# Matrix Inverse
## Student Activity

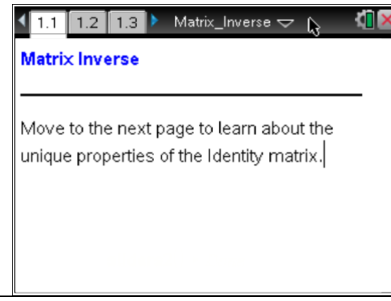
**Name** ________________

**Class** ________________

**Open the TI-Nspire document *Matrix_Inverse.tns.***

In the expression $x * 5 = 1$, the value of x must be 1/5. What would the value of $x$ be in the equation $x\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$?

This activity will show you how to find $x$.

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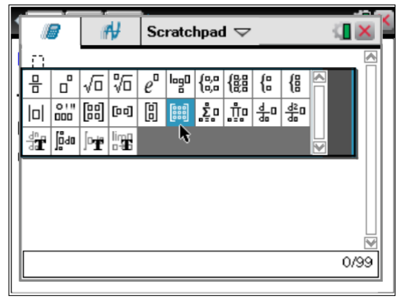
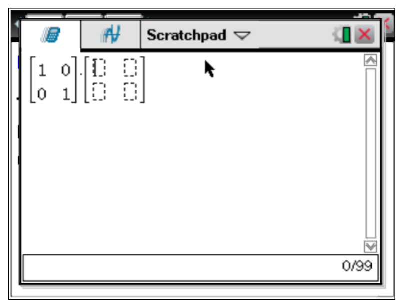
The number 1 is an incredibly powerful number in mathematics, and it can be written in many different ways. In matrix notation, the number 1 is expressed as $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and is called the *identity matrix.*




1. Multiplying 1 by any number results in no change to the number. Test this in matrix notation by multiplying $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ by any 2 × 2 matrix.

- Open the **Scratchpad**.
- Enter the identity matrix by pressing [template key], selecting the 2 × 2 matrix template and entering $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.
- Now enter another 2 × 2 matrix, but choose any element values for the matrix. Press **enter**.
- When you finish question 1b, press **esc** to exit the **Scratchpad**.




a. What is the result of the matrix multiplication?

b. Repeat this two more times using a different second matrix. What do you notice about the results? Will this always happen? Why or why not?

**Name ______________**
**Class ______________**

**Move to page 1.2.**

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

2. Attempt to change the element values in matrix B until the product [A][B] is the identity matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Why is it so difficult to find the correct values for matrix B?

**Move to page 1.3.**

3. When the product of two matrices is the identity matrix, then the second matrix is the *inverse* of the first matrix. The inverse matrix can be calculated using a system of equations.
   a. Identify the necessary system of equations by multiplying matrices A and B. Write your result below. Confirm your result by moving the slider to *yes* for *Show Equations*.

   b. Determine the correct element values for matrix B by solving the system of equations. To display the solution to this system, move the slider to *yes* for *Show Solutions*.

   c. Use the **Scratchpad** to confirm that [A][B] results in the identity matrix. What patterns do you notice between the element values in matrix A and matrix B?

4. Using the **Scratchpad**, find the reciprocal of the determinant of matrix A by pressing 1 ÷ D E T ( and entering matrix A.

   a. Knowing the value of the reciprocal of the determinant, are there other patterns that you now notice between matrix A and matrix B?

   b. Would you like to change anything you wrote for question 3? Try rewriting the matrix so each element has a common denominator before answering.

Name _______________
Class _______________

**Move to page 1.4.**

5. Use the calculated determinant to help choose correct values for matrix B so that the product, [A][B], results in the identity matrix.

**Move to page 2.1.**

6. This next page is for practice. Practice finding the correct values for matrix B so that the product, [A][B], is the identity matrix. Click the arrows by the question number to get a new question.

7. Amber says that the inverse of $\begin{bmatrix} -2 & 3 \\ 1 & -5 \end{bmatrix}$ is $\begin{bmatrix} \frac{5}{7} & -\frac{3}{7} \\ -\frac{1}{7} & \frac{2}{7} \end{bmatrix}$. Is Amber correct? Why or why not?

8. Sean says every square matrix has an inverse. Is he correct? Explain.