

## 1 | Isomorphism

def

An *isomorphism* is an invertible linear map

## 2 | Isomorphic

def

Two vector spaces are called *isomorphic* if there is an isomorphism from one vector space into the other

### 2.1 | intuition

Can be thought of as relabeling each element  $v$  from one space into an element  $Tv$  in the other.

### 2.2 | results

#### 2.2.1 | equal dimension iff isomorphic Axler3.59

Two vector spaces over some field  $\mathbb{F}$  are isomorphic iff they have the same dimension.

#### 2.2.2 | $\mathcal{L}(V, W)$ and $\mathbb{F}^{m,n}$ are isomorphic

Given two bases of  $V$  and  $W$ ,  $\mathcal{M}$  is an isomorphism between  $\mathcal{L}(V, W)$  and  $\mathbb{F}^{m,n}$

#### 2.2.3 | Axler3.61 $\dim \mathcal{L}(V, W) = (\dim V)(\dim W)$

### 2.3 | intuition

Not only do two isomorphic spaces have a one to one correspondence between them, that correspondence is linear which means that the way the elements interact on one side is the same on the other.