

PHYS419/MATH419: Classical Mechanics
Final example

Problem 1.

Consider two particles of equal mass m . The forces on the particles are $F_1 = 0$ and $F_2 = F_0 \hat{x}$. If the particles are initially at rest at the origin, what is the position, velocity and acceleration of the center of mass?

(solution in ch9_1.pdf)

Problem 2.

A particle moves in an elliptical orbit in an inverse-square law central-force field. If the ratio of the maximum angular velocity to the minimum angular velocity of the particle in its orbit is n , find the eccentricity of the orbit ϵ .

(solution in ch8_1.pdf)

Problem 3.

A billiard ball of initial velocity u_1 collides with another billiards ball of the same mass initially at rest. The first ball moves off at $\psi = 45^\circ$. For an elastic collision, what are the velocities of the two balls after the collision? At what angle does the second ball emerge?

Problem 4.

A pendulum consists of a mass m suspended by a massless spring with unextended length b and spring constant k . Find the Lagrange equations of motion.

Problem 5.

A simple pendulum of length b and bob with mass m is attached to a massless support moving vertically upward with acceleration a .

- a) Determine the equations of motion and the period of oscillations using Lagrange equations.
- b) (extra credit) Determine the equations of motion and the period of oscillations using Newton's laws.