

Math 142-1, Group work 3

Problem 1

A massless and frictionless pulley of radius r centered at the origin has a rope of length ℓ draped over it. The position of the rope can be described by $x(t)$, the distance of the right end of the rope below the center of the pulley. The rope has total mass m , uniformly distributed along its length.

- (a) What are the coordinates of the endpoints of the rope?
- (b) What is the total gravitational potential energy (ϕ) of the rope?
- (c) The motion of the rope can be described by $\dot{x}(t)$. What is the total kinetic energy (KE) of the rope?
- (d) What is the total energy of the rope?
- (e) Derive a second order ODE that describes the motion of the system.
- (f) Find the equilibria of the system. Are they stable?

