

Row Reduction

Row reduction is the way that we abstract this process of solving system of equations to just working with matrices. To do row reduction, we use the three *elementary row operations*.

- 1) Swap two rows of the matrix.
- 2) Multiply a row of the matrix by any real number.
- 3) Add some multiple of one row to another row.

Gaussian Elimination

For Systems of Equations

→ Apply to the augmented matrix coming from the system.

The goal is to get to either the *row echelon form* or *reduced row echelon form*.

Row Echelon Form

- The first non-zero entry in each row is a 1.
- The leading entry of each row is always strictly to the right of any leading entries above it.
- Any entries below a leading 1 are all zero.

Ex

$$\left[\begin{array}{cccc|c} 1 & 0 & 2 & 3 & 4 \\ 0 & 1 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 & 2 \end{array} \right]$$

→ Can read off at least 1 variable then use back substitution.

Reduced Row Echelon Form

- Everything from the Row Echelon Form

Plus

- All entries above the leading 1s are zero.

(Does the back substitution for you)

$$\begin{bmatrix} \boxed{1} & 0 & 2 & 3 & 4 \\ 0 & \boxed{1} & 0 & 1 & 3 \\ 0 & 0 & 0 & \boxed{1} & 2 \end{bmatrix}$$



$$\begin{bmatrix} 1 & 0 & 2 & 0 & -2 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}$$