

## Formulas & Definitions: Section 14-8

**Method of Lagrange Multipliers:** To find the maximum and minimum values of  $f(x, y, z)$  subject to the constraint  $g(x, y, z) = k$  [assuming that these extreme values exist and  $g \neq 0$  on the surface  $g(x, y, z) = k$ ]:

- (a) Find all values of  $x, y, z$ , and  $\lambda$  such that

$$\nabla f(x, y, z) = \lambda \nabla g(x, y, z), \quad g(x, y, z) = k.$$

- (b) Evaluate  $f$  at all points  $(x, y, z)$  that result from step (a). The largest of these values is the maximum value of  $f$ ; the smallest is the minimum value of  $f$ .

**Two constraints:**

$$\nabla f(x_0, y_0, z_0) = \lambda \nabla g(x_0, y_0, z_0) + \mu \nabla h(x_0, y_0, z_0)$$