# MATH 18 SI Leader Demo

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## 1 Dimension

If V is a vector space, dimension of V (dim(V)) is the number of vectors in any basis.

**Example:**

V is the span of $\begin{pmatrix}1\\0\\2\end{pmatrix}$, $\begin{pmatrix}3\\-1\\1\end{pmatrix}$, $\begin{pmatrix}2\\-1\\-1\end{pmatrix}$. Find the dimension of V.

The matrix A = $\begin{pmatrix}1 & 3 & 2\\0 & -1 & -1\\2 & 1 & -1\end{pmatrix}$ has RREF: $\begin{pmatrix}1 & 3 & 2\\0 & 1 & 1\\0 & 0 & 0\end{pmatrix}$ There are two pivot positions in this matrix. Since V = Col(A), dim(V) = dim(Col(A)) = 2.

### 1.1 Practice Problem 1

Find the rank of the following matrix (hint: how do we find column space?)

$$A = \begin{pmatrix}1 & 1 & 4\\0 & 1 & 1\\1 & 0 & 3\end{pmatrix}$$

**Solution:**

Row Reduction steps:

$$\begin{pmatrix}1 & 1 & 4\\0 & 1 & 1\\1 & 0 & 3\end{pmatrix} \to \begin{pmatrix}1 & 1 & 4\\0 & 1 & 1\\0 & -1 & -1\end{pmatrix} \to \begin{pmatrix}1 & 1 & 4\\0 & 0 & 0\\0 & -1 & -1\end{pmatrix}$$

$$\begin{pmatrix}1 & 1 & 4\\0 & 1 & 1\\0 & 0 & 0\end{pmatrix} \to \begin{pmatrix}1 & 0 & 3\\0 & 1 & 1\\0 & 0 & 0\end{pmatrix}$$

From this RREF, what can we conclude about the column space and rank?
(hint: pivots are important)

$$\begin{pmatrix} 1 & 0 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{pmatrix}$$