Assignment 1

Due date: Wednesday, January 30

1. H&F 1.2
2. H&F 1.3
3. H&F 1.4
4. H&F 1.6
5. H&F 1.8

6. A massless wheel of radius $r$ rolls without slipping around the circumference of a circular hole of radius $R$ as shown below:

![Diagram of wheel and hole](image)

The only mass in this system is a point mass $m$ fixed on the rim of the wheel.

(a) Neglecting gravity (the wheel moves in a horizontal plane) express the kinetic energy for this system in terms of the angle $\theta(t)$ that describes the position of the wheel’s center about the center of the hole. Assume the mass is attached so that it touches the hole when $\theta = 0$.

(b) Using the fact you learned from elementary mechanics, that mechanical energy is conserved (in the absence of friction), determine how the angular velocity $\dot{\theta}$ depends on $\theta$. 