## Algebra II

Lesson 3x3: Matrices, Determinants, and Inverses
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The computations for $3 \times 3$ determinants are messier than for $2 \times 2$ 's. Various methods can be used, but the simplest method is probably the following:

1) Write down the determinant
2) Expand the determinant by rewriting the first two columns of numbers
3) Multiply along the down-to-the-right-diagonals, and then add them up.
4) Multiply along the down-to-the-left-diagonals and then add these values up.
5) Lastly subtract the down-right-diagonal total from the down to the left diagonal total.

## Example:

\(A=\left[$$
\begin{array}{ccc}4 & -2 & 0 \\
-3 & 10 & 1 \\
2 & 6 & -1\end{array}
$$\right] \quad \operatorname{det} A=\left|\begin{array}{ccc}4 \& -2 \& 0 <br>
-3 \& 10 \& 1 <br>

2 \& 6 \& -1\end{array}\right| \quad\) expand: | 4 | -2 | 0 | 4 | -2 |
| :---: | :---: | :---: | :---: | :---: |
| -3 | 10 | 1 | -3 | 10 |
| 2 | 6 | -1 | 2 | 6 |

expand: $\quad$ down to the right $=$

FIND THE DETERMINANT FOR THE FOLLOWING MATRICES:
(by hand)
$\left[\begin{array}{lll}1 & 4 & 0 \\ 2 & 3 & 5 \\ 0 & 1 & 0\end{array}\right]$

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[\begin{array}{lll}{1}&{2}&{5}\\{3}&{1}&{0}\\{1}&{2}&{1}\end{array}]
```


## Calculator Method

Determinants:
A $3 \times 3$ determinant may be calculated on a calculator using!!!

## Remember <br> YOU MUST BE ABLE TO CALCULATE DETERMINANTS WITHOUT THE AID OF A CALCULATOR!!!!

1. Press MATRIX ( $\mathbf{2}^{\text {nd }} \mathbf{x}^{-1}$ ) >> to EDIT. Down to 1:[A]. ENTER
2. Enter the matrix dimensions: \# rows ENTER \# columns ENTER.
3. Enter the matrix data.
4. Press $\mathbf{2}^{\text {nd }}$ MODE (QUIT)
5. Press MATRIX again. Go right once to MATH. Down to 1 :det.
6. Press MATRIX again. Down to $1:[\mathrm{A}]$. ENTER. Answer is displayed.

Inverses:

1. Using a calculator, enter the data for your matrix
2. Now to calculate the inverse hit $\mathbf{2}^{\text {nd }}$ MATRIX select the matrix you want the inverse for and hit ENTER
3. Hit $\mathbf{x}^{-1}$ The view screen will show: $[\mathrm{A}]^{-1}$
4. ENTER the view screen will give the matrix inverse of your matrix.

Find the inverse of the matrices:

$$
\left[\begin{array}{ccc}
-3 & 4 & 0 \\
2 & -5 & 1 \\
0 & 2 & 3
\end{array}\right]
$$

$$
\left[\begin{array}{ccc}
3 & 4 & 1 \\
-2 & 0 & 2 \\
1 & 5 & 3
\end{array}\right]
$$

Soloving a 3X3 Matrix Equation

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

Yes, we use the calculator.

1. Enter your matrix data into the calculator. Enter the $3 \times 3$ data into matrix $A$ and the $3 \times 1$ data into matrix B .
2. Now to calculate the inverse hit $\mathbf{2}^{\text {nd }}$ MATRIX select the matrix you want the inverse for and hit ENTER
3. Hit $\mathbf{x}^{-1}$ The view screen will show: $[\mathrm{A}]^{-1}$
4. With the matrix inverse on the screen hit (times) $2^{\text {nd }}$ Matrix [B] ENTER Will see: $[A]^{-1}[B]$ hit ENTER one more time.
5. The resulting matrix will be our answer, the matrix that equals $X$.

ORDER COUNTS! [B] [A] ${ }^{-1}$ WILL NOT WORK!!!


