Problem 1: Spring-Loop-the-Loop Solution

A small block of mass $m$ is pushed against a spring with spring constant $k$ and held in place with a catch. The spring compresses an unknown distance $x$. When the catch is removed, the block leaves the spring and slides along a frictionless circular loop of radius $r$. When the block reaches the top of the loop, the force of the loop on the block (the normal force) is equal to twice the gravitational force on the mass. How far was the spring initially compressed?
Problem 2: Ball on String

A ball of mass $m$ is attached to point $a$ by a string of length $L$. The ball is held out horizontally as shown in the figure, then released from rest and allowed to fall. When the string becomes vertical it impinges on a fixed peg at point $b$ and the ball begins circular motion about that point. What is the minimum distance $D$ between points $a$ and $b$ necessary to allow the ball to pass above $b$ while still on a circular path? Note that the alternative is for the string to go slack before the ball passes the line between $a$ and $b$. 

![Diagram of ball on string problem]