Math 116 Problem Set #9 Due Wed., Oct. 31, 2018, in class.

In Apostol, Volume **I**, read Chapter 14, Sections 10-20, pages 529-548. In Apostol, Volume **II**, read Chapter 8, Sections 1-8, pages 243-255.

1. From Apostol, Volume **I**, Chapter 14, Section 14.13, pages 535-536, do problems 3, 11, 13; from Section 14.15, pages 538-539, do problems 1 (just do #4 from 14.9), 2, 6; and from Section 14.19, pages 543-545, do problems 1, 2(a), 4.

2. From Apostol, Volume **II**, Chapter 8, Section 8.3, pages 245-246, do problems 1(c), 5; from Section 8.5, pages 251-252, do problems 1(b), 3 (in problem 3, the part relating to problem 2 is optional); and from Section 8.9, pages 255-256, do problem 4.

3. Let $f : \mathbb{R} \to \mathbb{R}$ be a twice differentiable function. Parametrize the plane curve $y = f(x)$ by $F(t) = (t, f(t))$, and suppose that $F(a) = (a, f(a))$ is an inflection point of this curve for some value of a. Prove that $T'(a) = 0$, where $T(t)$ is the unit tangent vector to the curve at the point $F(t)$. Is the principal normal vector $N(a)$ at $F(a)$ defined?

4. Consider the curve in $\mathbb{R}^3$ given parametrically by $F(t) = ti + t^2 j + t^3 k$, where i, j, k are the unit basis vectors. Find the curvature at the origin, and find all points where the curvature is zero.

5. For each of the following subsets of $\mathbb{R}^2$, find the set of interior points and find the set of boundary points.

a) $\{(x, y) \in \mathbb{R}^2 \mid x \geq 0, y > 0\}$
b) $\{(x, y) \in \mathbb{R}^2 \mid x, y \in \mathbb{Q}\}$
c) $\{(x, y) \in \mathbb{R}^2 \mid (1 - x^2 - y^2)y^2 \geq 0\}$