Multiplicative Inverse

For numbers, $ax = 1 \Rightarrow x = \frac{1}{a} \Rightarrow xa = 1$

What about matrices?

$A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$  \hspace{1cm}  $B = \begin{bmatrix} 3 & -2 \\ -1 & 1 \end{bmatrix}$

$AB$  \hspace{1cm}  $BA$

We write $B = A^{-1}$ and never $B = \frac{1}{A}$

$AA^{-1} = I$ and $A^{-1}A = I$

Q. What algebraic properties come with the notion of inverse?

Q. How does one calculate an inverse if there is one?

Zero matrix $0$ never has an inverse.

Makes sense only for a square matrix.

Inverse of $A = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$, don’t even ask.
Find the inverse of $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$.

Strategy: Find a solution of $AX = I$

1. Form augmented matrix $[A \ I]$
2. Row reduce same
3. See if the row reduced form is $[I \ X]$. If so, $X = A^{-1}$. If not, the matrix doesn’t have an inverse.