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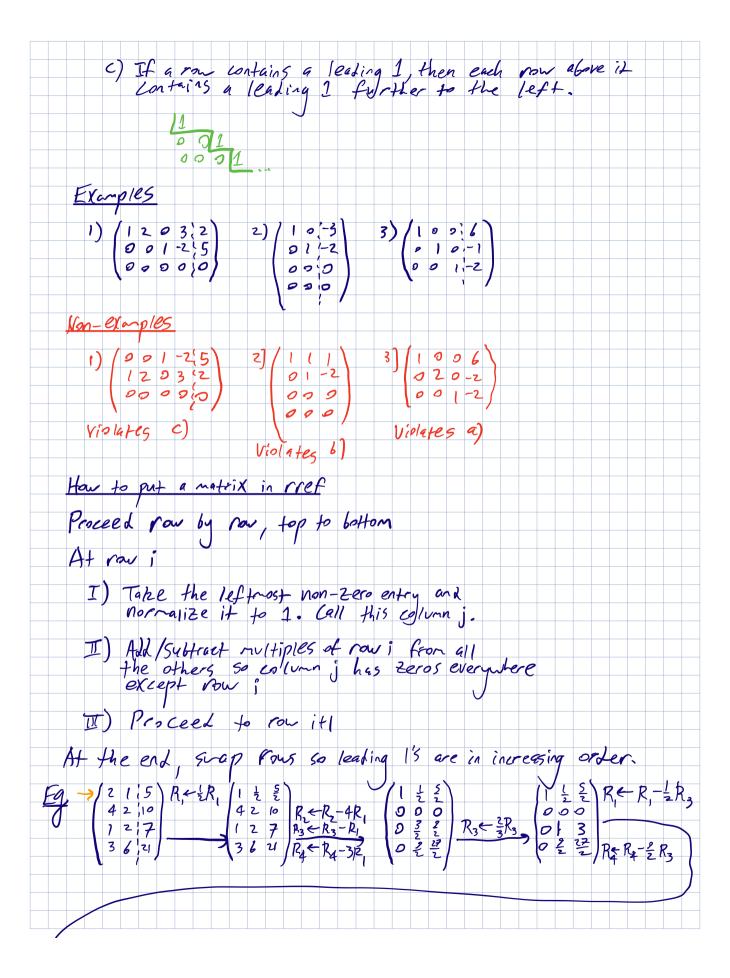
 $\begin{cases} x_1 + 2x_2 + 3x_3 = 2 \\ x_3 - 2x_4 = 5 \end{cases} = \begin{cases} x_1 = 2 - 2x_1 - 3x_4 \\ x_3 = 5 + 2x_4 \end{cases}$ X, and X3 are leading variables X2 and X4 are free Variables So, if $X_2 = t$, $X_4 = r$, then $X_1 = 2 - 2t - 3r$ and $X_3 = 5 + 2r$ Represent as a vector $\begin{pmatrix} X_1 \\ X_2 \\ X_3 \\ x \end{pmatrix} = \begin{pmatrix} 2 - 2t - 3r \\ t \\ 5 + 2r \\ r \end{pmatrix}$ Nice properties of Lesired matrix form for system of equations P1) The leading coefficient is 1 in each equation

P2) Each leading variable appears in only one equation

P3) Leading variables are in increasing order.

To solve a system of equations, we want to get to this form?

Def A matrix is in var-reduced echelon form (ref) if it satisfies a) If a row has nonzero entries, then 1st nonzero entry is a 1 D -- O(1) * -- * b) If a column has a leading 1, then all other entries in that 0 ... 0 1 * ... *



When lone on equations, this is called Gauss-Jordon Elimination

Caveat A system of equations can be inconsistent $Fg = \{X_1 + 2X_2 = 5\}$ $f(X_1 + 4X_2 = 1)$ $f(X_1 + 4X_2 = 1)$ $f(X_2 + 4X_3 = 1)$ $f(X_1 + 4X_3 = 1)$ $f(X_2 + 4X_3 = 1)$ $f(X_3 + 4X_3 = 1)$ $f(X_4 + 4X_3 = 1)$ $f(X_5 + 4X_3 = 1)$ Def The rank of a matrix A is the number of leading 1's in its rref.