MATH 265
FALL 2009
EXAM 1

1. Let $\vec{a} = \langle 2, 1, 3 \rangle$ and $\vec{b} = \langle -2, 7, -1 \rangle$
   a) (5 pts) Find the vector $5\vec{a} - 3\vec{b}$.
   b) (5 pts) Find $\vec{a} \circ \vec{b}$.
   c) (5 pts) Find the vector $\vec{a} \times \vec{b}$.
   d) (5 pts) Find the angle between the vectors $\vec{a}$ and $\vec{b}$.
   e) (5 pts) Find the scalar projection of $\vec{a}$ on $\vec{b}$.
   f) (5 pts) Find the vector projection of $\vec{a}$ on $\vec{b}$.

2. Consider the triangle with vertices $(1, 1, 1), (1, -2, 0)$ and $(0, -1, 3)$.
   a) (5 pts) Find the area of this triangle.
   b) (5 pts) Find the angle at the vertex $(1, 1, 1)$. Is this angle more or less than 90 degrees?

3. (5 pts) Find the line of intersection of the planes $x + y = 4$ and $x - z = 2$.

4. Consider the points $P(1, 0, 0)$ and $Q(-1, 0, 0)$.
   a) (5 pts) Find all points in $\mathbb{R}^3$ that have distance R from P and describe the surface.
   b) (5 pts) Find all points in $\mathbb{R}^3$ that are equidistant from P and Q and describe the surface.
   c) (5 pts) Find all points, A, in $\mathbb{R}^3$ such that the distance from P to A plus the distance from Q to A is 4 and describe the surface.

5. Consider the line $x = at - 1, y = bt - 1, z = ct - 1$ (a, b, c not all 0).
   a) (5 pts) Find the closest point on this line to the origin.
   b) (5 pts) What happens to your answer if $a = b = c$?