MATHEMATICA MODELLING ASSIGNMENT

Equations of motion : Due 2 Feb. 2015

The *Mathematica* modelling project will use the following scenario: Consider a large Ferris wheel that is built in Lake Michigan. (As you may know, Ferris wheels were first built in Chicago by George Ferris.) The wheel is 30 meters in radius and its center stands 80 meters above the lake level. At t = 0, a stunt person stands on the top of the Ferris wheel ($\theta = 0^o$) which is rotating at a constant angular velocity $\omega = 0.2$ rad/s. At t = 0, a rescue boat is 150 m from the vertical center line of the Ferris wheel and travels toward the base of the wheel at a constant speed of 10 m/s.(In other words, if the center of the wheel has coordinates (0, 80) and the initial coordinates of the person are (0, 110), the initial position of the front of the boat is (150, 0)). Assume the person has no initial velocity other than that of the rotating wheel; assume also that there are no sources of friction in this problem. Assume further that the boat is one meter in length and the long axis of the boat is moving directly toward the Ferris wheel. The Ferris wheel is rotating toward the incoming boat.Your program will allow you to determine when should the stunt person step off the Ferris wheel to safely land in the boat as it speeds by. At what angle (with respect to the vertical) should the person step off to accomplish this? Is there only one solution for this set of parameters or are there other angles that would work?

Before you can begin programming a solution to the Ferris wheel problem, you will need to determine the proper equations needed to model the situation.Your first assignment will be determining the equations of motion of the person and the boat.The equation of motion of the boat is easy. However, the motion of the person is a bit more complicated since the person starts on the rotating wheel and then steps off.If the person steps off the wheel when it makes a an angle θ with respect to the vertical, at what time t will splashdown occur?Where will the boat be at this time?

Write the equations of motion for the person and the boat. Calculate numerically where and when the person lands if he/she steps off the wheel at $\theta = 0^o$, $\theta = 90^o$, $\theta = 180^o$, and $\theta = 270^o$. What is the position of the boat at each of those times? This exercise should inform you the quadrant (s) in which the correct solution (s) occurs.

This assignment will represent 20 % of your complete project grade.