

1 15.8: Lagrange Multipliers

Definition. (Parallel Gradients)

Let f be a differentiable function in a region of \mathbb{R}^2 that contains the smooth curve C given by $g(x, y) = 0$. Assume f has a local extreme value on C at a point $P(a, b)$. Then $\nabla f(a, b)$ is orthogonal to the line tangent to C at P . Assuming $\nabla g(a, b) \neq \mathbf{0}$, it follows that there is a real number λ (called a **Lagrange multiplier**) such that $\nabla f(a, b) = \lambda \nabla g(a, b)$.

Procedure- Lagrange Multipliers: Absolute Extrema on Closed and Bounded Constraint Curves

Let the objective function f and the constraint function g be differentiable on a region \mathbb{R}^2 with $\nabla g(x, y) \neq \mathbf{0}$ on the curve $g(x, y) = 0$. To locate the absolute maximum and minimum values of f subject to the constraint $g(x, y) = 0$, carry out the following steps.

1. Find the values of x , y , and λ (if they exist) that satisfy the equations

$$\nabla f(x, y) = \lambda \nabla g(x, y) \text{ and } g(x, y) = 0.$$

- 2.