## MA 313: Nominal study guide for Exam 1

Here are some things you should be sure to know for the exam. You should know other things too.

## 1. **DEFINITIONS**

- smooth curve
- regular curve
- tangent vector
- arc length
- closed curve
- simple closed curve
- Frenet frame (and formulas for T, N, and B)
- curvature of a curve
- signed curvature of a planar curve
- surface

## 2. Results

You should know the statements of these results, how to use them, and the key components of their proofs. For those proofs that are very long or involved you will not be asked to recreate the entire proof.

- If  $\mathbf{v}: (\alpha, \beta) \to \mathbb{R}^n$  is smooth and if  $||\mathbf{v}(t)|| = 1$  for all *t*, then  $\mathbf{v}(t)$  and  $\mathbf{v}'(t)$  are orthogonal for all *t*.
- If a curve  $\gamma: (\alpha, \beta) \to \mathbb{R}^n$  is regular, then it has a unit speed reparameterization.
- The smooth turning angle theorem
- The total signed curvature of a closed plane curve is an integer multiple of  $2\pi$ .
- Signed curvature is the derivative (with respect to arc-length) of the turning angle.
- Given a smooth signed curvature function  $k: (\alpha, \beta) \to \mathbb{R}^2$ , there is a regular curve  $\gamma: (\alpha, \beta) \to \mathbb{R}^2$  such that the signed curvature of  $\gamma$  is *k*.
- The isoperimetric inequality.
- The four vertex theorem.