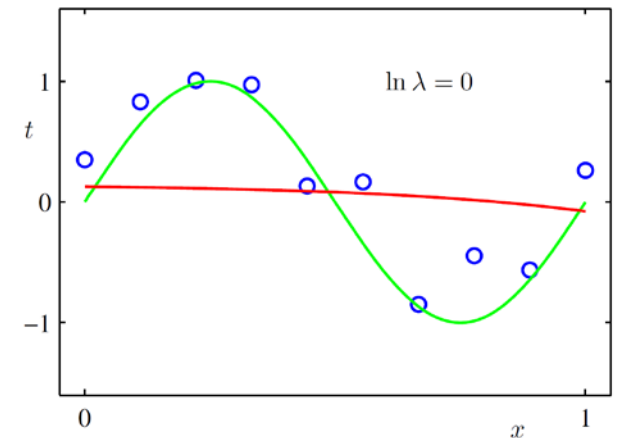# Project 1

BASICS ON CURVE FITTING
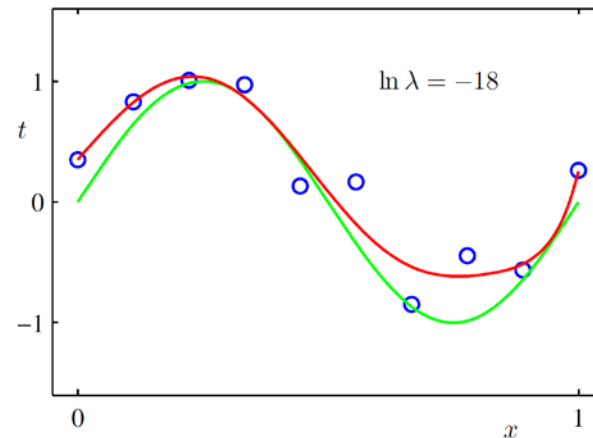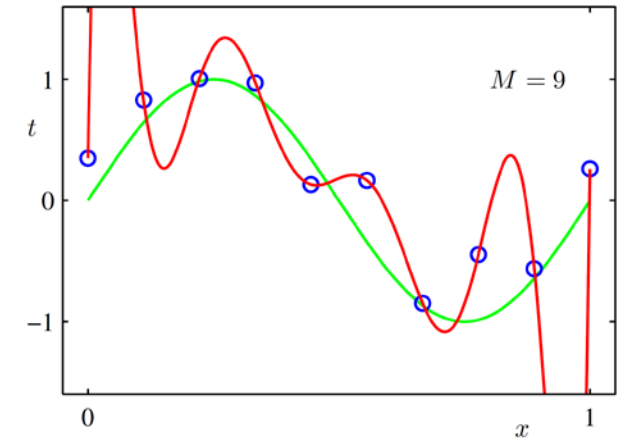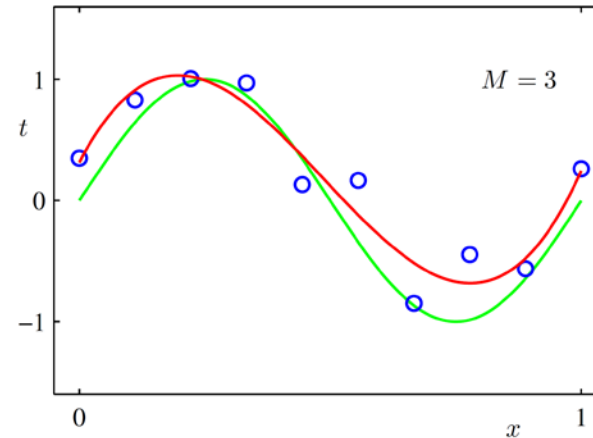
Part 1 and 2

- Energy Minimization

$$E(\mathbf{w}) = \frac{1}{2} \sum_{n=1}^{N} \{y(x_n, \mathbf{w}) - t_n\}^2$$

- Energy Minimization with Regulation

$$\widetilde{E}(\mathbf{w}) = \frac{1}{2} \sum_{n=1}^{N} \{y(x_n, \mathbf{w}) - t_n\}^2 + \frac{\lambda}{2} \|\mathbf{w}\|^2$$
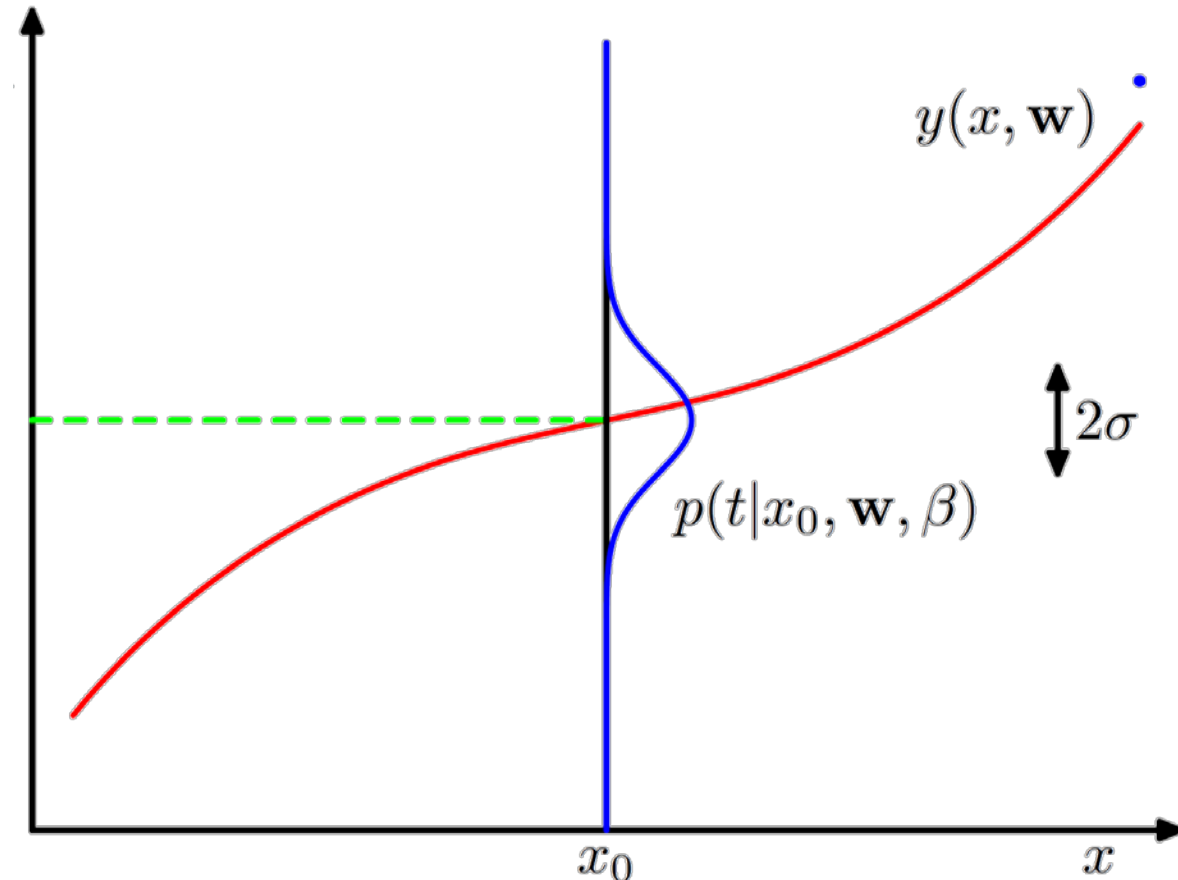
  - Note: when ln λ = 0, *it is the same as without regularization*

Part 3

▶ Maximum Likelihood

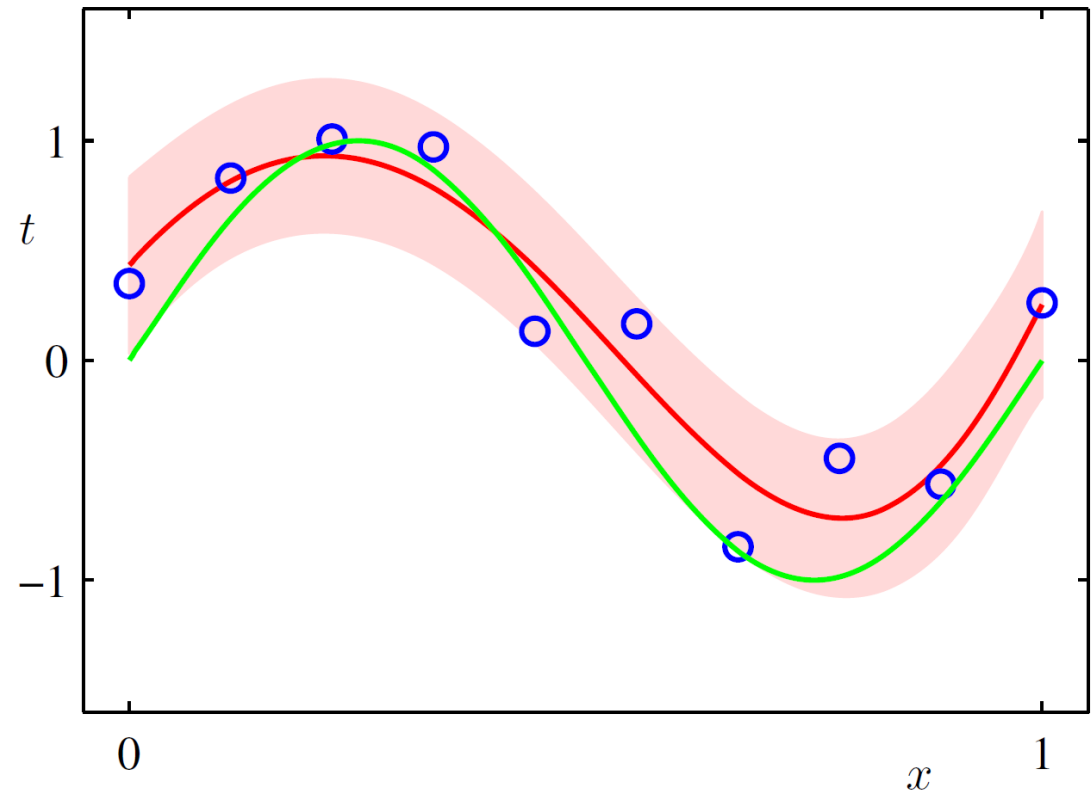> ▶ Find the beta parameter around the line by minimizing:

$$\ln p(\mathbf{t}|\mathbf{x}, \mathbf{w}, \beta) = -\frac{\beta}{2}\sum_{n=1}^{N}\{y(x_n, \mathbf{w}) - t_n\}^2$$

$$+ \frac{N}{2}\ln\beta - \frac{N}{2}\ln(2\pi).$$

Part 4

- Maximum a Posteriori
  - Regularizing weights with *hyperparameter* alpha

$$\frac{\beta}{2} \sum_{n=1}^{N} \{y(x_n, \mathbf{w}) - t_n\}^2 + \frac{\alpha}{2} \mathbf{w}^{\mathrm{T}} \mathbf{w}$$

Tips

- Do not wait until the last minute
  - Things usually take longer than expected
- Do not use inbuild matlab functions for the core functions (such as polyfit)
  - When we say "write a function", you have to write it
- Use backslash Matlab operator to solve linear system of equations (much faster and better)
  - E.g. to solve "$\vec{y} = A\vec{x}$" for a known "$\vec{y}$" and "A" you can use "$\vec{x} = A\backslash\vec{y}$"

How to write a good report

- Mimic what you see in research papers.
  - Use at least one figure or table to back up each point
  - Every figure and table has a descriptive caption
  - Separate out the report into logical sections
  - Use Latex to make it look decent and **Submit a PDF!!!**
  - Show Your work on how you derive EACH equation