Math 442 | **Differential Geometry** | **Winter 2011**

Assignment #2: Due 1/21/11

Reading:

- Make sure you've read all of Section 2.2. We probably won't get to 2.3 until late next week.

Written Assignment:

A. Bär, Exercise 2.4 (page 33).

B. Bär, Exercise 2.11 (page 36).

C. Bär, Exercise 2.13 (page 56).

D. Bär, Exercise 2.14 (page 56). More precisely, show that there is a unit-speed parametrization of the osculating circle, $C\colon \mathbb{R} \to \mathbb{R}^2$, with the following properties:

$$C(t_0) = c(t_0), \qquad \dot{C}(t_0) = \dot{c}(t_0), \qquad \ddot{C}(t_0) = \ddot{c}(t_0).$$

E. The parametrized plane curve $c\colon \mathbb{R} \to \mathbb{R}^2$ given by $c(t) = (t, \cosh t)$ is called a ***catenary***. (Any finite piece of it is a good model of the shape of a chain or cable hanging by its own weight.) Compute the curvature $\kappa(t)$ as a function of t. (Warning: this is not a unit-speed parametrization.)

F. Let a and b be positive constants. The ellipse defined by $x^2/a^2 + y^2/b^2 = 1$ has a periodic (but not unit-speed) parametrization given by $c(t) = (a\cos t, b\sin t)$ for $t \in \mathbb{R}$. Compute the curvature as a function of t.