -1 & 4 & 3 \end{bmatrix}$ 7. $\begin{bmatrix} 5 & 7 \\ -3 & 0 \\ 1 & 5 \end{bmatrix}$ 8. $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 0 & 8 \end{bmatrix}$ 9. $A=\begin{bmatrix} -799 \end{bmatrix}$

VI. Review Problem (if time)

10. Find the inverse of B.

$$B=\begin{bmatrix} -1 & 1 & 0 \\ 6 & -2 & -3 \\ -1 & 0 & 1 \end{bmatrix}$$

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- p. 545: 6, 7, 9, 11, 13, 23, 25
- p. 538: 13, 17
- p. 528: 46