

## Problems Proposed for the Final

April 14

### Proposed by Jordan Franks

Consider the functional

$$\mathcal{F}(u) = \int_0^b \frac{1}{\sqrt{-2gu(x)}} \sqrt{1 + u'(x)^2} dx.$$

This is the functional for the Brachistochrone problem. Show that there exists a first integral of the form

$$p = f(u, C),$$

where  $C$  is a constant of integration.