$$\Delta Y = 0 = \left(\frac{\partial Y}{\partial x_1} - \frac{\partial g / \partial x_1}{\partial g / \partial x_2} \frac{\partial Y}{\partial x_2} \right) dx_1$$

$$0 = \frac{\partial Y}{\partial x_1} - \frac{\partial Y / \partial x_2}{\partial g / \partial x_2} \frac{\partial g}{\partial x_1}$$

Method of Lagrangian Multiplier

$$0 = \frac{\partial Y}{\partial x_1} + \lambda_1 \frac{\partial g_1}{\partial x_1} + \lambda_2 \frac{\partial g_2}{\partial x_1} + \cdots \qquad \lambda_1 = - \frac{\partial Y / \partial x_2}{\partial g / \partial x_2}$$

$$0 = \frac{\partial Y}{\partial x_2} + \lambda_1 \frac{\partial g_1}{\partial x_2} + \lambda_2 \frac{\partial g_2}{\partial x_2} + \cdots$$

$$Y(x_i)$$

Subject to

$$g_j(x_i) = 0$$

$i = 1 \text{ — } \text{ — } n$

$j = 1 \text{ — } \text{ — } m$

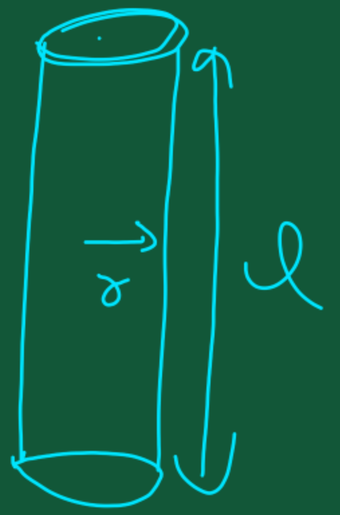
$$L(x_i, \lambda_j) = Y(x_i) + \sum_{j=1}^{m} \lambda_j \, g_j(x_i)$$

Necessary Condition

$$\frac{\partial L}{\partial x_i} = \frac{\partial Y}{\partial x_i} + \sum_{j=1}^{m} \lambda_j \frac{\partial g_j}{\partial x_i}$$

$$V = \pi r^2 l$$

$$A_0 = 2A\pi = 2\pi r l + 2\pi r^2$$



$$L = \pi r^2 L + \lambda_1 \left[2\pi r l + 2\pi r^2 - 24\pi \right]$$

$$\frac{\partial L}{\partial r} = 0$$

$$\frac{\partial L}{\partial l} = 0$$

$$\frac{\partial L}{\partial \lambda_1} = g(r, L) = 0$$