Physical Dynamics (SPA5304) – Exercise Class
Week 2 (20-Jan-2017)

Problem 1

A billiard ball of mass m moving on a horizontal plane with initial velocity $v := |\vec{v}|$ scatters off an identical ball which is initially at rest. The collision is completely elastic (i.e. the energy is preserved in the process) and there is no friction.

1. Using appropriate conservation laws, show that the velocities $\vec{v}_1$ and $\vec{v}_2$ of the first and of the second ball after the colllision are orthogonal.

2. Determine $|\vec{v}_1|$ and $|\vec{v}_1|$ as functions of v and of the angle θ formed by the initial velocities $\vec{v}$ and $\vec{v}_1$.

Problem 2

A particle of mass m is subject to an attractive force $\vec{F}$ towards point O. The modulus of the force is given by $\left|\vec{F}\right| = b/r^n$ where n is a positive integer larger than 1, b is a (positive) constant, and r is the distance between the position of the particle and the point O. At time $t = 0$ the particle is at a distance a from O and is moving with speed v away from point O.

1. Calculate the potential of the particle.

2. Determine the minimum initial velocity such that the particle will be able to reach an infinite distance from point O.

3. For the case where the modulus of the initial velocity is equal to $\sqrt{b/\left[(n-1)\,m\,a^{n-1}\right]}$, determine the maximum distance from O that the particle can achieve.