

Math 13 Fall 2008: Exam 1

Name:

Instructions: There are 5 questions on this exam of which you must do 4. Each problem is scored out of 10 points for a total of 40 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:

Circle below the 4 problems you wish to be graded. Otherwise, I will grade the first 4 completed problems

1 2 3 4 5

Problem 1. Consider motion along the curve

$$\vec{r}(t) = \langle \sin^2 t, \sin t \cos t, \cos t \rangle, \quad 0 \leq t \leq 2\pi.$$

- (a) Find the velocity and acceleration as functions of t .
- (b) At $(0, 0, -1)$ find \vec{T} and κ .

Problem 2. Consider the two lines

$$L1 : \frac{x-1}{6} = y-1 = \frac{z}{2}$$

$$L2 : \langle 5 + 15t, 1 + 2t, -2 + 6t \rangle$$

and the point

$$P = (1, 0, -1).$$

- (a) Show that $L1$ and $L2$ are skew.
- (b) Find the equation of the plane containing P and $L2$.

Problem 3. Find the parametric equations for the line that is tangent to the curve of intersection of the surfaces

$$z = x^2 + y^2, \quad 4x^2 + 4y^2 + z^2 = 12$$

at the point $(-1, 1, 2)$.

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

Problem 5. Given two vectors \vec{a} and \vec{b} which form a rhombus: a parallelogram whose sides are the same length ($|\vec{a}| = |\vec{b}|$). Use vectors to show that its two diagonals are perpendicular.

