# Class Feb 1st

February 2, 2017 11:45 AM

Class Feb 1st

Audio recording started: 12:01 PM February 2, 2017

## Three more subspaces

(1) Surrounding space:

$$\mathbb{M}_{22} = \left\{ \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \middle| \text{ all } a_{ij} \in \mathbb{R} \right\}$$

with addition & scalar multiplication introduced last class

$$\mathcal{L} = \left\{ \begin{bmatrix} a & b \\ b & c \end{bmatrix} \middle| a, b, c \in \mathbb{R} \right\} \subseteq \mathbb{M}_{22}$$

subspace

"Complicated proof" p. 56 of textbook

"Simple" proof later today

$\mathcal{L}$ is called the space of symmetric 2x2 matrices

There is a fancy way to describe $\mathcal{L}$ (s).

**Definition:** The transpose of $m \times n$ matrix $A$ is the $n \times m$ matrix $A^t$ whose rows are the columns of $A$.

Ex) $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $A^t = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$

Therefore, $\mathcal{L} = \{ A \in \mathbb{M}_{22} \mid A^T = A \}$

(2) Surrounding space

$F(\mathbb{R}) = \{ \text{all functions from } \mathbb{R} \text{ to } \mathbb{R} \}$ #1

Subset:

$P_2 = \{a + bx + cx^2 \mid a, b, c \in \mathbb{R}\}$

polynomials of degree at most 2

that would be my subspace

Simple proof later today

③ Surrounding space $\mathbb{R}^3$

with standard operations

$W = \{(x, y, z) \in \mathbb{R} \mid x - 2y + z = 0\}$

subspace

$W = \{(x, y, z) \in \mathbb{R}^3 \mid x - 2y + z = 0\}$

solve $x - 2y + z = 0$

$[\,① \; -2 \; 1 \mid 0\,]$ RREF

($-2$ ↑ $s$, $1$ ↑ $t$)

$x = 2s$
$y = s$
$z = t$

$W = \{(2s - t, s, t) \mid s, t \in \mathbb{R}\}$

$= \{s(2,1,0) + t(-1,0,1) \mid s, t \in \mathbb{R}\}$

That's the set of all linear combinations of $(2,1,0)$ & $(-1,0,1)$. For short:

$W = \text{span}\{(2,1,0), (-1,0,1)\}$

__Define__: Let $\vec{v}_1, \dots, \vec{v}_m$ vectors in a vector space V. The set of all linear combinations of $\vec{v}_1$ up to $\vec{v}_m$ is called the <u>span</u> of $\vec{v}_1, \ldots, \vec{v}_m$ written, $\text{span}\{\vec{v}_1, \ldots, \vec{v}_m\}$

## BIG THEOREM (part 1)

$W = \text{span}\{\vec{v}_1, \ldots, \vec{v}_m\}$ is always a subspace of $V$

(couple examples: (done before)

(3)

(1) $\mathcal{J} = \{ \,|\, {}^{a}_{1} \quad b$