

# Change of Basis

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Think of coordinates as scalars

- The first coordinate scales  $\hat{j}$
- The second coordinate scales  $\hat{i}$
- The tip to tail sum is what the vector is meant to describe

**First coordinate is left to right**

**Second coordinate is up down**

$\hat{j}$  and  $\hat{i}$  are the basis vectors of our standard coordinate system

What if we used different basis vectors? Alternate basis vectors.

If a different basis vector is used, you must multiply it by the original corresponding vector values in order to scale the results, then you add them up in order to correctly translate.

## Different Languages Metaphor

We all look at the same vector and space, but we have different ways of describing it. The coordinates are relative to what basis vector you use.

## Our origin is the same

We all agree that the origin is when you scale a vector by 0

## **Translate between Coordinate Systems**

Multiply their values by your corresponding values and the resulting vector is what is translated into something that **we** would describe in our own system

**This is essentially matrix-vector multiplication**