Show ALL your work. If you need more workspace, use the back of the same page and write a note indicating this.

1. A mass $m$ is attached to a light string passing through a small hole in a frictionless, horizontal table. The mass initially moves in a circular path of radius $r_i$ with speed $v_i$. The downward force on the string is then increased and the radius of the circle decreases to $r_f$. Where appropriate, express your answers in terms of $m, r_i$, and $v_i$.

(a) [3 pts] What is the initial angular momentum $L_i$ of the mass about the center of the circle? Be sure to specify magnitude and direction, sketching your coordinates if necessary.

(b) [4 pts] Find the speed of the mass $v_f$ when the radius is $r_f$.

(c) [4 pts] What is the tension $T$ in the string when the radius is $r_f$?

(d) [4 pts] Calculate the ratio of the final kinetic energy to the initial kinetic energy.