1 Introduction

Today is 20211211, and I deciede to note down all of my knowledge about problems in this notebook. Actually we think for a while whether to seperatre the knowledge into different documents.

2 Physics

2.1 Energy

2.1.1 T0001

The coordinate of free fall ball ends. With energy equation, we have $GH = \mu G \xi kH$, considering of the backward length, we draw the figure and it can be transfered from the figure $y = |x|$. We have the coordinate at $[1 - |(\mu k)^{-1} \pmod 2 - 1|]kH$.

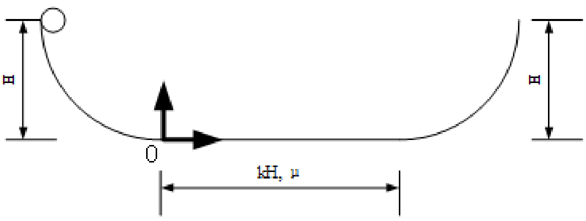

图 1: [T0001: Where the ball ends]

2.1.2 T0002

Suppose the ball free falls tangently into a circle, at the top of the circle, to matian the circular movement, $mg + F_{support} = mv^2/R$, since $m(n-2)gR = 1/2mv^2$, we have $F_{support} = mg(2n-5)$.

When $n <= 1$, it is easy to see that the ball swings. When $n >= 2.5$, the ball keeps going along the circle. When $n \in (1, 2.5)$, suppose the ball is at the angle θ as shown in the figure, the energy equation shows that $(nR - R + R\cos\theta)mg = 1/2mv^2$, force equation shows that $F_{support} - mg\cos\theta = mv^2/R = 2mg(n - 1 + \cos\theta)$, so $F_{support} = mg(2n - 2 + 3\cos\theta)$. when $F_{support} = 0$, the ball falls, and it falls at the angle $\cos\theta = \frac{2}{3}(1-n)$.

2.1.3 T0003

When an object seperates into several parts, the velocity of each component is different. Using the momentum equation, we have $mv = (-dm)u + (v + dv)(m + dm)$, and we let $u = v + dv - v_{rel}$, so we have $0 = v_{rel}dm + mdv$, so $dv = -vrel\frac{dm}{m}$, the formula is integrated as $v_{final} - v_0 = v_{rel}\ln\frac{m_0}{m_{final}}$. This means that when the rocket accolerates like this, the final mass

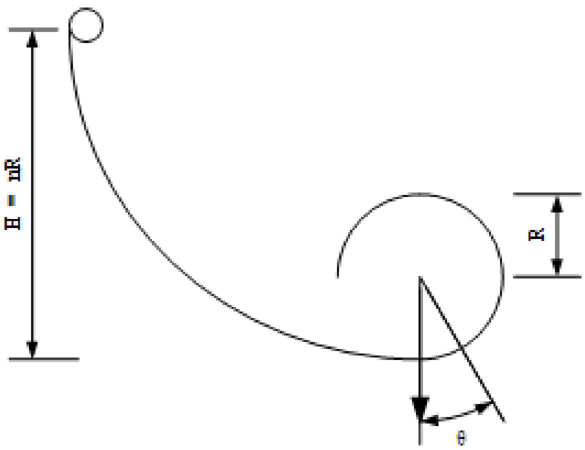

图 2: [T0002: Where the ball falls]

needs to be quite small, because the logarithm function decreases rapidly, also the v_{rel} needs to be big.

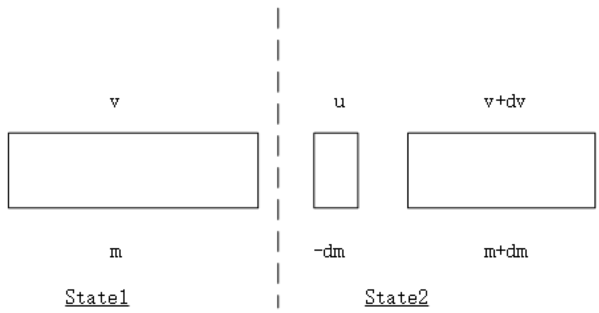

图 3: [T0003: Where the ball falls]