13.3 Problem Set

Dr. Holmes

February 13, 2006

This corrects an error in the setup of problem 1 which made it impossible to carry out the integration. Notice that both the vector function and the sample point are different.

1. Find the length of the segment of the curve parameterized by

\[ t^3 \mathbf{i} + 3t^2 \mathbf{j} + 6t \mathbf{k} \]

from the point \((0, 0, 0)\) to the point \((27, 27, 18)\).

2. Reparameterize the curve parameterized by \(\langle 2 \sin(t), 3t, 2 \cos(t) \rangle\) with respect to arc length.

3. Find the unit tangent and unit normal vectors and the curvature for \(\langle 2 \sin(t), 3t, 2 \cos(t) \rangle\).

4. Find the curvature for \(ti + t^2j + t^3k\). Find the equation of the osculating circle to this curve at \((1, 1, 1)\). (This has nasty numbers in it – lots of radicals – but doesn’t seem impossible to do if you keep all the concepts straight).

5. Find the curvature of the graph of \(y = x^3\). Where is the curvature largest? (You may use a grapher to answer the question as to where the curvature is largest: though M170 techniques ought to work, they might be quite involved).