Read Along: Sections 2.1-2.4
Term Test: Thu Oct 25 3-5PM, Examination Facility room EX 200 (east side of McCaul St., near College).
Riddle Along: 1 2 3 4 5 6 7 8 9
 Two players alternate drawing cards from the above deck. The first player to have 3 cards that add up to 15, wins. Would you like to be the first to move or the second? (More on today's web, including a video link).

4	3	8
9	5	1
2	7	6

(enough to remember yellow & parities)

Following 09-240 hour 16, taught by Yael Karshon:

- "T:V->W is linear"
- Preserving 0.
- Claim on cx+y.
- Example: R^2->R^2 by explicit formula.
- Example: Differentiation, multiplication by x.
- Example: Matrices and linear transformations on F^n.
- Example: Rotation (+ explicit formula).

start line

- Claim on differences and many-element sums.
- Added 2012: \calL(V,W) is a vector space.
- Composition of linear trans is a linear trans.
- Composition is non-commutative. Example: differentiation and muliplication by x.
- For a l.t., arbitrary values on a basis.
- "Isomorphism".

Def V & W are isomorphic if $\exists$ l.t. $T: V \to W$ and $S: W \to V$ s.t. $S \circ T = I_V$ & $T \circ S = I_W$

Thm If V, W are f.d. over F, then $\dim V = \dim W$ iff V is isomorphic to W.

Corollary If $\dim V = n$ over F, V is isomorphic to F^n.

Two "mathematical structures" are "isomorphic" if there's a bijection (1-1 & onto corres.) between their elements which preserves all relevant relations.

Example plastic chess is iso. to ivory chess, but not to checkers.

Example The game of 15.

Pf of Thm & of Corollary

done

line

Fix a l.t. $T: V \to W$

Def $N(T) = \ker T = \{v : Tv = 0\}$ "null space", "kernel".

$R(T) = \operatorname{im} T = \{Tv : v \in V\}$ "range", "image"

Prop/Def $N(T) \subset V$ is a subspace; $\text{nullity}(T) := \dim N(T)$

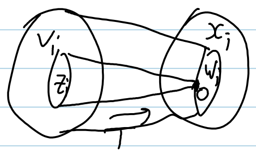
$R(T) \subset W$ is a subspace; $\text{rank}(T) := \dim R(T)$

Examples 0, I_V, $D : P_n(\mathbb{R}) \to P_n(\mathbb{R})$

Thm/ "the dimension theorem", "the rank-nullity Thm"

Given $T : V \to W$, $\underset{m}{\dim V} = \underset{r}{\text{rank}}(T) + \underset{n}{\text{nullity}}(T)$

Pf $(z_i)_1^n$ basis of $N(T)$, extend to $(z_i) \cup (v_i)$ a basis of V,



claim $w_i := T(v_i)$ are lin. indep. in W Pf....

claim w_i span $R(T)$ Pf...