2 - Systems of Linear Equations

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2.1 Systems of Linear Equations

- **a SoLE:** is a finite set of equations each with the same variables
- **a Solution:** is a vector which is simultaniously a solution to each equation in the system
- **a Solution Set:** is the set of all solutions and is equivalent to solving the system

Thrm 3.22 - linear equations have either; a unique solution | infinitly many solutions | no solutions

2.2 Solving Linear Equations

- coefficients matrix → augmented matrix → row echelon form
- **Row Echelon Form:** a) leading 0's @ bottom, and, b) 1st non-zero entry (leading) in column to the left of any below
- Elementry row operations;
  1) Interchange rows
  2) Multiply a row by a non-zero constant
  3) add multiples of a row to another

Rank: is the number of non-zero rows in its row echelon form

Rank theorem: Let A be a coefficient matrix with n variables;

- no. of free variables = n − rank(A)

  → 0 free variables → unique solution

- **Homogenious:** constant term in each equation (d) = 0 (can't have no solutions)

Thrm 2.3 if A is homogenious system of 'm' equations with n variables; when m>n the system has infinitly many solutions

2.3 Spanning Sets & Linear Independance

Thrm 2.4 - A system of linear equations [A|b] is consistant iff b is a linear combination of A.

Span - All linear combinations of a set of vectors

Span - if $S=\{v_1, v_2, \dots, v_k\}$ is a set of vectors in $\mathbb{R}^n$ then span(S) is the set of all linear combinations of the vectors

→ if $\text{span}(S)=\mathbb{R}^n$, then S is a spanning set for $\mathbb{R}^n$