K Can Be Chosen Conveniently To Make the Boundary Conditions Match, Where $K = \rho g l^2$. **a) Determine the Explicit Potential Energy Functional,** U**, as a Definite Integral Over** x**, And Identify the Integrand** f**. b) Determine the Extremum Solution,** $z(x)$, Which Represents the Cable Configuration That Corresponds To the Minimum Potential Energy, Where You Can Use $K = \rho g l^2$, **And Specify the End Point,** (x_0, z_0)**, In Terms Of** x_0**. c) Sketch the 2D Cable Curve**, Where the First End Point Is $(0,1)$, And Second (Elevated) End Point Is (x_0, z_0), Noting the Specific z_0 Value As a Function Of x_0, And Describe If the Solution Function, $z(x)$, Is Well Known (Stating Where You Have Seen It Before). **d) Calculate the Potential Energy,** U_{straight}**, For the Path Which Is the Straight Line Path; Calculate the Potential Energy,** U_{low}**, For the Low Path** That Goes Horizontally Along $z = 1$, And Then Vertically Along $x = x_0$; **And Calculate the Potential Energy,** $U_{\min}$**, For Your Minimum Solution Path,** $z(x)$, All Between the Same Two End Points That You Have Identified (As Shown Below), Where All Results Should Be Expressed In the Given Parameters, ρ, g, l, x_0. **e) Finally, Compare All Potential Energy Results,** $U_{\text{straight}}, U_{\text{low}}, U_{\min}$**, By Calculating the Ratio,** $U / \rho g l^2$**, For Dimensionless** x_0 **Length Values Of** $x_0 = 0.1, 0.5, 1.0, 2.0, 3.0$ (If Necessary, To 5 Decimals)**, Also, Expand Each Result For a Small** $x_0 \ll 1$**, Up To the First Two Lowest Order Powers In** x_0, So That You Can Finally **Give An**