## Circular Motion Example Problems

## Problem 1: Driving on a flat road

On a wet day, a car begins to slip on a curve ( $r=35 \mathrm{~m}$ ) when its speed reaches $8.0 \mathrm{~m} / \mathrm{s}$. What is the coefficient of static friction between the tires and the road in this weather?

## Problem 2: Tetherball

The game of tetherball is played with a ball tied to a pole with a string. When the ball is struck, it whirls around the pole. Solve for the speed of the tetherball if the angle the rope makes with respect to the vertical is $30^{\circ}$.


## Problem 3: Revolving ball (vertical circle)

A 0.150 kg ball on the end of a 1.10 m long cord is swung in a vertical circle. At its highest point, the speed of the ball is $5.2 \mathrm{~m} / \mathrm{s}$. Determine the tension in the cord at point $A$ and point $B$.


## Problem 4: Banking angle

(a) For a car traveling with speed $v$ around a curve of radius $r$, determine a formula for the angle at which a road should be banked so that no friction is required.
(b) An engineer wishes to design a curved exit ramp in such a way that the car will not have to rely on friction to round the curve without slipping. Suppose a typical car rounds the curve with a speed of 30 mph and the radius of the curve is 50 m . At what angle should the curve be banked? ( $1 \mathrm{mph}=0.447 \mathrm{~m} / \mathrm{s}$ )
(c) In which direction will friction act if a car rounds the curve at a speed lower than 30 mph ?

