# Homework Problem Set 7 – Due 11/1

## Problem 1

If I walk along the outside edge of a circle of radius 2 m, and my total distance walked along that edge is 18 m, what can I say about the angle $\theta$ (the "angular distance") that this corresponds to? Give your answer both in degrees and in radians. (Assume I start at an angle $\theta = 0$).

## Problem 2

A Ferris wheel is making one revolution during the time $T = 30$ s. It has cabins that are attached at a radius $R = 30$ m from the center. How fast (in terms of linear speed, m/s) are the people in those cabins moving?

## Problem 3

Why are roads often "banked" in a curve? I.e., the roadbed is tilted sideways so that the higher edge is on the outside of the curve, and the lower edge on the inside. (You can see this for instance in the construction of the new Hampton Roads Bridge-Tunnel). Explain how this helps to provide the necessary centripetal acceleration by discussing ALL forces acting on a car driving through that curve, and the resulting net force.

## Problem 4

A small mass $m = 0.2$ kg is moving in a circle at the end of a tether of length $R = 0.5$ m, with an angular velocity $\omega = 12$ radians/s.
   a) Roughly how many rounds per second are this?
   b) What is the linear tangential velocity of the mass?
   c) What is the angular momentum $L$?
   d) What is the centripetal force on the mass?
   e) What is the kinetic energy of the mass?

XC: Assume that we shorten the tether, forcing the mass to move on a tighter circle (without pushing the mass itself). Will its speed v go up or down? What about its angular momentum? And what about its kinetic energy? If its kinetic energy changes, what supplies the work to do so?

## Problem 5

Which of the following has a larger angular momentum **L**:

a) A bicycle wheel with a diameter of 1 m rolling down a street at a speed of 2 m/s.

b) A scooter wheel with only ½ of that diameter (0.5 m) but the same mass, also rolling down a street at 2 m/s.

Explain your answer. You may assume that both wheels have the same basic structure: A thin hub, spokes leading to the light-weight rim, and a tire making up nearly all of the mass.