EE185 Play and learn Matrices
FLL2020 let us focus on 2x2

How to multiply two 2x2 matrices

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} e & f \\ g & h \end{pmatrix} = \begin{pmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{pmatrix}$$

Given a 2x2 (2 by 2) matrix find its inverse

$$N = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

Determinant of **det(N)= ad-bc**

Inverse of N is defined as

$$\boldsymbol{N^{-1}} = \frac{\mathbf{1}}{\mathbf{det}\,(\boldsymbol{N})}\begin{pmatrix} \boldsymbol{d} & \boldsymbol{-b} \\ \boldsymbol{-c} & \boldsymbol{a} \end{pmatrix} = \frac{\mathbf{1}}{\mathbf{ad} - \mathbf{bc}}\begin{pmatrix} \boldsymbol{d} & \boldsymbol{-b} \\ \boldsymbol{-c} & \boldsymbol{a} \end{pmatrix} = \boldsymbol{N^{-1}}$$

How to check? See if $N^{-1}N = I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$$\frac{\mathbf{1}}{\mathbf{ad} - \mathbf{bc}}\begin{pmatrix} \boldsymbol{d} & \boldsymbol{-b} \\ \boldsymbol{-c} & \boldsymbol{a} \end{pmatrix}\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \frac{\mathbf{1}}{\mathbf{ad} - \mathbf{bc}}\begin{pmatrix} ad - bc & db - bd \\ -ca + ac & -cb + ad \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

We can use this to solve 2 equation and 2 unknown Problems

ax-by=w
cx+dy=Q

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} w \\ q \end{pmatrix} \ \ in\ the\ form\ \ M\begin{pmatrix} x \\ y \end{pmatrix} = B$$

To solve we do the following

$$M^{-1}M\begin{pmatrix} x \\ y \end{pmatrix} = M^{-1}B$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = M^{-1}B \rightarrow \begin{pmatrix} x \\ y \end{pmatrix} = M^{-1}B$$

How do we check our answers? Does $M\begin{pmatrix} x \\ y \end{pmatrix} = B$? that is how

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