

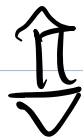
Find the quadratic equation through the origin that is a best fit for the points $(1,1)$, $(2,5)$, $(-1,-2)$.

Since quadratic equation, *through origin,

$$\underline{ct + dt^2 = y}$$

$$A = \begin{pmatrix} 1 & 1 \\ 2 & 4 \\ -1 & 1 \end{pmatrix}, \hat{x} = \begin{pmatrix} c \\ d \end{pmatrix}, b = \begin{pmatrix} 1 \\ 5 \\ -2 \end{pmatrix}$$

* We cannot solve $A\hat{x} = b$



$$A^T A \hat{x} = A^T b$$

$$\bullet A^T A = \begin{pmatrix} 1 & 2 & -1 \\ 1 & 4 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ 2 & 4 \\ -1 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 6 & 8 \\ 8 & 10 \end{pmatrix}$$

$$\bullet A^T b = \begin{pmatrix} 1 & 2 & -1 \\ 1 & 4 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 5 \\ -2 \end{pmatrix} = \begin{pmatrix} 13 \\ 19 \end{pmatrix}$$

$$\Rightarrow \begin{matrix} \times 2 \\ \times 4 \end{matrix} \begin{pmatrix} 6 & 8 \\ 8 & 10 \end{pmatrix} \hat{x} = \begin{pmatrix} 13 \\ 19 \end{pmatrix}$$

using elimination:

$$\begin{pmatrix} 6 & 8 \\ 0 & -2 \end{pmatrix} \hat{x} = \begin{pmatrix} 13 \\ 5 \end{pmatrix}$$

$$d = -5/2, \quad c = 11/2$$

$$\left[y^2 \frac{11}{2} t - \frac{5}{2} t^2 \right]$$

Steps:

- (S1) Identify the equation
- (S2) Matrix format
- (S3) Set up Projection Equations
- (S4) Computation.