

**Quiz #3**

Monday 1 October 2001 (25 minutes)

The ball has a mass  $m$  and is attached to a rubber band. The rubber band has a spring constant  $k$ , an unstretched length  $L$  and is tied at the top to a swivel. The ball is set in motion around the vertical line OA. Neglect air resistance and the size of the ball.

1. (10 points) What forces act on the ball? Draw a free body diagram.
2. (15 points) Let the ball circle around OA, such that the rubber band is deformed to a constant length  $(1+c)L$  (with  $c$  a constant) and makes a constant angle  $\theta$  relative to OA. Find  $v$ , the speed of the ball.
3. (10 points) Discuss whether the motion of the ball described in part 2 is possible for  $\theta \geq 90^\circ$  (i.e., the rubber band lies in or above the horizontal plane). You may assume that the rubber band cannot withstand compression. *Hint*: draw a free body diagram.
4. (5 points) Would your answer to part 3 change if the rubber band were replaced with a metallic spring that *can* withstand compression? Explain your answer.

