EXAM I Physics 218

Name.....Section Number..... (1 point)

USEFUL INFORMATION

$$If \quad f(x) = kx^n \qquad \frac{df}{dx} = nkx^{n-1}$$

$$If \quad f(x) = kx^n \qquad \int f(x)dx = \frac{1}{n+1}kx^{n+1} + C$$

Make sure it is clear how you arrive at your solutions

1.

2.

3.

1. (33 points)This is a one dimensional problem. An object is dropped from a height H above the ground. Defining vertically up to be the positive direction the object experiences an acceleration

$$a(t) = \beta t - g$$

where β is a known constant.

a. Obtain an algebraic equation for the velocity as a function of time.

b. Obtain an algebraic equation for the height as a function of time.

c. Find the time, T, at which the object reaches its lowest point, assuming this occurs before it hits the ground.

2. (33 points) A small block of mass m is placed on the frictionless floor which we define to be the x, y plane. There are two forces, $\vec{F}_1$ and $\vec{F}_2$,acting on the block that have components only in the x, y plane. Because of these forces the block moves in a very strange way so that its position vector is observed to be

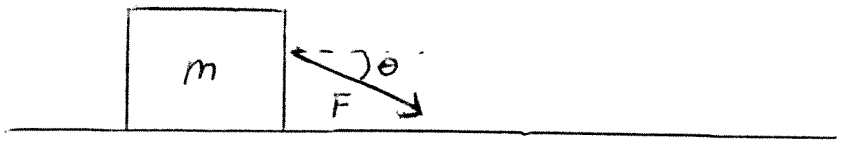
$$\vec{r}(t) = (c_1 t^3 + c_2 t)\vec{i} + (c_3 t^2 + c_4 t)\vec{j}.$$

Here all the $c's$ are known constants. One of the forces is known to be given by

$$\vec{F}_1 = k_1 \vec{i} + k_2 t \vec{j}.$$

Here k_1 and k_2 are known constants. What is the other force?

3. (33 points) A block of mass m is at rest on a table. A force of known magnitude $|\vec{F}| = F$ acts on the block, at the known angle θ as shown:



a. Assuming no friction between the table and the block, isolate the block and show all forces acting on it. (In other words draw the free body diagram for the block.)

b. Find the acceleration of the block.

c. Now assume there is a coefficient of friction μ between the table and the block. Find the acceleration of the block assuming the force $\vec{F}$ is large enough to make the block move.

d. Find the minimum value that $|\vec{F}|$ must have in order to cause the block to move.