PHY 3221 : Intermediate Mechanics, Spring 2003

January 10^{th}, 2003

Assignment # 1

(due Friday January 17^{th}, 2003, at the beginning of class)

1. A buzzing fly moves in a helical path given by the equation

$$\mathbf{r}(t) = \mathbf{i}\, b \sin(\omega t) + \mathbf{j}\, b \cos(\omega t) + \mathbf{k}\, ct^2$$

(a) Show that the magnitude of the acceleration of the fly is constant, provided b, c and ω are constant.

(b) Can you figure out and describe what the trajectory of the fly looks like?

(c) Check your intuition with *Maple*, using the **spacecurve** command. Take $b=c=1$ and $\omega=2$ and try:

> with(plots);

> b:=1; c:=1; omega:=2;

>spacecurve([b*sin(omega*t),b*cos(omega*t),c*t^2],t=0..4*Pi,numpoints=100);

2. Read and practice *Maple Tutorial n.1.* Then try the following commands of *Maple* and explain what is wrong with them. Correct them and write down the answers you get.

(a) tan(pi/4);

(b) Evalf(Pi);

(c) plot(sin(a*t),t=0..2*Pi);

3. Find the velocity $v(t)=\dot{x}(t)$ and the position $x(t)$ as functions of the time t for a particle of mass m, which starts at rest at $x=0$ and $t=0$, subject to the following force functions:

(a) $F_x = F_0 + c\,t$

(b) $F_x = F_0 \sin(c\,t)$

(c) $F_x = F_0\, e^{ct}$

You can learn about how to integrate a differential equation using *Maple* from the first part of *Tutorial n. 2.* This is a good problem to try your solutions by hand and check them with *Maple.*

4. Problem 2.3 of Marion and Thornton's book.

5. Problem 2.6 of Marion and Thornton's book.

6. Problem 2.8 of Marion and Thornton's book.