**Class 14** – **System of Linear Equations (Chp. 8-10)**

ChE310\_SecB\_S2019 / 2.28.19

<http://www.reuelgroup.org/numerical-methods-che-310.html>

Announcements:

* Test grades released 2.28.19, prelim feedback
* Office hours: Friday request to meet w/ some groups 12-2

**Warm Up Group Activity:** submit to Jared by 2:25pm.

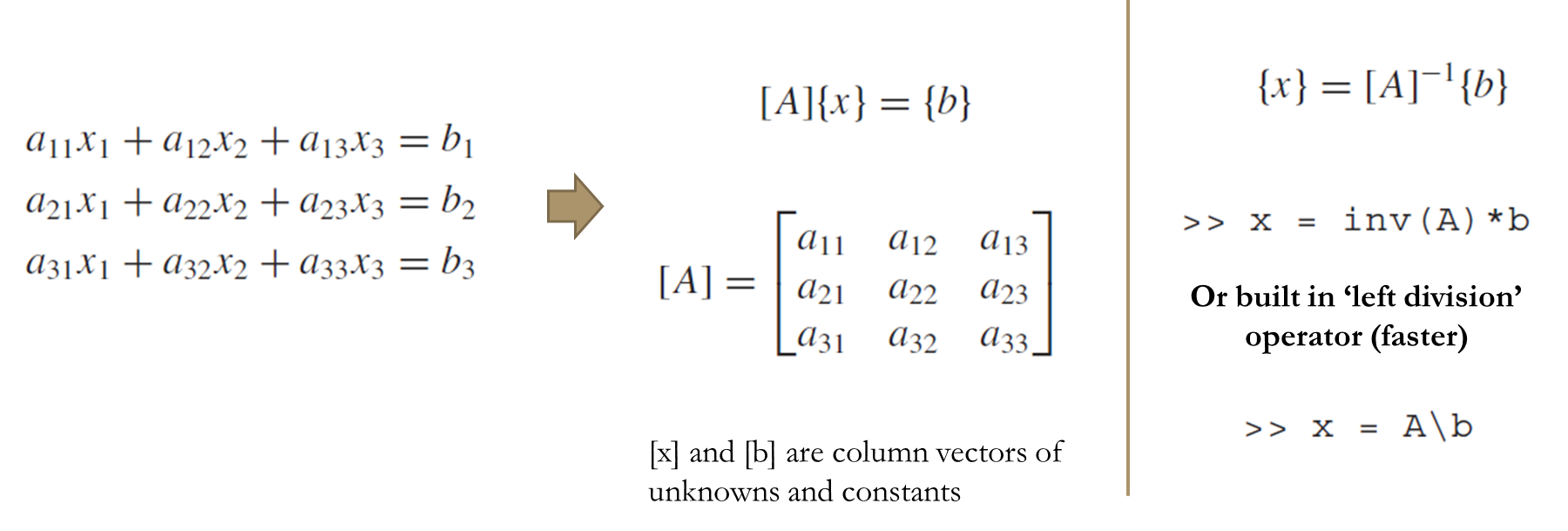
F(x,y) = 4\*exp(- ((x - 27/10)^2)/2 – ((y - 19/5)^2)/2)

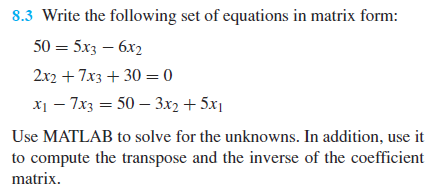
Plot a contour plot of the function [x and y from 0 to 5]

Find the maximum in this same region.

**Outline for Class 13 Lecture**

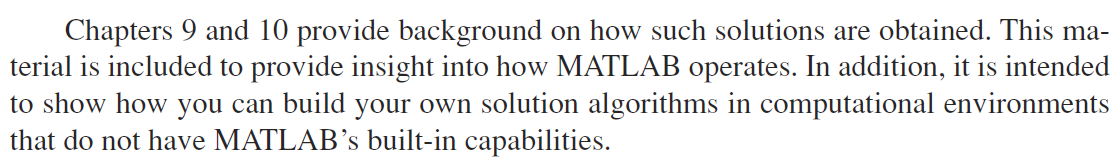
1. Chp. 8 Matrix math and setting up systems of linear equations (you review)
2. System of linear equations and **\** command





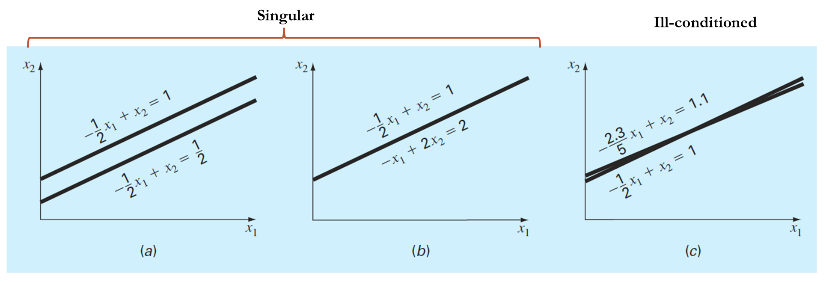
[demonstrate it is faster using tic toc]

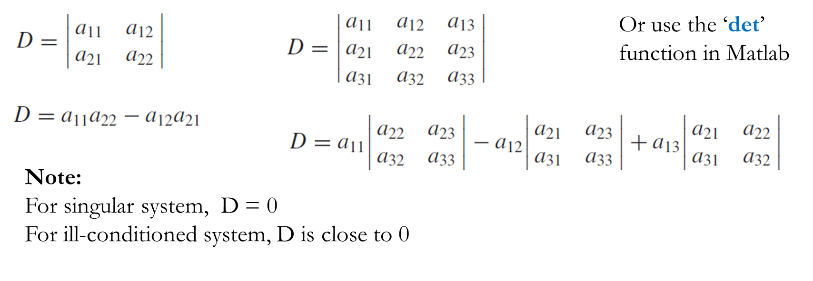
1. Why condense Chp. 9 and 10?



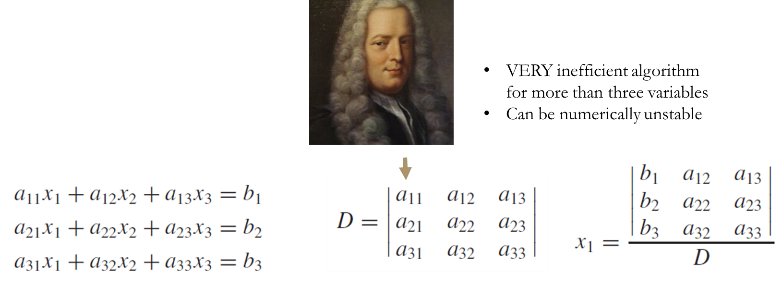
Dr. Reuel, “You will NEVER have to do this. At end of semester I will show you free Matlab clones.”

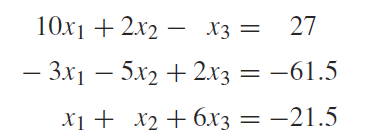
1. Condition and Determinants



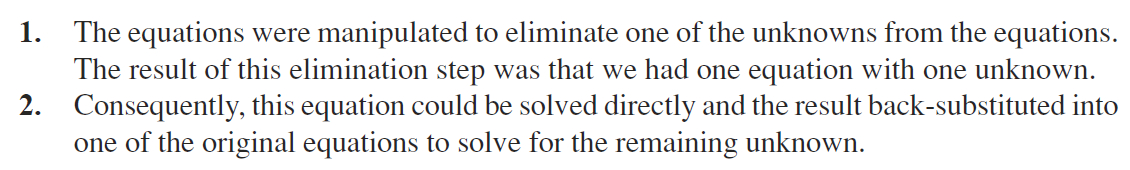


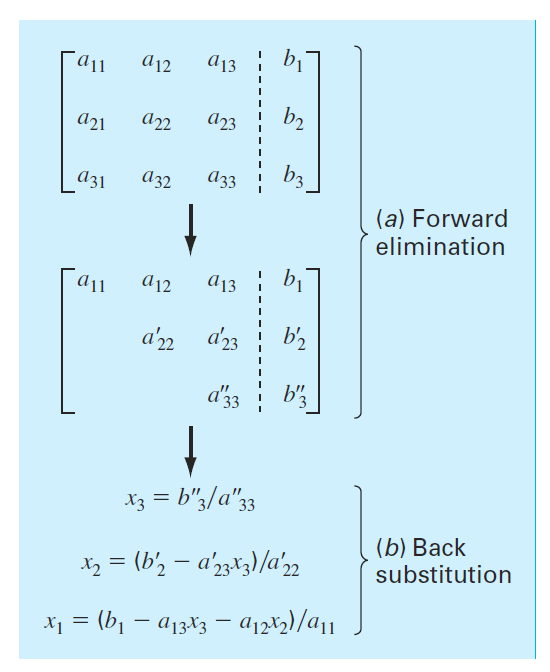
1. Cramer’s Rule [inefficient variables > 3]



Example (problem 9.6)

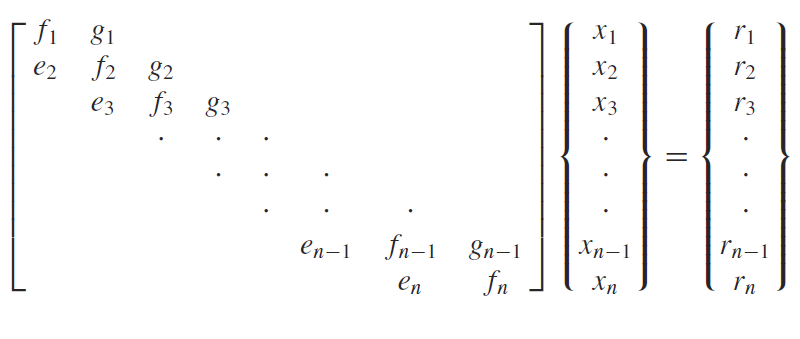
1. Under the hood of **\**
   1. Gauss Elimination





[**GaussNaive**, **GaussPivot**]

* 1. Partial Pivoting (move large element 1st)
  2. Banded Structures [Chapra **tridiag**]



FLOPS scale n^3 for Gauss elimination

FLOPS scale n for this algorithm…much faster for BIG systems

* 1. LU factorizations [Chp 10]
  2. Gauss Elimination as LU Factorization
  3. LU with pivoting
  4. Cholesky Factorization [Chp 10.3]

1. Another Example – distillation columns!
2. When **\** is used Matlab evaluates your coefficient matrix, and detects if efficient algorithms can be used for sparse, banded, symmetric or triangular patterns. No patterns it reverts to gauss elimination w/ partial pivoting.