# Linear Combinations

**Linear Combinations**:

$$2\begin{bmatrix} 2 \\ 1 \end{bmatrix} + 3\begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 4 \\ 2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$$

Question: Given a point, say $\begin{bmatrix} 8 \\ 11 \end{bmatrix}$, in 2D, can we write it as a linear combo of the two vectors here?

$$x\begin{bmatrix} 2 \\ 1 \end{bmatrix} + y\begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 2x \\ x+y \end{bmatrix} = \begin{bmatrix} 8 \\ 11 \end{bmatrix}? \quad \begin{matrix} \text{linear} \\ \text{combo} \\ \text{problem} \end{matrix}$$

This will be a **central** and **continuing** question: Can we reach all points in 2D ($n$D) through linear combos of 2 ($n$) given vectors?