Linearization

Linearization

- Why is it important for this class?

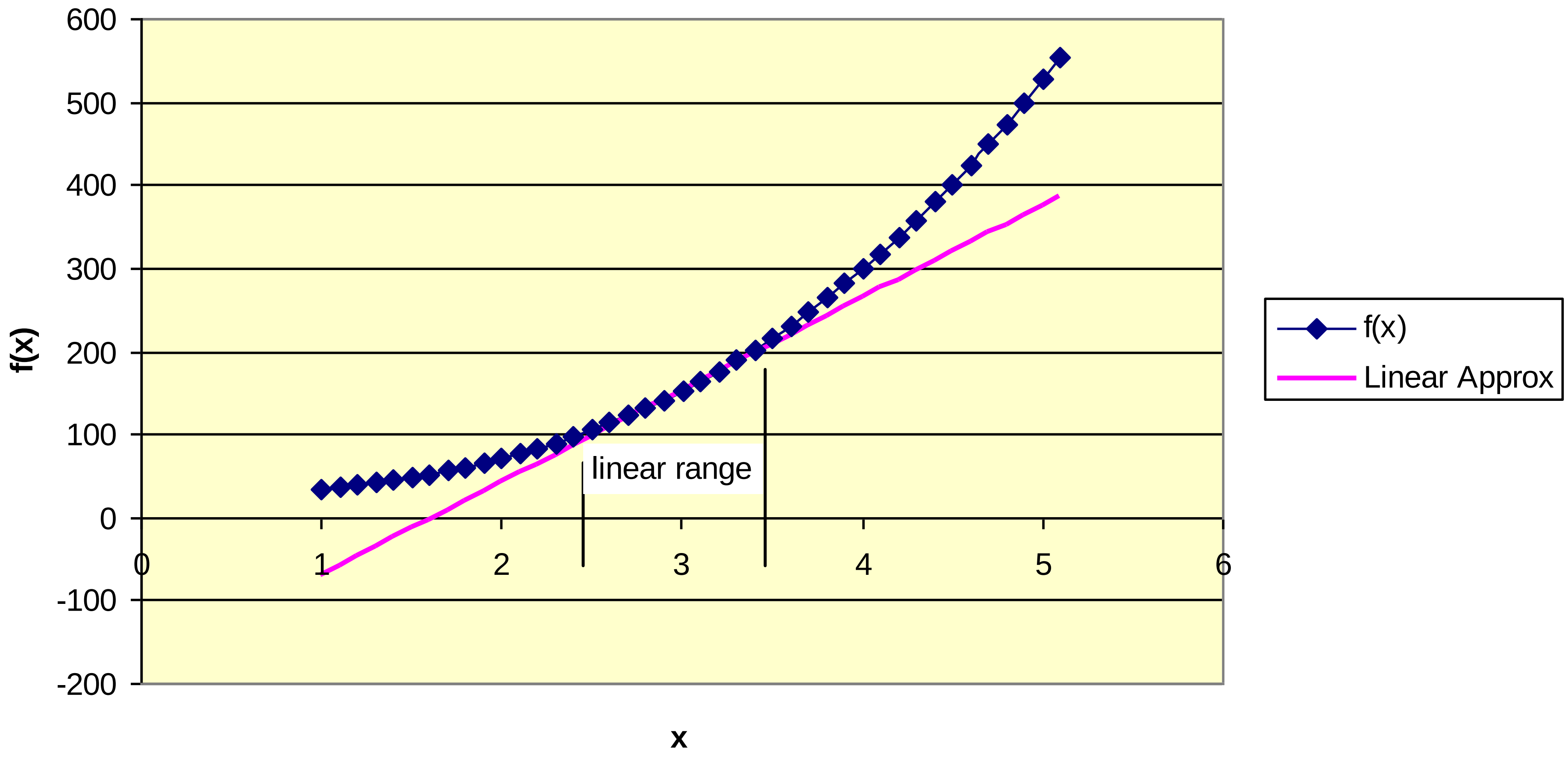
- How do we linearize a nonlinear equation?

$$f_{lin}(x,y) := f(x_{lin}, y_{lin}) + \left(\frac{d}{dx_{lin}} f(x_{lin}, y_{lin})\right) \cdot (x - x_{lin}) + \left(\frac{d}{dy_{lin}} f(x_{lin}, y_{lin})\right) \cdot (y - y_{lin})$$

1-D Linearization Example

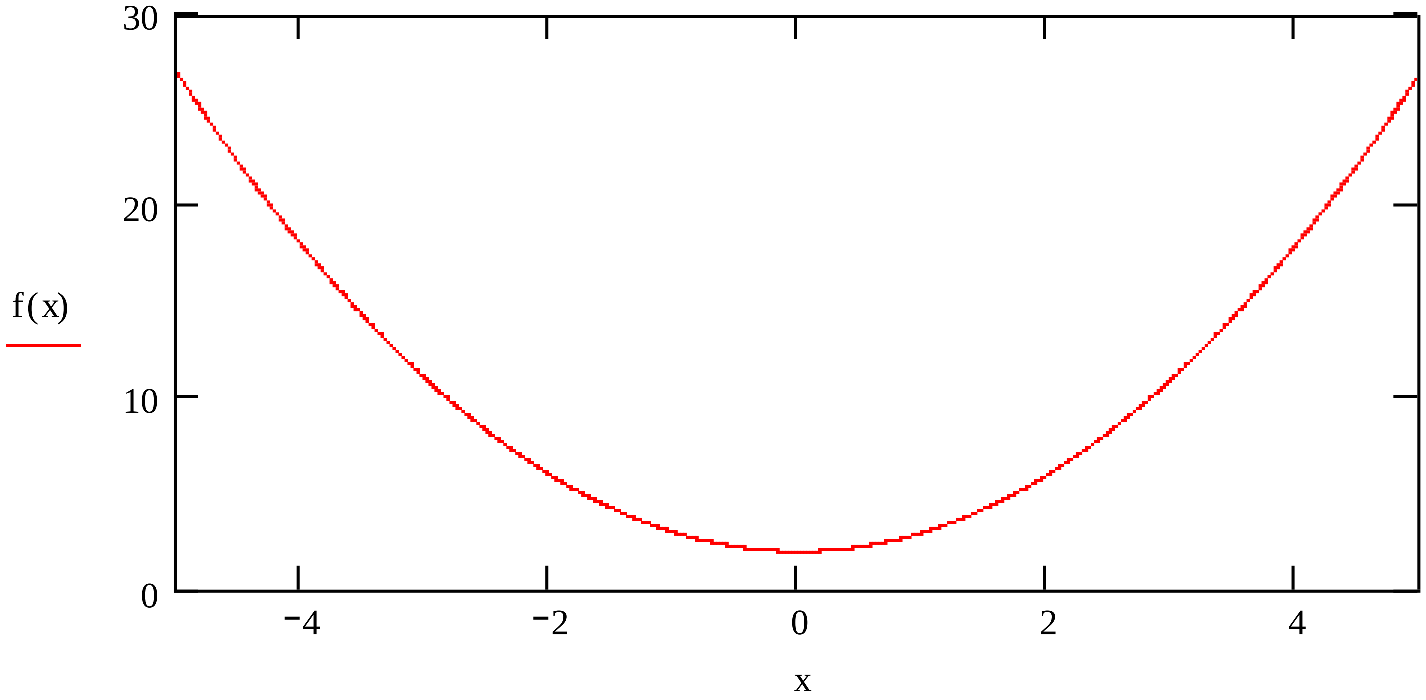
$$f(x) = 3x^3 + 5x^2 + 27$$

$$\bar{x} = 3.0$$



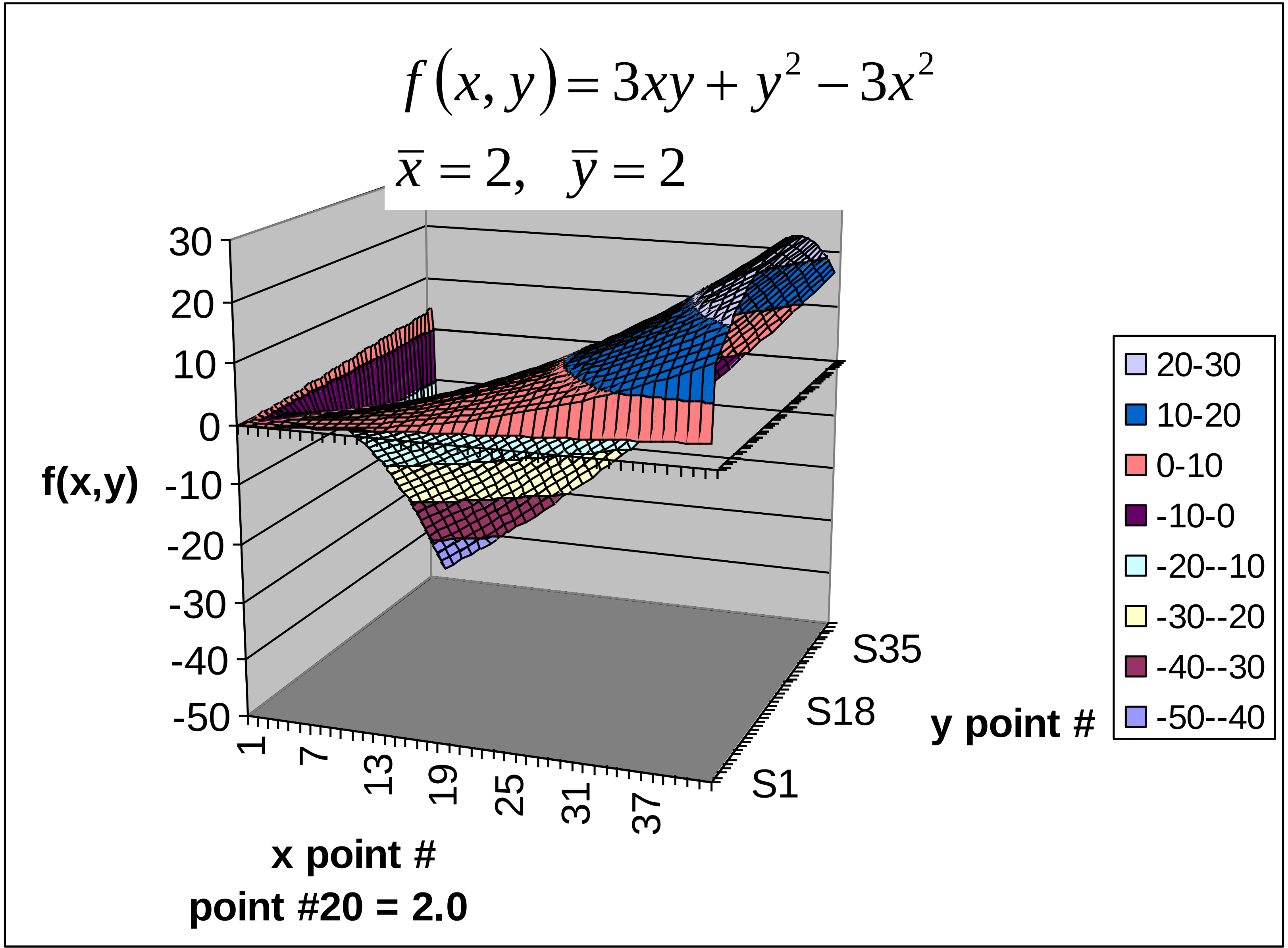
1-D Linearization Application

$$f(x) := x^2 + 2$$

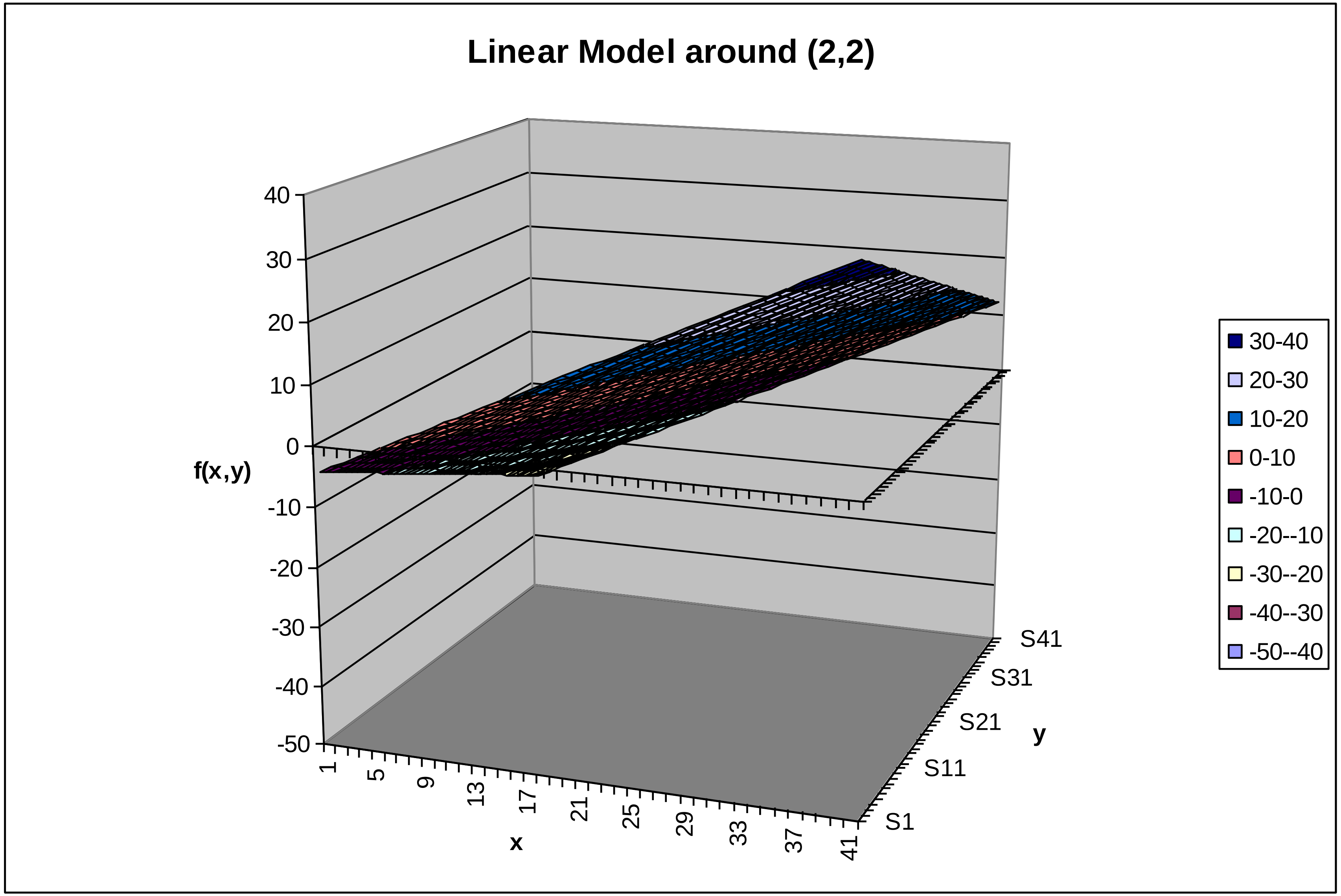


$$f_{lin}(x,y) := f(x_{lin}, y_{lin}) + \left(\frac{d}{dx_{lin}} f(x_{lin}, y_{lin})\right) \cdot (x - x_{lin}) + \left(\frac{d}{dy_{lin}} f(x_{lin}, y_{lin})\right) \cdot (y - y_{lin})$$

2-D Linearization Example

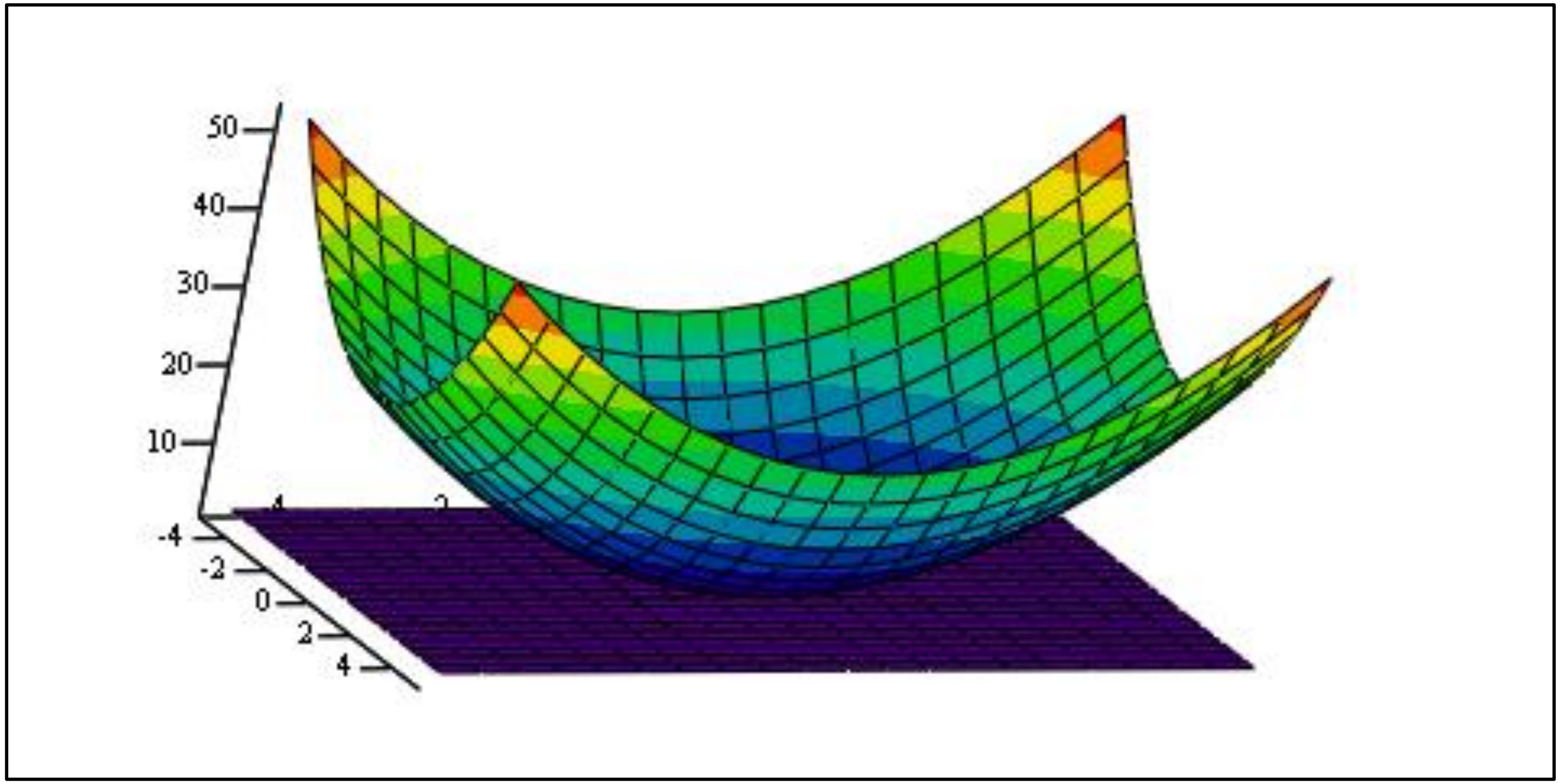


2-D Linearization Example



2-D Linearization Application

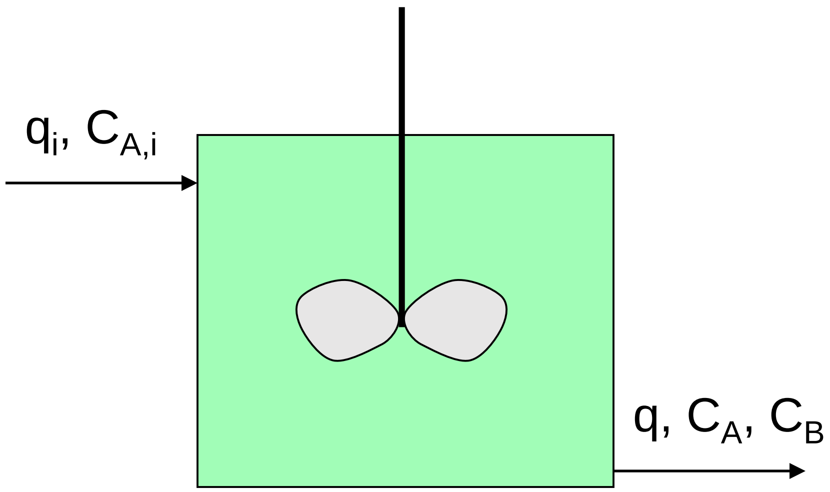
$$f(x,y) := x^2 + y^2 + 2$$



f, f_{lin}

$$f_{lin}(x,y) := f(x_{lin}, y_{lin}) + \left(\frac{d}{dx_{lin}} f(x_{lin}, y_{lin})\right)\cdot(x - x_{lin}) + \left(\frac{d}{dy_{lin}} f(x_{lin}, y_{lin})\right)\cdot(y - y_{lin})$$

CSTR



$$-r_A = k_1 C_A^2 - k_2 C_A C_B$$