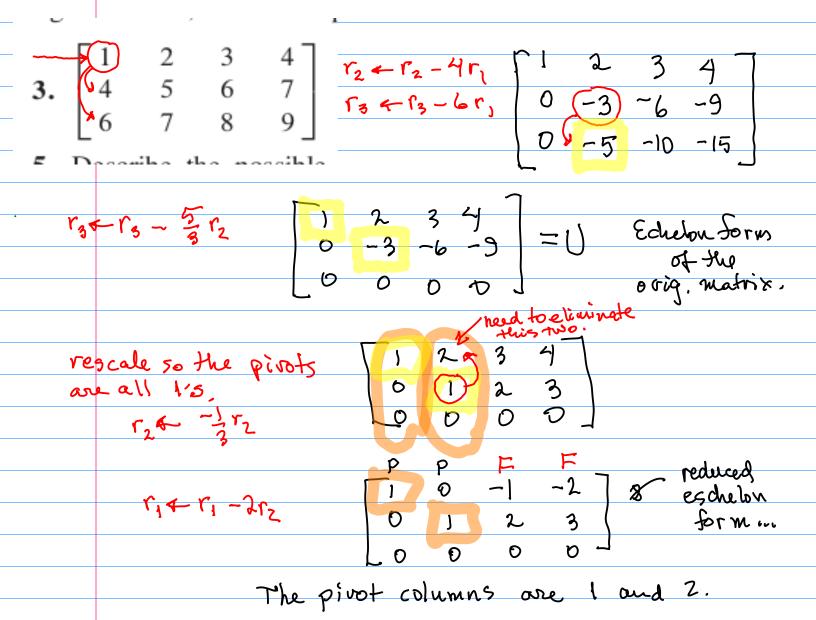
A rectangular matrix is in **echelon form** (or **row echelon form**) if it has the following three properties:

- 1. All nonzero rows are above any rows of all zeros.
- Each leading entry of a row is in a column to the right of the leading entry of the row above it.
- 3. All entries in a column below a leading entry are zeros.

If a matrix in echelon form satisfies the following additional conditions, then it is is reduced echelon form (or reduced row echelon form):

**4.** The leading entry in each nonzero row is 1.

5. Each leading 1 is the only nonzero entry in its column.



$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 5 & 6 & 7 \\ 6 & 7 & 8 & 9 \end{bmatrix} = LU$$
  
Fector ...
  

$$\begin{bmatrix} 1 & 3 & 3 & 4 \\ 4 & 5 & 6 & 7 \\ 6 & 7 & 8 & 9 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 5 & 6 & 7 \end{bmatrix} \begin{bmatrix} 0 & 2 & 3 & 4 \\ 0 & -3 & -6 & -9 \\ 0 & 0 & 0 & 7 \end{bmatrix}$$
  
To undo these row operations
  

$$\begin{bmatrix} r_{2} = r_{2} - 4r_{1} \\ r_{3} = r_{3} - 6 \\ 0 & 0 & 7 \end{bmatrix}$$
  
To undo these row operations
  

$$\begin{bmatrix} r_{2} = r_{2} - 4r_{1} \\ r_{3} = r_{3} - 6 \\ r_{3} = r$$

zero or oull vector P F F x1 - x3 - 22cy =0 1 D ଚ -1  $x_{2} + 2x_{3} + 3x_{4} = 0$  0 = 01 2 3 0 R= 0 Ð Ð ช Ð Ð Short cut set of  $x_2 = -2x_3 - 3x_4$ ansyl r Ship solutions 7 x1 = 23 + 224 the's . -. In vector form. れこ linear combination of rectors ... set of all such compinations ic called a subspace... Can write this Called the nullspace of A. matrix mult. -mullspace matrix In matrix form: Check x3 xy answer X3+2 Xg 2 -2 ~3 -223 324 X3 D Ry

## What we looked at during class from the textbook and margin notes:

