Quiz #4

Monday 8 October 2001 (30 minutes)

A block of mass m lies on a smooth stationary ramp and is attached to a rubber band. The rubber band is parallel to the ramp and has a spring constant k. The block is initially held at rest with the rubber band *unstretched*. Suppose that the block is now suddenly released.

1. (5 points) Show that at the instant of the release, the block will start to slide downward along the ramp. *Hint*: draw a free-body diagram.
2. (10 points) Find the velocity v of the block in terms of the net stretch l of the rubber band using conservation of mechanical energy.
3. (10 points) Show that v achieves its maximum at the rubber band's equilibrium stretch l_{eq} (i.e. the rubber band's net stretch when the block is in equilibrium under the action of the gravity and spring forces). Also determine the maximum velocity v_{max}.
4. (10 points) What is the maximum net stretch l_{max} of the rubber band following the release of the block?
5. (5 points) Show that at the instant the rubber band is maximally stretched, the block will start to slide upward along the ramp. *Hint*: draw a free-body diagram and also use your knowledge of the rubber band's equilibrium stretch l_{eq}.

Rubber Band k

m

α