ME 5180 Homework #4

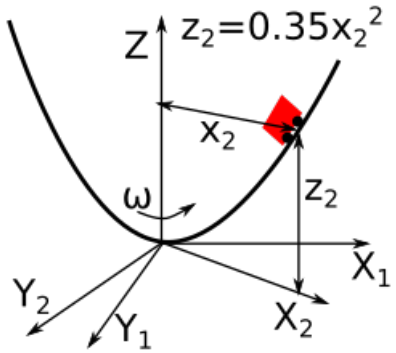

Figure 1: Whirling Roller-coaster

A roller coaster is being designed on a parabolic track that rotates at a constant speed as seen in the figure above. Assume the cart rolls on the track as a frictionless point-mass of 100-kg. Determine the equations of motion in terms of the distance from the lowest point, $q_1 = x_2$.

a. What is the kinetic energy of the cart?

b. What is the virtual work done by gravity on the cart, F_{q_1} ?

c. What is the equation of motion for the cart?

d. If the cart starts at rest at a=10 m, what speed would keep the cart stationary as the track spins?