

1st cell $\begin{matrix} 0 \\ 1 \end{matrix}$

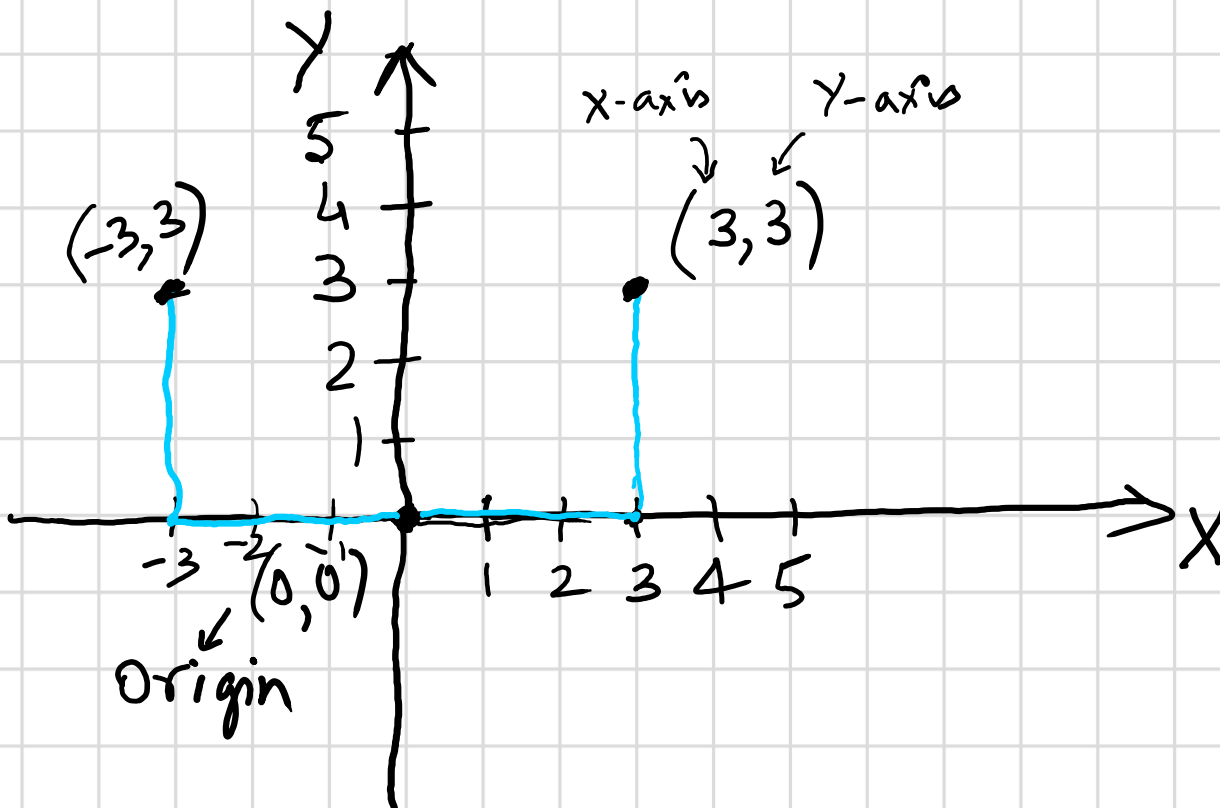
2nd cell $\begin{matrix} 0 \\ 1 \end{matrix}$

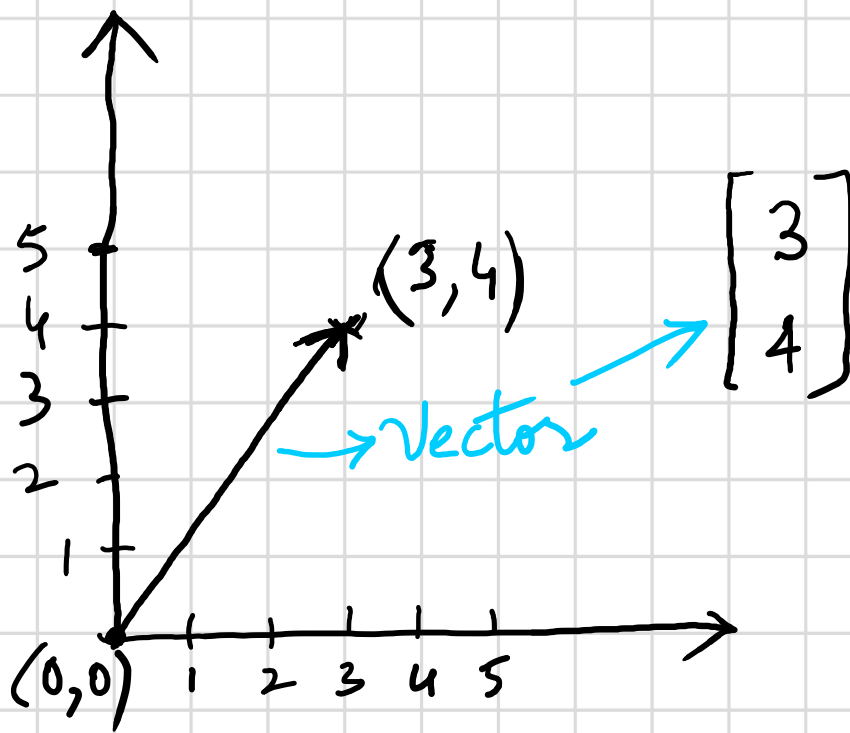
1st 2nd $\begin{matrix} 00 \\ 01 \\ 10 \\ 11 \end{matrix}$
 $2 \times 2 = 4$

1st 2nd 3rd
 $2 \times 2 \times 2 = 8$

1st . . . 6th $= 2 \times 2 \times \dots \times 2 = 2^{6\text{th}}$ ways

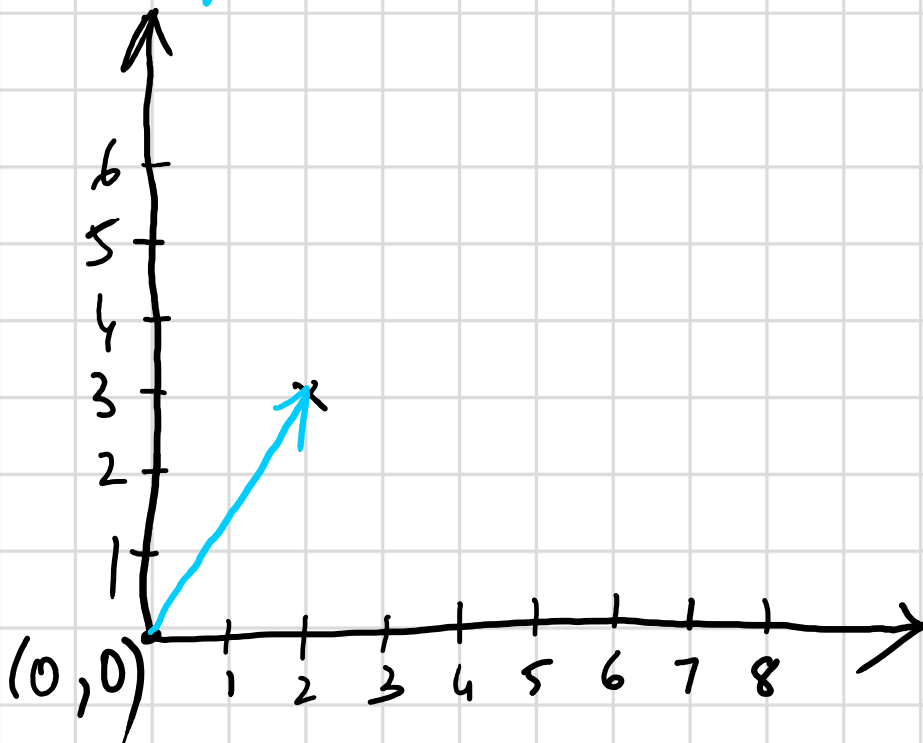
2^{900} ways, $900^2 = 81,00,00$ ~~X~~





$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} \rightarrow \text{Zero Vector}$$

What can you do with vectors?



$$u = \begin{bmatrix} 2 \\ 3 \end{bmatrix}_{2 \times 1} \Rightarrow 2 \times u =$$

$$u = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$v = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$$

$$w = \begin{pmatrix} 8 \\ 7 \end{pmatrix}$$

$$1u + 1v = w$$

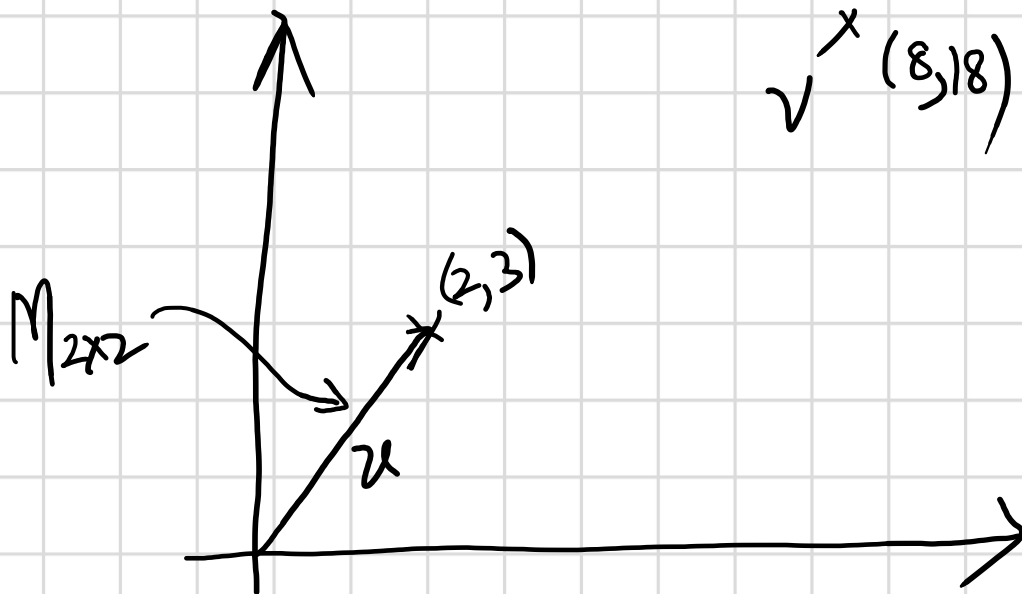
$$u = \begin{pmatrix} 2 \\ 3 \end{pmatrix}_{2 \times 1}$$

$$M = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}_{2 \times 2}$$

$$M \times u \Rightarrow \underline{2 \times 2} \quad \underline{2 \times 1} = \text{result}_{2 \times 1}$$

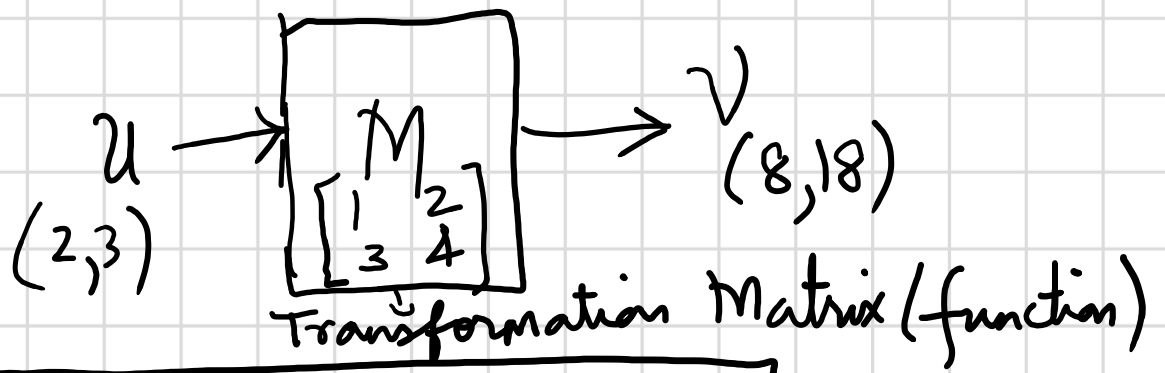
$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}_{2 \times 2} \begin{pmatrix} 2 \\ 3 \end{pmatrix}_{2 \times 1} = \begin{pmatrix} 1 \times 2 + 2 \times 3 \\ 3 \times 2 + 4 \times 3 \end{pmatrix}_{2 \times 1} = \begin{pmatrix} 8 \\ 18 \end{pmatrix}_{2 \times 1}^v$$

$v^x (8, 18)$



$$v = M u$$

Using a Matrix M , we transformed a point u into a new point v .



Linear Transformation

$$N = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}_{2 \times 2} \quad u = \begin{pmatrix} 2 \\ 3 \end{pmatrix}_{2 \times 1}$$

$N \times u = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 1 \times 2 + 0 \\ 0 + 1 \times 3 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$

Identity Matrix

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} x_2 \\ y_2 \end{pmatrix}$$

$M * u = v$