Transpose: row$_1$ → col$_1$ ... $\begin{pmatrix}1&3\\2&4\end{pmatrix}^t=\begin{pmatrix}1&2\\3&4\end{pmatrix}$. **Transpose Mult**: $(AB)^t = B^tA^t$ **Matrix Mult** $A(B+C) = AB+AC$; $A(cB) = c(AB)$ **Inverses**: sometimes no exist. check with $\det(A) \neq 0$ for invertibility. **Cofactor**: $A_{ij} = -1^{(i+j)} \cdot M_{ij}$ **Minor** M_{ij}: matrix formed by deleting cross thru i, j. **Determinant Rules**: any row or col of Ø → det = Ø. Two same r/c: det = Ø. switching 2 rows or cols, det = $\cdot -1$. Mult. a row or col does same to det. **Elementary Matrix**: I that has had an EROp done on it **Consistency** for simeq if leading in last col, inconsistent ≡ no solutions. If not, question is how many solutions. **SymEq**: if the reduced matrix is consistent and has no free variables, 1 solution if it is consistent and has ≥1 free var, then ∞ solutions. **Homogenious systems** $Ax=0$, or $a_1c_1 + \dots + a_nc_n = 0$ Always have solution $x=0$ **Nontrivial**: other solns to ↗ than $x=0$. find by finding var's. **Linear Combination**: $ax+by$ = a linear comb x, y. **Superposition**: if x, y are solns to $Ax=0$ (homog), then any lin com of x, y also is. **Equivalent** A is invertible, A reduces to I. **Determinant Rules Cont'd**: $\det(A) = \det(A^t)$ $\det(AB) = \det(A)\cdot\det(B)$ **Subspace**: V (a subset of $\mathbb{R}^n$) is a subspace if 1] $\begin{bmatrix}0\\ \vdots\\ 0\end{bmatrix} \in V$ 2] closed under addition (for v in V, $cv \in V$ ...) and 3] closed under addition..

Basis: spans the subspace, all linear independent

(Row, Col, Null) · (space Basis, Dim) Ex:

get into Echelon 1 * * ...

Dim:	Row	Col	Null
	leading vars		free vars

Basis: Col space: cols in original at indexes of leading vars in echelon

Row Space: Rows in ~~original~~ echelon with leading vars.

Null: Ex:

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} s \\ t \\ s+t \end{pmatrix} \to s\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} + t\begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$$

$\hookrightarrow \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}\begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}$ = Null Basis

Inverse Formula:

$$A^{-1} = \frac{1}{\det A} \cdot (A_{ji})$$

not ij

Check Inverse

$A^{-1} \cdot A = I$

Subspace problem

$V = \text{span}(v_1, v_2 \ldots v_n)$

① v's are lin indep

② then the set of vectors are basis for V.

Subspace

- Check for Close under Add, Mul and OES

Determinant: Ex

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ * & * & * \\ * & * & * \end{pmatrix}$$

A_{ij} = cofactor

$a_{11}A_{11} + \ldots + a_{13}A_{13}$

Det Rules Cont Cont

$(\frac{1}{2}A)\det \to \frac{1}{2}^{\wedge}\text{rows} \cdot \det A$

$\det(A^{-1}) = \frac{1}{\det A}$