\[
\frac{mv^2}{2} = mgh = mgL(1 - \cos \theta)
\]
\[
V = \sqrt{2gL(1 - \cos \theta)} = 2.748 \text{ m/s}
\]

\[
W = \int Fds = \int_{x_1}^{x_2} \frac{M}{L} x \cdot g \, dx
\]

\[
= \frac{M}{L} g \left[ \frac{x^2}{2} \right]_0^{x_2} = \frac{MgL}{32}
\]

\[
mg \cdot 5R = mgR + \frac{1}{2}mv^2
\]

\[
4mgR = \frac{1}{2}v^2 \quad \Rightarrow \quad v^2 = 8gR
\]

\[
F_c = \frac{mv^2}{2} = 8mg
\]

\[
F_{\text{gravity}} = mg
\]

\[
\theta = 82.9^\circ
\]

\[
\text{ Net } F_{\text{net}} = \sqrt{65}mg = 8.06mg
\]

\[
W = \int Fds = \int_{x_1}^{x_2} (52.8x + 38.4x^2) \, dx = \left(52.8 \frac{x^2}{2} + 38.4 \frac{x^3}{3}\right)_{x_1}^{x_2} = 69.09 \text{ Joule}
\]

\[
\Rightarrow \quad v = \sqrt{\frac{2W}{m}} = 7.98 \text{ m/s}
\]

\[
F = -\frac{du}{dx}
\]

\[
100 \quad \text{ rip } c \quad \text{ or } \quad u = 52.8 \frac{x^2}{2} + 38.4 \frac{x^3}{3} + C
\]

\[
F = -\frac{du}{dx}
\]
\[ F = N + mg = m \frac{v^2}{R} \]

\[ m \frac{v^2}{R} = mg \implies v^2 = rg \]

Case 1: \( N = 0 \)

Case 2: With frictionless surface, centripetal force is zero, \( C = 0 \) and solving the equation:

\[ \frac{mu^2}{2} = \frac{mr_0g}{2} \]

\[ \text{orbital height } h = \frac{R}{2} \]

\[ E = E_k + \frac{1}{2}mv^2 + \frac{mr_0g}{2} \]

\[ h = \frac{R}{2} \]

\[ E = mgh = m r_0g \square \alpha \beta \gamma \delta \epsilon \zeta \eta \theta \]