Please fill the information below _neatly!_

NAME: _____

Your class hour: (Circle one)   **10:00**   **11:00**

Directions: 1. Exam in-class on Friday. You may do the first problem at home. It is initially closed book, and is only on material from Chapter 1. Please spend no more than 10 minutes on it. After that, you may continue to work on the problem with open book / open notes / anything on the course homepage (but you cannot talk to anyone else), so long as you use another color for your solutions. I want to see what you were able to do.

1. (20 points) Let $\overrightarrow{P} = \langle 1, 1, 1 \rangle$, $\overrightarrow{Q} = \langle 1, -2, 1 \rangle$ and $\overrightarrow{R} = \langle 1, 0, 0 \rangle$.

   1. Find the cosine of the angle between $\overrightarrow{P}$ and $\overrightarrow{Q}$.

   2. Find the equation of the line going through $\overrightarrow{P}$ in the direction $\langle 3, 2, 1 \rangle$.

   3. Find the equation of the plane containing $\overrightarrow{P}$, $\overrightarrow{Q}$ and $\overrightarrow{R}$.

   4. Find the volume of the parallelpiped spanned by the directions $\overrightarrow{P}$, $\overrightarrow{Q}$ and $\overrightarrow{R}$; in other words, compute

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -2 & 1 \\ 1 & 0 & 0 \end{vmatrix}.$$

   5. Find $||\overrightarrow{Q} \times \overrightarrow{R}||$, and a unit vector in the direction $\overrightarrow{Q} \times \overrightarrow{R}$.