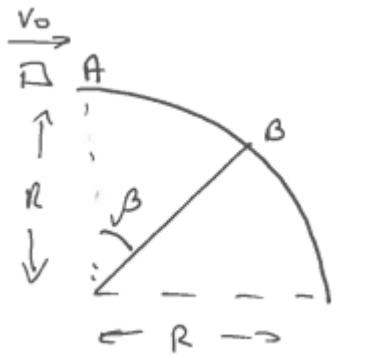
PHYS216 Midterm

February 2016

1 Question 1

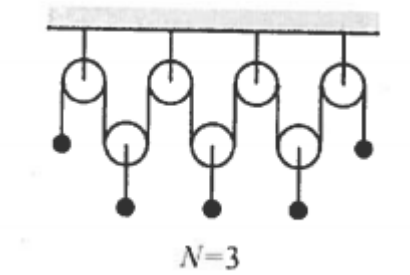
(10 pt) A small vehicle enters the top (point A) of a circular path with horizontal velocity V_0 (and angular velocity $\omega_0 = \frac{V_0}{R}$), and gathers speed as it moves down the track.



1. draw a free body diagram. write the balance of forces in the radial and angular directions (3 pt)
2. Recall that if $\ddot{\beta} = f(\beta)$, $\omega = \dot{\beta}$ then $\omega d\omega = f(\beta)d\beta$. Derive this expression (2pts)
3. Using this equation, intergrate both sides of the angular force balance equations to find ω as a function of β (ie. find $\omega(\beta)$). (3pts)
4. Using $\omega(\beta)$ (leave it arbitrary if you have not obtained it), find the support force N acting in the radial direction. (2pt)

2 Question 2

(10pt) Consider an arbitrary number (N+ 2) of equal masses (m) configured as in the figure. The N = 3 case is drawn. Clearly Define the coordinates for the location of each mass in your answer.



1. Write down the equations F = ma for each of the masses. Use a free body diagram, neglect friction and express the force in terms of the cable's tension T (3pts)
2. Write down the constrain on the acceleration of each mass , resulting from the cable being in-extendible. (3 pts)
3. Use the equations above to find T (2 pts).
4. Use T to find the acceleration of each mass. (2 pts)