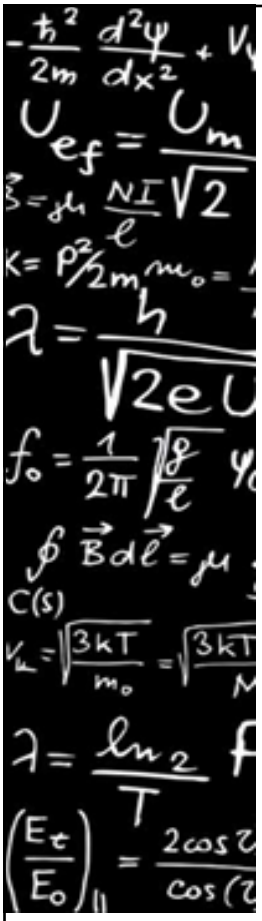

# Unit #3 Day #6

# Calculator Matrices and the Inverse Matrix Method

## Objectives:

1. Students will learn how to enter and edit matrices in their graphing calculators.
2. Students will solve systems using the Inverse Matrix Method.

**To enter a matrix in your calculator:**

[2nd] MATRIX EDIT

**Use the matrices A, B, C & D with your calculator to do problems #1 - #8.**

$A=\begin{bmatrix}8 & 1\\ -2 & 5\end{bmatrix}$ 2x2 $\quad B=\begin{bmatrix}-3 & 1 & 0\\ -2 & -1 & 5\end{bmatrix}$ 2x3 $\quad C=\begin{bmatrix}9 & 4\\ 5 & 1\\ 2 & 0\end{bmatrix}$ 3x2 $\quad D=\begin{bmatrix}1 & 7 & 3\\ 8 & 10 & -2\end{bmatrix}$ 2x3

1. $2C$ $\begin{bmatrix}18 & 8\\ 10 & 2\\ 4 & 0\end{bmatrix}$

2. $3B-2D$ $\begin{bmatrix}-9 & 3 & 0\\ -6 & -3 & 15\end{bmatrix}-\begin{bmatrix}2 & 14 & 6\\ 16 & 20 & -4\end{bmatrix}=\begin{bmatrix}-11 & -11 & -6\\ -22 & -17 & 19\end{bmatrix}$

3. $A+B$ not possible must have the same dimensions

4. $AB$ 2x2 · 2x3 ✓ = 2x3 $=\begin{bmatrix}-26 & 7 & 5\\ -4 & -7 & 25\end{bmatrix}$

5. $BA$ 2x3 · 2x2 don't match not possible undefined

6. $BC+A$ 2x3 · 3x2 = 2x2 + 2x2 ✓ $\begin{bmatrix}-22 & -11\\ -13 & -9\end{bmatrix}+\begin{bmatrix}8 & 1\\ -2 & 5\end{bmatrix}=\begin{bmatrix}-14 & 10\\ -15 & -4\end{bmatrix}$

7. $2CD$ $\begin{bmatrix}82 & 206 & 38\\ 26 & 90 & 26\\ 4 & 28 & 12\end{bmatrix}$

8. $DC-4A$ 2x3 · 3x2 = 2x2 − 4(2x2) ✓ $=\begin{bmatrix}18 & 7\\ 126 & 22\end{bmatrix}$

**INVERSE MATRIX METHOD**

Solve the following:

| | | | |
|---|---|---|---|
| $\frac{1}{2}x = 5$ ·2<br>$x = 10$ | $\frac{2x}{2} = \frac{8}{2}$<br>$x = 4$ | $x + 4 = 7$<br>$-4 \quad -4$<br>$x = 3$ | $x - 3 = 2$<br>$+3 \quad +3$<br>$x = 5$ |

What did we do to solve each of the previous problems? used the inverse operation

**Solving using matrices…**

Solve for $x$: $AX = B$

$$X = A^{-1}B$$

… remember that matrices use slightly different properties!

**To solve a system using the Inverse Matrix Method:**

1. Enter the coordinate matrix in calculator as [A]
2. Enter the constant matrix in calculator as [B]
3. Compute $A^{-1} \cdot B$

**Solve the following problems using the inverse matrix method on your calculators.**

**9.** $\begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 14 \end{bmatrix}$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}^{-1} \cdot \begin{bmatrix} 5 \\ 14 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

**10.** $\begin{bmatrix} 0 & 9 & 2 \\ 3 & 2 & 1 \\ 1 & -1 & 0 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 14 \\ 5 \\ -1 \end{bmatrix}$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 & 9 & 2 \\ 3 & 2 & 1 \\ 1 & -1 & 0 \end{bmatrix}^{-1} \begin{bmatrix} 14 \\ 5 \\ -1 \end{bmatrix} *$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -2 \end{bmatrix}$$

**Rewrite the system as a matrix. Use the Inverse Matrix Method to solve.**

$$\begin{cases} x-3y=-1 \\ -5x+16y=5 \end{cases}$$

(-1, 0) intersection

| Coordinate Matrix: | Variable Matrix: | Constant Matrix: |
|---|---|---|
| $A=\begin{bmatrix} 1 & -3 \\ -5 & 16 \end{bmatrix}$ | $X=\begin{bmatrix} x \\ y \end{bmatrix}$ | $B=\begin{bmatrix} -1 \\ 5 \end{bmatrix}$ |

Solve using the Inverse Matrix Method:

$$\begin{bmatrix} x \\ y \end{bmatrix}=\begin{bmatrix} 1 & -3 \\ -5 & 16 \end{bmatrix}^{-1}\cdot\begin{bmatrix} -1 \\ 5 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix}=\begin{bmatrix} -1 \\ 0 \end{bmatrix}$$

**Practice Problems:**

**11.** $\begin{cases} 2x+y-z=5 \\ 3x-y+2z=-1 \\ x-y-z=0 \end{cases}$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 2 & 1 & -1 \\ 3 & -1 & 2 \\ 1 & -1 & -1 \end{bmatrix}^{-1}\begin{bmatrix} 5 \\ -1 \\ 0 \end{bmatrix}$$

**12.** $\begin{cases} x+y+z=2 \\ 2x+y=5 \\ x+3y-3z=14 \end{cases}$

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 0 \\ 1 & 3 & -3 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 2 \\ 5 \\ 14 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & 0 \\ 1 & 3 & -3 \end{bmatrix}^{-1}\begin{bmatrix} 2 \\ 5 \\ 14 \end{bmatrix}$$

**13.** $\begin{cases} x+y+z=4 \\ 4x+5y=3 \\ y-3z=-10 \end{cases}$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 1 & 1 & 1 \\ 4 & 5 & 0 \\ 0 & 1 & -3 \end{bmatrix}^{-1}\begin{bmatrix} 4 \\ 3 \\ -10 \end{bmatrix}$$

**14.** $\begin{cases} x=5-y \\ 3y=z \\ x+z=7 \end{cases}$ → $\begin{aligned} x+y &= 5 \\ 3y+z &= 0 \\ x+\ \ z &= 7 \end{aligned}$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 1 & 1 & 0 \\ 0 & 3 & 1 \\ 1 & 0 & 1 \end{bmatrix}^{-1}\begin{bmatrix} 5 \\ 0 \\ 7 \end{bmatrix}$$

**15.** Mr. Frederickson bought 4 pencils, 3 erasers, and 2 binders and spent a total of $22.50.
Mr. Edwards bought 5 pencils, 8 erasers, and 3 binders and spent $43.50.
Ms. Isaacson bought 7 pencils, 1 eraser, and 6 binders for $27.00.
Set up a system of equations. Solve your system using the inverse matrix method.

$4P + 3E + 2B = 22.50$
$5P + 8E + 3B = 43.50$
$7P + E + 6B = 27.00$

$$\begin{bmatrix} P \\ E \\ B \end{bmatrix} = \begin{bmatrix} 4 & 3 & 2 \\ 5 & 8 & 3 \\ 7 & 1 & 6 \end{bmatrix}^{-1} \begin{bmatrix} 22.50 \\ 43.50 \\ 27.00 \end{bmatrix}$$

A pencil costs $2.50
An eraser costs $3.50
A binder costs $1.00