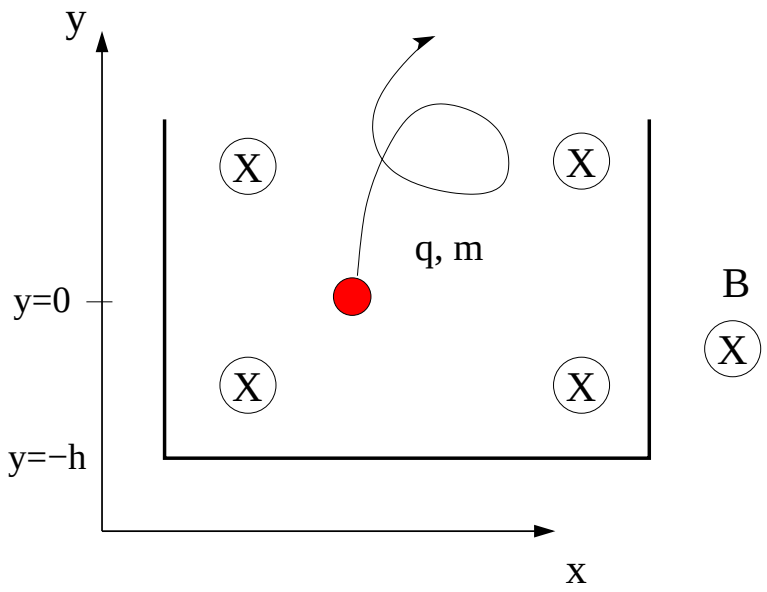

FIG. 1: A particle of charge q and mass m confined to the pinball court. What is the largest y that with a set of jolts $\pm J$ (as outlined in the various levels of the game) you can send it too? In (3) note that the bottom, at $y = -h$ absorbs the particle and ends the game prematurely : (.

CPL- second winter challenge

Magnetic Pinball

In a magnetic pinball machine a charged particle (charge q, mass m) is confined to the x-y plane. The controls connect to a capacitor which, when you press a button, delivers an impulse $J\hat{y}$ to the particle. The minimum time between impulses (pressing the button...) is τ, which you can assume is very small ($\tau \ll m/qB$). Your goal as a player is to get the particle from $y = 0$ to as big a y as possible with n presses of the button. The x and y directions are unbounded essentially (upto level 3). This would be easy had it not been for a magnetic field in the $\hat{z}$ direction, normal to the pinball plane.

1. What is the best strategy you can come up with? what is the distance with your strategy?

2. Pinball level 2 is such that the jolt given is of opposite direction everytime you press: J, -J, J, -J etc. (starting with positive).

   What is your best strategy with n presses and the maximum y?

3. Level 3 is the most challenging: The pinball board has a lower absorptive cutoff at $y = -h$. This time you have an unlimited number of *alternating* (as in 2) jolts at your disposal. How far up y can you get the particle to without it being absorbed in the bottom end of the court?