Math 20C
Midterm Exam 1
February 1, 2013
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Version A

Instructions

1. **No calculators or other electronic devices are allowed during this exam.**
2. **You may use one page of notes, but no books or other assistance during this exam.**
3. **Write your *Name*, *PID*, and *Section* on the front of your Blue Book.**
4. **Write the *Version* of your exam at the top of the page on the front of your Blue Book.**
5. **Write your solutions clearly in your Blue Book**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each question on a new side of a page.**
6. **Read each question carefully, and answer each question completely.**
7. **Show all of your work; no credit will be given for unsupported answers.**

0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

1. Let $P = (6, 4, -1)$, $Q = (5, 7, 1)$ and $R = (6, 9, 0)$ be three points in $\mathbb{R}^3$.
   (a) (4 points) Find a formula $a\,x + b\,y + c\,z = d$ for the plane containing the points P, Q and R.
   (b) (2 points) The points P, Q and R form a triangle $\triangle PQR$ in $\mathbb{R}^3$. Determine whether $\angle Q$ (the angle at the vertex Q) is an acute, obtuse or right angle. Be sure to justify your answer.

2. (6 points) Find a vector parametrization $\mathbf{r}(t) = \mathbf{r}_0 + \mathbf{v}t$ for the line of intersection of the two planes given by $6x - 3y + 2z = 2$ and $x + 2y - 2z = 1$.

3. Tom is chasing Jerry up a spiral staircase. The position of Tom at time t is $\mathbf{T}(t) = \langle \cos(3\pi t),\, \sin(3\pi t),\, 3t \rangle$ and the position of Jerry is $\mathbf{J}(t) = \langle \cos(\pi t),\, \sin(\pi t),\, t + 4 \rangle$. The chase starts at time $t = 0$.
   (a) (3 points) At what time does Tom catch Jerry?
   (b) (3 points) What is the distance covered by Tom from time $t = 0$ until he catches Jerry?

4. (6 points) A particle follows a path $\mathbf{r}(t)$ that satisfies $\mathbf{r}'(t) \cdot \mathbf{r}''(t) = 0$. The particle's velocity at time $t = 0$ is $\mathbf{r}'(0) = \langle 2,\, 4,\, 4 \rangle$. Determine the total distance traveled by the particle along the path from $t = 0$ to $t = 1$.