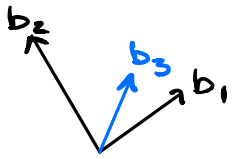
Not all basis vectors have to be the natural basis vectors; that is $[1\,0\,0\,0\ldots0]^T$, $[0\,1\,0\,0\ldots0]$, etc..

Basis — the definition has these requirements,

1. linear independence (not combinations of one another).
2. span the space
3. the space is n-dimensional

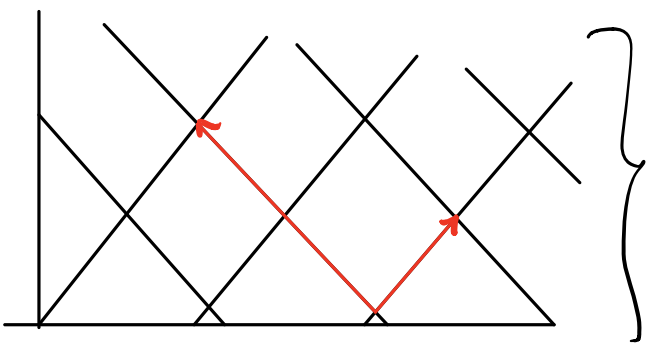
Linear Independence



$b_3 \neq \alpha b_1 + \beta b_2$. that is all vectors are unexpressable in terms of the other vectors apart of the basis.

(*) vectors do not have to be orthonormal (i.e modulus 1 and 90° apart).

If the vectors are not orthogonal to one another require matrices to changes basis — can't just use dot product and vector projection.



Lin. A. stretch, invert and rotate space. It does not warp or fold space.