1. Please work through problems 6.7 and 6.9 in §6.2. You do not need to write them up to turn in.
2. Calculate the first and second fundamental forms, the principal curvatures, and the mean and Gaussian curvatures, for the following parametrization of the torus. Here, a and b are non-zero constants.
$$\sigma(u, v,) = (u\cos(v), u\sin(v), \sqrt{b^2 - (u-a)^2}\,).$$
3. For a non-zero constant c, compute the normal curvature of the curve
$$\gamma(t) = \left(c\cos(t), c\sin(t), \sqrt{b^2 - (c-a)^2}\right)$$
in the torus, using the parametrization in problem 2.
4. Which points of a generalized cone are parabolic?
5. Calculate the principal, Gaussian, and mean curvatures of the **helicoid**, defined by the chart
$$\sigma(u, v) = (v\cos(u), v\sin(u), \lambda u),$$
where λ is a non-zero constant.
6. Compute the Gaussian curvature of the hyperboloid of one sheet,
$$x^2 + y^2 - z^2 = 1.$$
Express your answer in terms of the Euclidean coordinates (x, y, z).
7. Let Σ denote the pseudosphere, and consider the chart
$$\sigma(u, v) = \left(e^u\cos(v), e^u\sin(v), \sqrt{1 - e^{2u}} - \cosh^{-1}(e^{-u})\right),$$
for $-1 < u < 0$. Calculate the principle curvatures for σ and show that all points in Σ are hyperbolic.