

Problem E

Derive the appropriate Euler-Lagrange equation for the case where the integral S has the form

$$S = \int_{x_1}^{x_2} f\left(y(x), y'(x), y''(x), x\right) dx$$

that is, where the integrand can depend on y'' as well as y and y' . The values of y and y' are specified at the end points x_1 and x_2 . This means the variation of the path, $\eta(x)$, must satisfy all of

$$\eta(x_1) = \eta(x_2) = 0, \quad \text{and} \quad \eta'(x_1) = \eta'(x_2) = 0.$$