# Math 423 Differential Geometry

**Assignment 2, Due Tuesday Sept 15**

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1. Let $c\colon I \to \mathbb{R}^3$ be a smooth space curve such that $\dot{c}(t) \neq 0$ and $\ddot{c}(t) \neq 0$ for all $t \in I$. Show that the curvature and torsion of $c$ are given by the formulas
$$\kappa(t) = \frac{\|\dot{c} \times \ddot{c}\|}{\|\dot{c}\|^3}$$
and
$$\tau(t) = \frac{\langle \dot{c} \times \ddot{c}, \dddot{c} \rangle}{\|\dot{c} \times \ddot{c}\|^2}.$$

2. According to the Lorentz force law, an electron moving in a constant magnetic field follows a path $c(t)$ which satisfies
$$\ddot{c} = \dot{c} \times B$$
where $B$ is a constant vector on $\mathbb{R}^3$. Prove that this path is a helix.

3. Compute explicitly a plane curve $c(s)$ which is parameterized by arclength and whose curvature is $\kappa(s) = s^{-1/2}$.