5.9 Stationary Values Under Constraints

let's consider finding max value of differentiable f$\underline{^{n}}$ $f(x,y)$ subject to constraint $g(x,y) = c$

method of Lagrange undetermined multipliers

to max f, need: $df = \dfrac{\partial f}{\partial x} dx + \dfrac{\partial f}{\partial y} dy = 0$

constrained b/c g is constant: $dg = \dfrac{\partial g}{\partial x} dx + \dfrac{\partial g}{\partial y} dy = 0$

multiplying dg by an unknown value λ & adding to df:

$$d(f + \lambda g) = \left(\dfrac{\partial f}{\partial x} + \lambda \dfrac{\partial g}{\partial x} \right) dx + \left(\dfrac{\partial f}{\partial y} + \dfrac{\partial g}{\partial y} \lambda \right) dy$$

λ is Lagrange undetermined multiplier

dx & dy are indpt. & arbitrary

must choose λ st. : $\dfrac{\partial f}{\partial x} + \dfrac{\partial g}{\partial x} \lambda = 0$ $\dfrac{\partial f}{\partial y} + \lambda \dfrac{\partial g}{\partial y} = 0$

w/constraint $g(x,y) = c$, enough to find λ