

### Math 317 Assignment 3

This assignment is due in class on Wed. Feb. 1. I will try to put relevant pages of the text on the webpage.

1. Derive the following Frenet-Serret formula

$$\frac{d\mathbf{N}}{ds} = -\kappa(s)\mathbf{T}(s) + \tau(s)\mathbf{B}(s)$$

from the other two Frenet-Serret formulae (which followed from our definitions in class). Here we are working with the arclength parametrization of a smooth curve.

2. A smooth curve  $C$  has constant curvature  $\kappa = .12$ , constant torsion  $\tau = .16$  and arclength  $L = 10\pi$ . Describe the curve.

3. Derive Kepler's second law.

**Hint:** Take a look at Question 1 on p. 884. We derived (a) and (b) in class prior to Hamilton's Theorem so you may assume them (we used  $J$  in place of  $h$ ). For (c) it may help to take a look at Formulae (3) and (4) in Section 11.4.

4. Derive Kepler's third law.

**Hint:** Take a look at Question 2 on p. 885. We stated the first equality in (b) in class as part of our statement of Kepler's first law.

5. Section 14.3 # 55(d) (You may use the other parts—we derived (a) and (b) in class),  
# 57
6. Section 14.4 # 36
7. Review Exercises-page 886 # 14