MAC 2313 Calculus 3 **Test 1** 9 Sep 2004

Directions: Show **ALL** work for credit; Give **EXACT** answers when possible; Start each problem on a **SEPARATE** page; Use only **ONE** side of each page; Be neat; Leave margins on the left and top for the **STAPLE**; Calculators can be used for graphing and calculating only; Nothing written on this page will be graded;

1. Let $P(1,0,2)$, $Q(1,4,0)$ and $R(0,2,2)$. Find the equation of the plane throught the points P, Q and R and the area of the parallelogram with sides PQ and PR.

2. Determine whether the lines L_1 and L_2 are parallel, skew or intersecting. If they intersect find the point of intersection.

$$L_1: \quad x = 2 - 2t, \quad y = 4t, \quad z = 2$$
$$L_2: \quad x = -1 + 3s, \quad y = 3s, \quad z = -2 + 6s$$

3. A woman walks due southeast on the deck of a huge airship at 2 km/h. The ship's horizontal motion is northeast at a speed of 4 km/h and its vertical motion is climbing at a rate of 2 km/h Find the velocity vector of the women relative to the ground. Find her speed and a unit vector in the direction of the velocity. (The x-axis points East, the y-axis points North, and the z-axis points up.)

4. Using vector operations write $\vec{a} = \langle -1, 3, 1\rangle$ as the sum of two vectors $\vec{w} + \vec{v}$, where $\vec{w}$ is parallel to $\vec{b}$ and $\vec{v}$ is perpendicular to $\vec{b}$, when $\vec{b} = \langle 2, -1, 0\rangle$.

5. True or False and a brief reason why or why not.
   (a) The equation $x^2 + 2x + y^2 + z^2 = 3$ is an equation of a sphere with radius 2.
   (b) The vectors $\langle 1, -2, 3\rangle$ and $\langle -2, 4, -6\rangle$ are parallel.
   (c) The equation $x^2 - y^2 - z^2 = -1$ is a hyperboloid of two sheets.
   (d) The equation $x^2 + y^2 - z^2 = 0$ is a hyperboloid of one sheet.
   (e) $\langle 1, 0, 3\rangle$ is normal to the plane $z = 3 - x/3$.
   (f) $\vec{i} \times \vec{k} = \vec{j}$
   (g) $\left\langle \sqrt{3}, 1 \right\rangle$ makes an angle of $\pi/6$ with respect to the x-axis.
   (h) The ellipsoid $x^2 + 4y^2 + 9z^2 = 1$ intersects the z-axis at the points $(0, 0, \pm 3)$.
   (i) $\vec{i} + \vec{k} = \langle 1, 1\rangle$
   (j) Two distinct lines are either parallel or they intersect.