Math 13 Spring 2010: Exam 1
February 23, 2010

Name:

Instructions: Each problem is scored out of 8 points for a total of 32 points. You may not use any outside materials(eg. notes or calculators). You have 50 minutes to complete this exam. Remember to fully justify your answers.

Score:

Problem 1.

(a) Find an equation for the tangent line to $\vec{r}(t) = \langle \cos t, 2\sin t, t \rangle$ at $(1, 0, 0)$.

(b) Find the distance from $(1, 4, 2)$ to the plane $2x - 6y + z = 3$.

(c) Find the angle of intersection of the two planes $2x + y - 3z = -1$ and $x + 2y - z = 4$.

Problem 2.

(a) Find the vector function that represents the curve of intersection of the paraboloid $z = 4x^2 + y^2$ and the parabolic cylinder $y = x^2$. Find the point(s) where this curve intersects the plane $x + 2y = 3$?

(b) Suppose you start at the point $(0, 0, 3)$ and move 5π units along the curve $\vec{r}(t) = \langle 3\sin t, 4t, 3\cos t\rangle$. Where are you now?

Problem 3. Given the curve $\vec{r}(t) = \langle t^2 - 1, 2t + 3, t^2 - 4t \rangle$

(a) Find the curvature at $(3, 7, -4)$.

(b) Find an equation for the normal plane at $(3, 7, -4)$.

Problem 4. Given $\vec{r}(t) = 2t^2\hat{i} + t\hat{j} + \hat{k}$.

(a) Find the tangential and normal components of acceleration as functions of t.

(b) What is the minimum speed and for what t does the minimum speed occur?