MIDTERM 2

Physics 311
Mechanics
Spring, 2003

1. A particle of mass m moves under the influence of the force

$$\mathbf{F} = -c^2 \frac{\mathbf{r}}{r^{5/2}} \tag{1}$$

a) Calculate the potential energy.
b) By means of the effective potential energy discuss the motion.
c) Find the radius of any circular orbit in terms of the angular momentum and calculate the period for the orbit.

2. A critically damped oscillator with $\omega_0 = 1 rad/sec$ is acted upon by a driving force F_{ext}
a) Find a particular solution for $F_{ext} = mfe^t$.
b) Find a particular solution for $F_{ext} = fme^{-t}$. *Hint* Try $x = At^n e^{-t}$ for $n = 0, 1, 2$.
c) Using the preceding results, obtain the general solution for $F_{ext} = mf \cosh t$ with initial conditions $x(0) = \dot{x}(0) = 0$.

1. Find the tensor of inertia elements for
a) a solid cylinder with radius a and length l
b) a disc with radius a
c) a cone with radius R at the base and height h