Problems 6 - Gravitational two body problems

To be handed in **ETH: Mon 02.11, UNI: Wed 04.11**

1. Planets falling into each other

Two particles move about each other in circular orbits under the inuence of gravitational forces, with a period T. Their motion is suddenly stopped, and they are then released and allowed to fall into each other. Prove that they collide after a time $T/4\sqrt{2}$.

2. Preceding orbits

A. Study the motion of a planet under a central force

$$F(r) = -\frac{k}{r^2} + \frac{2c}{r^3}.$$

Show that the orbit is given by

$$r = \frac{a(1 - \varepsilon^2)}{1 + \varepsilon \cos \alpha\varphi},$$

and analyze the meaning of α

B. What happens for $\alpha = 1$?

C. Show that for $\alpha > 1$ the orbit is a preceding ellipse and calculate the precession velocity.