Physics 821: Problem Set 1

Dr. Stroud

Due Thursday, October 1, 2009 by 11:59 P. M.

Each problem is worth 10 points unless otherwise specified. "GPS" means "Goldstein, Poole, and Safko."

1. GPS, Chapter 1, problem 1 (derivation).

2. GPS, Chapter 1, problem 2 (derivation).

3. GPS, Chapter 1, problem 12 (derivation).

4. A particle of mass m moving with velocity $\mathbf{v}_1$ leaves a half-space in which its potential energy is some constant U_1 and enters another in which its potential energy is a different constant U_2. Determine the change in the direction of motion of the particle. Hint: consider energy and momentum conservation.

5. (a). Show that, if a particle its moving in a central potential $U(r)$ (whose magnitude depends on the distance of the particle from the origin), then the component of angular momentum of the particle about any axis passing through the origin is a constant of the motion.

   (b). What is the corresponding result if the potential depends only on the distance of the particle from some axis? Derive this result.