Properties of Matrices

ANSWER KEY

In this activity, you will explore:

- *Properties of Matrices*
- *Procedures to solve systems of equations using matrices*

Follow this document to discover and study the properties of matrices.

Open a new document in calculator mode [home] [6] ❶.

Enter a 3 x 3 matrix of your choice on to calculator page [ctrl] [template] 3 x 3 matrix. You must [tab] from cell to cell. Press [enter] . Copy your matrix on this sheet.

Find the determinant of the matrix to make sure it is not zero. det(▲▲ until your matrix is highlighted, then [enter]). Press [enter] to check your determinant. If determinant is zero, press ▲▲ until your matrix is highlighted, then [enter] and change one number to make your determinant nonzero. Write down the determinant of your matrix.

We want to see what happens if you change rows in a matrix. Press ▲▲ until det(matrix) is highlighted, then [enter] to paste your matrix on the command line. Now switch any two rows in your matrix. Remember your original matrix is right there for you to see. What happened to the determinant?

The sign of the matrix changed.

Now we want to see what happens if you change columns in a matrix. Press ▲▲ until det(matrix) is highlighted, then [enter] to paste your matrix on the command line. Now switch any two columns in the matrix you just made. Remember that matrix is right there for you to see. What happened to the determinant?

The sign of the matrix changed again.

Now let's see what multiplying a row in a matrix will do to the determinant. Press ▲▲ until det(matrix) is highlighted, then enter to paste your matrix on the command line. Multiply the **first** row by 2. Find the determinant. How does this determinant compared with the previous one?

Determinant was multiplied by 2.

Press ▲▲ until det(matrix) is highlighted, then enter to paste your matrix on the command line. Multiply the **second** row by 2. Find the determinant. How does this determinant compared with the previous one?

Determinant was multiplied by 2 again.

Press ▲▲ until det(matrix) is highlighted, then enter to paste your matrix on the command line. Multiply the **third** row by 2. Find the determinant. How does this determinant compared with the previous one?

Determinant was multiplied by 2 again.

After we have multiplied all three rows by 2, we have effectively multiplied the matrix by the scalar 2. (2 […])

How does multiplying a 3 x 3 matrix by the scalar 2 affect the determinant of the matrix?

The determinant is multiplied by 8 (2^3).

How will changing the scalar affect the determinant?

Your determinant will be multiplied by that number to the third power.

How will changing the size of the matrix change the determinant when the matrix is multiplied by a scalar?

Changing the size of the matrix will change the power that the number is taken to.

Give an example of each.

$A=\begin{bmatrix} 2 & 1 \\ -3 & 5 \end{bmatrix}$, $B=\begin{bmatrix} -1 & 2 \\ 4 & 3 \end{bmatrix}$. Find $|A|, |B|, |A\cdot B|$.

$|A|=13$, $|B|=-11$, $|A\cdot B|=-143$

If you have $|A|$ = a and $|B|$ = b, make a conjecture about $|A\cdot B|$.

$|A\cdot B| = ab$

Write a summary of what you have learned about the properties of matrices.

1) The sign of the determinant changes when rows or columns are switched.

2) When a square matrix is multiplied by a number the determinant is multiplied by that number to the size of matrix power. Number n times a p x p matrix would multiply the original determinant by n^p.

3) The determinant of matrices that have been multiplied is the same of the determinants of the matrices multiplied together.