Midterm Exam No. 01 (2021 Spring)

PHYS 510: CLASSICAL MECHANICS

Department of Physics, Southern Illinois University–Carbondale

Date: 2021 Mar 2

1. (**20 points.**) Evaluate the functional derivative

$$\frac{\delta F[u]}{\delta u(x)} \tag{1}$$

of the following functional,

$$F[u] = \int_a^b dx \, \frac{1}{\sqrt{1 + \left(\frac{du}{dx}\right)^2}}, \tag{2}$$

assuming no variation at the end points.

2. (**20 points.**) Evaluate the functional derivative

$$\frac{\delta F[u]}{\delta u(x)} \tag{3}$$

of the following functional,

$$F[u] = \int_a^b dx \, \sqrt{1 + \frac{du}{dx} + \frac{d^3u}{dx^3}}, \tag{4}$$

assuming no variation at the end points.

3. (**20 points.**) Prove the intuitively obvious statement that the curve of shortest distance going through two points on a plane, the geodesics of a plane, are straight lines passing through the two points.