University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Fall 2012

Homework 5

Due date: October 10, 2012

Problems

Taken or adapted from Sections 13.1–13.4 the book *Calculus: Early Transcendentals* 7th edition by J. Stewart.

1. At what points does the curve $\vec{r}(t) = \langle \sin t, \cos t, t \rangle$ intersect the sphere $x^2 + y^2 + z^2 = 5$?
2. Find a vector function that represents the curve of intersection of the surfaces $z = 4x^2 + y^2$ and $y = x^2$.
3. At what point do the curves $\vec{r}(t) = \langle t, 1 - t, 3 + t^2 \rangle$ and $\vec{p}(s) = \langle 3 - s, s - 2, s^2 \rangle$ intersect? Find their angle of intersection at that point. (The angle of intersection of two curves at a certain point is the angle between two vectors that are tangent to the curves at that point.)
4. Show that the velocity and acceleration of a particle moving in a circular trajectory of radius a are perpendicular to each other.
5. Find the length of the curve $\vec{r}(t) = \langle 12t, 8t^{3/2}, 3t^2 \rangle$, $0 \leq t \leq 1$.
6. Find the length of the curve of intersection of the cylinder $4x^2 + y^2 = 4$ and the plane $x + y + z = 2$. (You may use Maple or a similar package to solve part of this problem. If you do use a software package, include a printout of the code you used.)
7. Reparametrize the curve $\vec{r}(t) = \langle e^{2t} \cos 2t, 2, e^{2t} \sin 2t \rangle$ with respect to arc length measured from the point where $t = 0$ in the direction of increasing t.
8. Using any method you like, find the curvature of $\vec{r}(t) = \langle t, t, (1 + t^2) \rangle$ when $t = 0$.
9. Find an equation of a parabola that has curvature 16 at the origin.
10. Find the curvature of the curve with parametric equations $x = \sinh t$, $y = \cosh t$, and $z = t$ at the point (0,1,0).