Math 241   Exam 1   Spring   2008

Write your answers as legibly as you can on the blank sheets of paper provided. Use only **one side** of each sheet. Be sure to number your pages. Put your solution to problem 1 first, and then your solution to number 2, etc.; although, by using enough paper, you can do the problems in any order that suits you.

There are 6 problems. SHOW your work. Make your work be coherent and clear. Write in complete sentences whenever this is possible. $\boxed{CIRCLE}$ your answer. **CHECK** your answer whenever possible. **No Calculators.**

1. (8 points) Find an equation for the line through the points $P_1 = (5, -2, 1)$ and $P_2 = (2, 4, 2)$. **Check your answer. Make sure it is correct.**

2. (8 points) Find an equation for the plane through the points $P_1 = (-2, 1, 1)$, $P_2 = (0, 2, 3)$, and $P_3 = (1, 0, 1)$. **Check your answer. Make sure it is correct.**

3. (8 points) Express $\overrightarrow{v} = <-2, 1, 6>$ as the sum of a vector parallel to $\overrightarrow{b} = <0, -2, 1>$ and a vector orthogonal to $\overrightarrow{b}$. **Check your answer. Make sure it is correct.**

4. (8 points) A bowling ball of radius R is placed in a box just large enough to hold it, and is secured for shipping by packing a styrofoam sphere into each corner of the box. Find the radius of the largest styrofoam sphere that can be used.

5. (10 points) Let P be the point $P = (1, -2, 3)$ and let $\mathfrak{P}$ be the plane $2x - 2y + z = 4$.
   a. What is the distance from P to $\mathfrak{P}$?
   b. What is the point on $\mathfrak{P}$ which is nearest to P?
   c. What is the equation of the line which is perpendicular to $\mathfrak{P}$ and passes through P?

6. (8 points) Find the equation of the line tangent to $\overrightarrow{r}(t) = t\,\overrightarrow{i} + t^2\,\overrightarrow{j}$ at the point $P = (2, 4)$.