Math4090 Individual Project

Due 11:30am, March 17, 2010

Consider the situation when the path of the tunnel is given by the monotonically increasing function $y = \eta(x)$ with $\eta(0) = h$ and $\eta(L) = h + H$. Here h is the depth of the lake at the tunnel entrance and H is the verticle height difference between the tunnel entrance and the exit, cf. Fig 1.

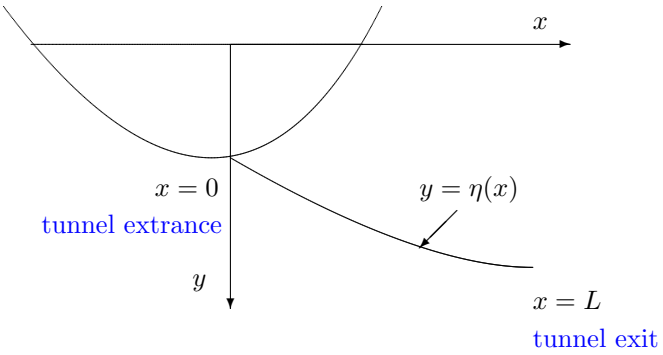

Figure 1: *Schematic of the under water tunnel.*

1. Suppose that the cost of contruction is depth dependent, given by $c(y)$, where y is the depth measured from the lake surface. Find the equation satisfied by the path $y = \eta(x)$ so that the total cost of constrcuction is minimized when $c(y)$ is a monotonically increasing function of y.
2. Find the path function $\eta(x)$ when $c(y)$ is a constant.
3. Find the path function $\eta(x)$ when $c(y) = 1 + y/(H + h)$.
4. Based the tunnel path obtained above and the equation of motion derived in Assignment 2, compute the maximum pressure in the tunnel after the rock plug is removed.
5. Write a short report to summarize solution procedures and numerical results. You must include working codes and relevant printouts to demonstrate the methodologies used in obtaining your solutions.