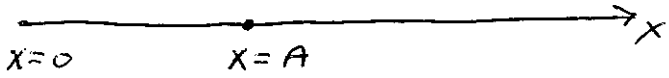
1. (25 points)The acceleration of some object, that only moves along the x-axis, is given by

$$a(t) = \alpha t$$

where α is a constant. The object is observed to have velocity W when you start your clock and when you measure its position, 2 seconds later, it is at the point $x = A$. Find the velocity and position of the object as functions of time.



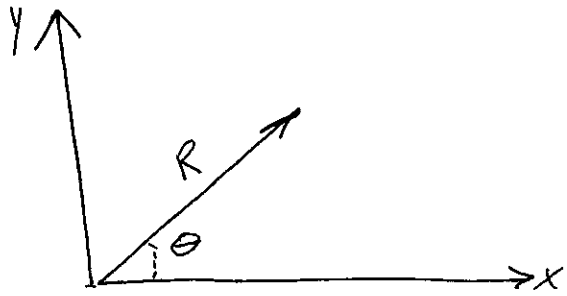
2. The position vector for some small object is

$$\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j}$$

where

$$x(t) = c_1 + \alpha t^2 \qquad \textit{and} \qquad y(t) = c_2 + \beta t.$$

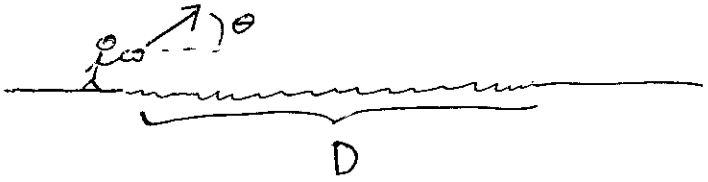
Here α and β are known constants but c_1 and c_2 are unknown. At $t = 0$ the position vector is known and has magnitude R and points at the angle θ as shown. Find the object's velocity and acceleration and determine the values of c_1 and c_2.



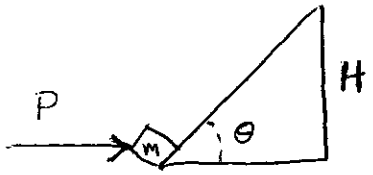
3. (25 points)You wish to throw a stone across a pond which is D wide. You are going to throw it from the initial height H. Of course there is an acceleration due to gravity that has magnitude g and points towards the earth. At the instant you throw the stone a wind starts to blow from directly behind you, horizontally across the pond. The wind is such that it causes a horizontal acceleration with magnitude given by

$$\alpha t^2 + \beta t.$$

Here α and β are constants. If you throw the stone at an angle θ as shown, what must be the magnitude of the initial velocity for the stone to just make it across the pond? It is sufficient to obtain the necessary equations that could be solved for the magnitude of the initial velocity. DO NOT SOLVE.



4. (25 points)A block of mass m starts at rest at the bottom of an inclined plane. There is no friction. In addition to the other forces there is a horizontal force of magnitude P applied to the block. What will be the block's acceleration and how fast will it be going when it gets to the top?



If there were a coefficient of friction μ between the block and the plane, what would the acceleration of the block be?