Lagrange Multipliers

Lagrange Multipliers with One Constraint

1. Get zero on one side of the constraint, the other side is g
2. Find ∇f and ∇g
3. Solve $\nabla f = \lambda \nabla g$

   Either:
   - a) Find x = somethingλ, y = somethingλ
   - b) Plug these into constraint and solve for λ
   - c) Now plug λ into x = somethingλ, y = somethingλ and find x, y

   Or:
   - a) solve both equations for λ and equate them

1. Use Lagrange multipliers to find the indicated extrema, assuming that x and y are positive (Similar to p.976 #5-10)

$$Minimize \quad f(x,y) = x^2 + 3y^2$$
$$Constraint: x + 4y - 7 = 0$$

2. Use Lagrange multipliers to find the indicated extrema, assuming that x and y are positive (Similar to p.976 #5-10)

$$Minimize \quad f(x,y) = \sqrt{x^2 - y^2}$$
$$Constraint: 3x + 2y = 5$$

3. Use Lagrange multipliers to find the indicated extrema, assuming that x, y and z are positive (Similar to p.976 #11-14)

$$Minimize \quad f(x,y,z) = x^2 + y^2 + z^2$$
$$Constraint: x + y + z - 5 = 0$$

4. Use Lagrange multipliers to find the indicated extrema of f subject to two constraints. In each case, assume that x, y and z are nonnegative (Similar to p.976 #17-18)

$$Maximize \quad f(x,y,z) = xyz$$
$$Constraint: x + y + z = 20, x - y + z = 0$$

$$\nabla f = \lambda \nabla g + \mu \nabla h$$

5. Use Lagrange multipliers to find the minimum distance from the curve or surface to the indicated point. [Hint: use min $f(x, y) = (x-x_o)^2 + (y-y_o)^2$
(Similar to p.976 #19-25)

$$Curve: \quad Line: 4x - y = 2$$
$$Point: (3,5)$$