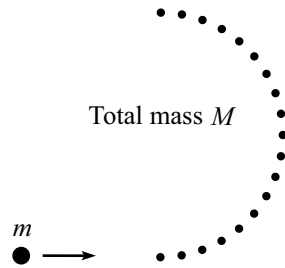


Week 29 (3/31/03)

Balls in a semicircle

N identical balls lie equally spaced in a semicircle on a frictionless horizontal table, as shown. The total mass of these balls is M . Another ball of mass m approaches the semicircle from the left, with the proper initial conditions so that it bounces (elastically) off all N balls and finally leaves the semicircle, heading directly to the left.



- In the limit $N \rightarrow \infty$ (so the mass of each ball in the semicircle, M/N , goes to zero), find the minimum value of M/m that allows the incoming ball to come out heading directly to the left.
- In the minimum M/m case found in part (a), show that the ratio of m 's final speed to initial speed equals $e^{-\pi}$.