# Chapter 1: Linear Equations in linear algebra

## Summary

Systems can have solutions. Namely, **exactly one solution**, **no solution**, or **infinitely many solutions**. Make simpler equivalent systems and solve those row equivalent matrixes.

## Terminology

- ***solution***
    - sub this in the system to get a true statement
- ***equivalent systems***
    - systems may look different but are equivalent if their solutions are the same
    - example: multiply whole system by a constant
- ***consistent / does a solution exist***
    - at **least** one solution
- ***inconsistent***
    - **no** solution exists
    - often when [0 0 ... 0 n] *// because 0 != n*
- ***unique***
    - one solution
- ***m x n matrix***
    - m is rows, n is columns
- ***coefficient matrix***
    - does not include right-hand constants
- ***augmented matrix***
    - does include right-hand constants
- ***row equivalent***
    - elementary row operations changed *B* to *A*; written *B ~ A*
    - same solution set
    - elementary row operatins are reversable

## Section 1.1

- a linear equation (what is it?)
    - y = mx+b || y-y1 = m(x-x1) || x = 0

    - 4x + 3y + 2z = 1 *// could be multiple dimensions*
    - Don't need **x, y, z** instead use **x1, x2, ... xn** because there could be a wack ton of dimensions

- a linear equation (what is it not?)

    - x^2 = y *// not parabola*
    - x1 * x2 = 3 *// variables multiplied*
    - **can't ever have anything raised to a power**

**In general...**

A linear equation can be written like **a1x1 + a2x2 + ... anxn = b**.

Contants can be "0".

- a system (what is it?)

    - you can use substitution
    - they are in the same universe
    - the value that satisfies it works for all

## Solving linear equations

*Big idea:* make an equivalent system that is simpler and solve that one.

**Three things you can do to make an equivalent system**

1. Interchange two equations

- move them around

2. Multiply an entire equation by a nonzero constant

- scale it

3. Add / subtract two equations

- a = b, c = d => a +- c = b +- d

## Format how we write linear equations

- linear terms on left side
- constants on right side
- variables in order
- welcome *matrix notation*

## Matrix notation

**Elementary Row Operations** *(similar to equivalent system operations)*

1. *Exchange:* Interchange two rows
2. *Scale:* Multiply row by non-zero constant
3. *Remplacement:* Replace one row by the sum of itself and a multiple of another row

Coming up...
solve more systematically!