University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Fall 2012

Homework 5

Due date: Octubre 2, 2012

Problems

Taken or adapted from Sections 13.2–13.4 the book *Calculus: Early Transcendentals* 7th edition by J. Stewart.

1. Find the angle of intersection of the curves $\vec{r}_1(t) = \langle t, t^2, t^3 \rangle$, and $\vec{r}_2(t) = \langle \sin t, \sin 2t, t \rangle$ at the origin. (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.)
2. Find the velocity, acceleration, and speed of a particle with the position function $\vec{r}(t) = e^t \langle \cos t, \sin t, t \rangle$.
3. The position function of a particle is given by $\vec{r}(t) = t^2\hat{i} + 5t\hat{j} + (t^2 - 16t)\hat{k}$. When is the speed minimum?
4. Find the position vector of a particle whose acceleration is given by $\vec{a}(t) = \langle 2t, \sin t, \cos 2t \rangle$, if its initial velocity is $\vec{v}(0) = \langle 1, 0, 0 \rangle$ and initial position is $\vec{r}(0) = \langle 0, 1, 0 \rangle$.
5. What force is required so that a particle of mass m has the position function $\vec{r}(t) = \langle t^3, t^2, t^3 \rangle$?
6. An object is launched from ground level. Determine the angle of the launch to obtain a) the maximum height (vertical distance from launching site) , b) the maximum range (horizontal distance from launching site), and c) the maximum length of the trajectory. (You may use Maple, Mathematica, or any other mathematical software.)
7. Find the length of the curve $\vec{r}(t) = \langle 2t, t^2, \frac{t^3}{3} \rangle$ for $0 \leq t \leq 1$.
8. Find the length of the curve $\vec{r}(t) = \langle \cos t, \sin t, \ln \cos t \rangle$ for $0 \leq t \leq \pi/4$.
9. Reparametrize the curve $\vec{r}(t) = \langle 2t, 1 - 3t, 5 + 4t \rangle$ with respect to arc length (that is, change $s(t)$ for $t(s)$) measured from the point where $t = 0$ in the direction of increasing t.
10. Reparametrize the curve $\vec{r}(t) = \langle 2\cos t, 2\sin t, t \rangle$ with respect to arc length measured from the point where $t = 0$ in the direction of increasing t. Find the coordinates of the point on the curve for arc lengths $s = \sqrt{5}$ and $s = 4$.