#flo #hw #inclass

---

1 | 3 and 4 sprint!

1.1 | 3.E products and quotients of vec spaces

```
title: $v+U$
addition of vec and subspace is just the subset of elements in the parent vecspace where the elements a
```

affine subsets can be imagined as parallel, where a subset is shifted over by a vector v.

the quotient space is the set of all affine subsets! it's denoted as $V|U$ which is ofc also a vec space

the quotient map, the map from $V \to V|U$ is denoted as π

$\tilde{T}$ allows for dealing with one dimensionality higher. it let's you propogate the null space across higher dimensions when trying to generalize a linear map.

1.2 | duality!

dual space and dual map

linear functional is a map which goes to the scalar field F. it's a set in $L(V, F)$

dual space, aka V', is the vec space of all linear functionals!

dual basis is the dual of $v_1, \ldots, v_n$ which goes to $\phi_1, \ldots, \phi_n$ is where each ϕ_j is the linear functional which takes v_k to 1 if $k = j$ and 0 else

we also get dual maps, T', which is just the composition of the linear functional and the normal map

ending on, pg 104.

annihilator, denoted as U^0 set of all linear functionals which take all elements to 0 ofc, the annihilator is a subspace

we can relate T' and T to surjective and injective

the transpose of a matrix, denoted as A^t, is the matrix obtained by switching the rows and columns so nxm -> mxn

algebra on tranpose is nice

on matricis, we can define the row rank and the column rank the row rank is the dimension of the span of rows whereas the column rank is the dim of the span of the columns but… they are the same? so we just use **rank** instead

we get a linear independence equivalent def for polynomials

formal defs of zeroes and factors and degree and relations and etc.

and we get the

```
title: Fundemental Theorem of Algebra
every non constant polynomial with complex coefffficients has a zero
```