

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 $[0 \ 0 \ \dots \ 0 \ n]$ // because $0 \neq n$
- **unique**
 - one solution
- **$m \times n$ 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 $B \sim A$
 - same solution set
 - elementary row operations are reversible

Section 1.1

- a linear equation (what is it?)
 - $y = mx + b$ || $y - y_1 = m(x - x_1)$ || $x = 0$

- $4x + 3y + 2z = 1$ // *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*
 - $x_1 * x_2 = 3$ // *variables multiplied*
 - **can't ever have anything raised to a power**

In general...

A linear equation can be written like **$a_1x_1 + a_2x_2 + \dots + a_nx_n = b$** .

Constants 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
 - $a = b, c = d \Rightarrow a + c = b + d$

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. *Replacement:* Replace one row by the sum of itself and a multiple of another row

Coming up...
solve more systematically!