University of California, Berkeley
Physics 105 Fall 2006 Section 2 (*Strovink*)

ASSIGNMENT 6

Reading:
SCCM 7.7-7.8, 8.1-8.3
Taylor 14.1-14.8

1. A rocket is in elliptical orbit around the earth. To put it into an escape orbit, the rocket's engine is fired for a very brief time Δt, exerting a fixed force $\mathbf{F}$ during that time. To minimize Δt, where in the orbit, and in what direction, should $\mathbf{F}$ occur?

2.
A federal starship, far from any other force, falls under the influence of a tractor beam from a Death Star that is far more massive than the starship. The starship's own means of propulsion are disabled. Relative to the Death Star, the starship's navigator calculates that her ship is travelling in a circle and is on a collision course with the Death Star.

With what force law exponent n ($F \propto r^n$) does the tractor beam attract the starship?

3.
For a hyperbolic orbit with eccentricity $\epsilon > 1$ and impact parameter b, prove that

$$b = \frac{k}{2E}\sqrt{\epsilon^2 - 1}\ ,$$

where E is the total energy in the center of mass, and the central force potential is given by

$$V(r) = \pm\frac{k}{r}\ .$$

[By convention k is positive; the $\pm$ is present because this result is correct for either an attractive or a repulsive potential.]

4. Taylor Problem 14.14.

5. Taylor Problem 14.20.

6. Taylor Problem 14.23.

7. Taylor Problem 14.29.