Math 451

Q's

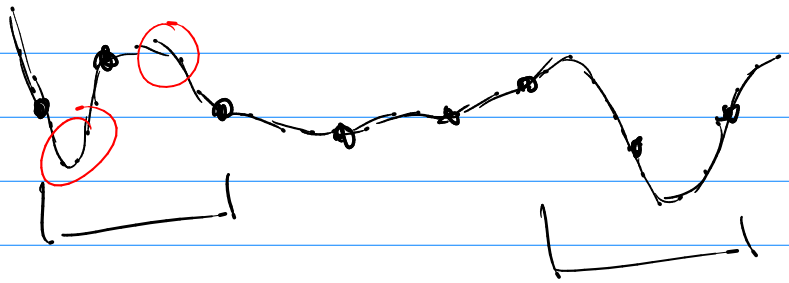
$Ax = b$

Math 541 → $x = A^{-1}b$

"Same" answer for x

linsolve(A, b)
linearsolver(A, b)
inv(A) * b
A\b

Interpolating Polynomial : ① K - data points
② polynomial of K terms
(degree = K-1)

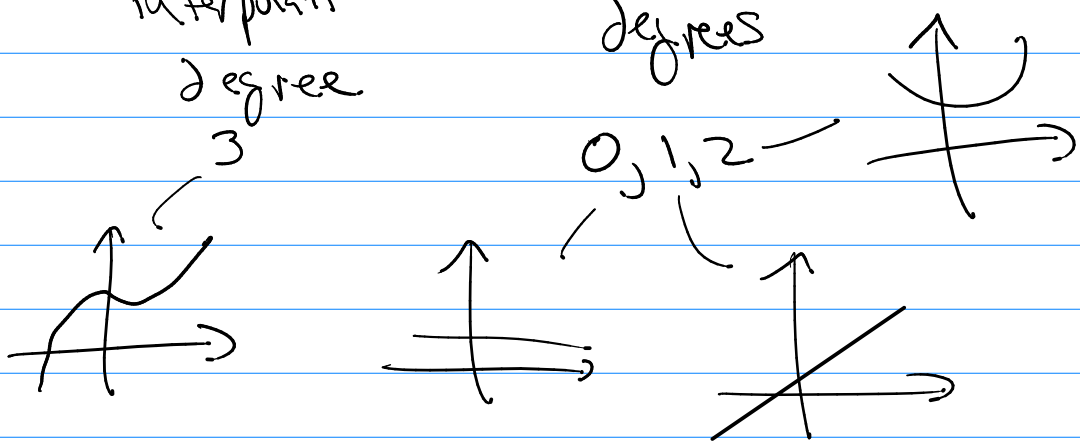


as K grew

Data fitting ① given K data points
② "fit" the data points with a polynomial of < K terms
(degree < K-1)

ex

Data	Polynomial interpolant degree	Data fitting degrees
4	3	0, 1, 2
20	19	0, 1, 2, ..., 18



$$y = c_1 x^n + c_2 x^{n-1} + \cdots + c_{n+1} x^0$$

degree n poly.

$(n+1$ coeff$)$

if data is actually represented by this poly (like it is for a polynomial interpolant) then..

system of eqns

$$y_k = c_1 (x_k)^n + c_2 (x_k)^{n-1} + \cdots + c_{n+1} (x_k)^0$$

in matrix form

$$\begin{bmatrix} x_1^n & x_1^{n-1} & \cdots & x_1 & 1 \\ x_2^n & x_2^{n-1} & \cdots & x_2 & 1 \\ \vdots & & & & \\ x_k^n & x_k^{n-1} & \cdots & x_k & 1 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ \vdots \\ c_{n+1} \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_k \end{bmatrix}$$

$$V c = Y$$

except $V c = y$

interpolating polynomial $V c = y$

V: $K \times K$, c: $K \times 1$, y: $K \times 1$

Data fitting $V c = y$

V: $K \times (n+1)$, c: $(n+1) \times 1$, y: $K \times 1$

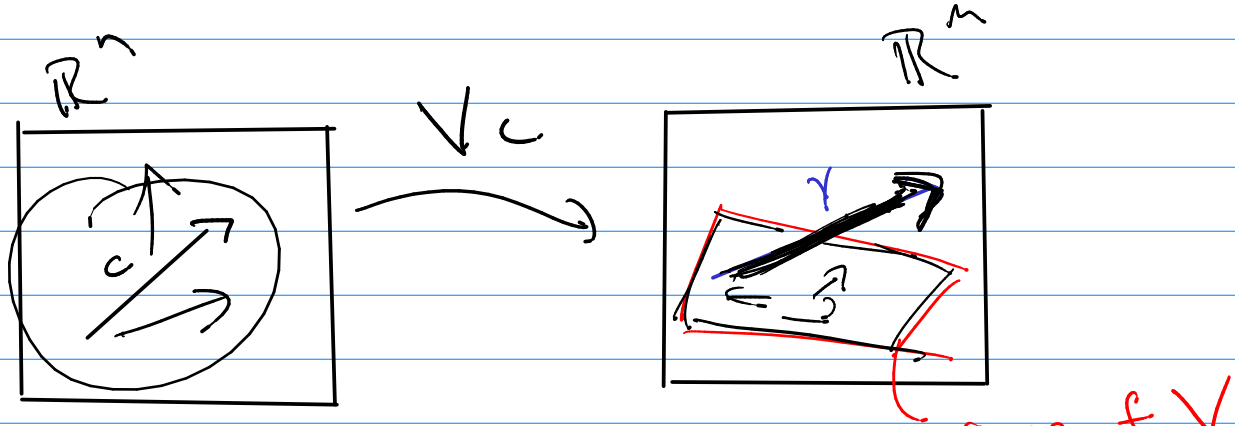
Over determined system → $n+1 < K$

→ typically has no sol'n.

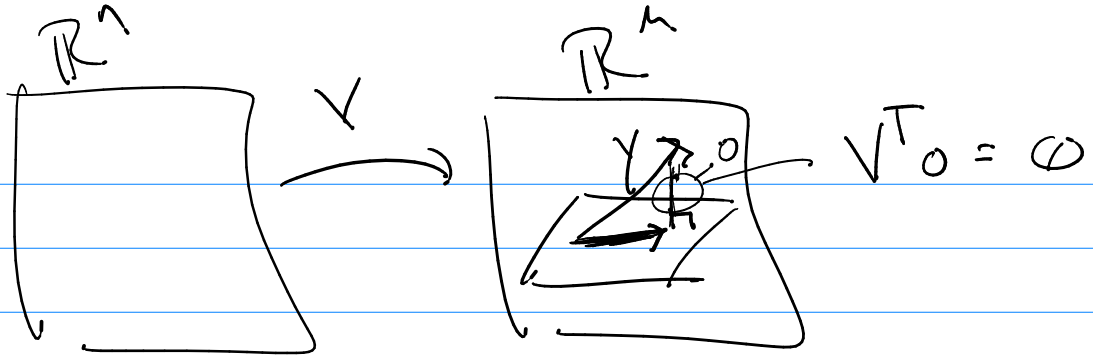
$V c = y$

V is $m \times n$ c is $n \times 1$ y is $m \times 1$

$m > n$ → over determined



So Solve $V c = y$



So $Vc = y$ (no-soln b/c over det)

Solve: $V^T V c = V^T y$ is now a determined system.

Sizes: $\underset{n \times n}{\left[V^T V \right]} \underset{n \times 1}{c} = \underset{n \times 1}{\left[V^T y \right]}$

$n \times n$ $\quad$ $n \times 1$

→ c is the least squares soln to $Vc = y$ (over det)