

1. Find the local and global minimum and maximum (if exist) of the following functions.

(a)

$$f(x) = 2x^3 - 9x^2 + 12, \quad x \in \mathbb{R}$$

(b)

$$f(x) = \begin{cases} e^{-x} & -1 \leq x \leq 1 \\ e^{x-2} & 1 \leq x < \infty \end{cases}$$

2. Try to give a definition of a curve  $y$  that gives the *functional*  $J(y) = \int_a^b f(x, y, y') dx$  a local minimum.
3. Find the rectangle with the maximum area, given the perimeter is  $L$ .
4. Set up “*find the closed curve that has the maximum area, given the perimeter is  $L$* ” as an *isoperimetric* problem.