3) (25 points) Round Up carnival ride

A carnival ride called the "Round Up" consists of a spinning cylindrical wall with radius R that riders stand against while it rotates. Once the rate of rotation is high enough, the floor drops so that the riders' feet are no longer supported from below, as shown in the first diagram.

a) If the coefficient of static friction between the rider and the wall is μ_s, then what is the *maximum* period of time T_{max} that it can take a rider of mass m to make one complete revolution around the circle? Express your answer in terms of any combination of m, R, μ_s, and any relevant physical constants.

b) At some point, the whole cylinder tilts to an angle θ, as shown in the second diagram; the rate of rotation is high enough so that the rider never slides or falls from the wall. Now what is the magnitude of the normal force from the wall acting on the rider when the rider is at her *highest* position? Express your answer to this and all following questions in terms of any combination of m, T, R, μ_s, θ, and any relevant physical constants.

c) What is the magnitude of the normal force from the wall acting on the rider when the rider is at her *lowest* position?

d) What is the magnitude of the force of static friction on the rider when she is at her *highest* point?

e) What is the magnitude of the force of static friction on the rider when she is at a height midway between her highest and lowest positions?