

linear equation - set of variables w/ coefficients and
a constant

ex $\rightarrow 2x + 5y = 3$

$\rightarrow 2x^2 + 5e^y = 7$

system of linear equations - set of linear equations
that all must be true simultaneously

solution - values for all vars that make system
true

solution set - all possible variables

solving - finding the solution set

consistent - there exists a solution

Inconsistent - no solution



R^n - all possible ordered n-tuples of real #'s

- how solutions are often expressed

ex - $(1, 2, -1, 0, 5)$

System of linear equations are converted
to a matrix

$$\left[\begin{array}{cccc|c} x_1 & y_1 & \dots & & a \\ x_2 & y_2 & & & b \\ \vdots & & \ddots & & c \\ & & & & \vdots \end{array} \right]$$

coefficients constants

• augmented
matrix

To solve convert to Row Reduced Echelon Form

free variables

$$\left[\begin{array}{ccc|c} 1 & 0 & * & a \\ 0 & 1 & * & b \end{array} \right]$$

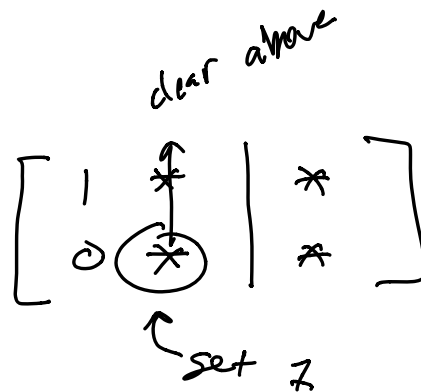
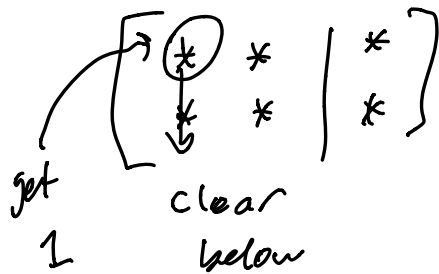
- above and below each pivot is all zeros
- this way we have isolated instances of these variables

Use 3 basic algebra tricks to convert to this form

- scaling
- replacement
- swapping

row equivalent - $M_1 = M_2$ through these techniques

Basic Algorithm



- extend to all dimensions

Parametric Form

- express solutions in form of parameters
- free variables become the parameters
- isolate pivots on left hand side

$$\text{ex} - (x, y, z) = (x, 5x-1, 3x)$$

Size of solution set

$$0 - \left[\begin{array}{ccc|c} 1 & 0 & 0 & a \\ & 1 & 0 & b \\ 0 & 0 & 0 & c \end{array} \right] \quad 0 \neq c$$

$$1 - \left[\begin{array}{ccc|c} 1 & 0 & 0 & a \\ & 1 & 0 & b \\ 0 & 0 & 1 & c \end{array} \right] \quad \cdot \text{all pivots}$$

$$\infty - \left[\begin{array}{ccc|c} 1 & 0 & * & a \\ 0 & 1 & * & b \end{array} \right] \quad \cdot \text{free variables}$$