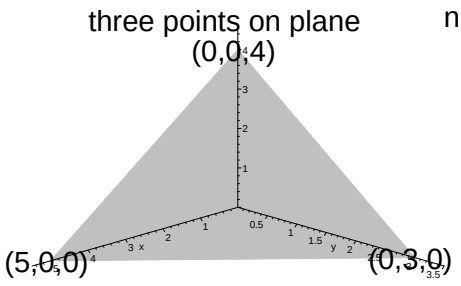
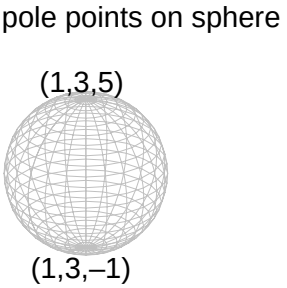
MAC 2313 Calculus 3 **Test 1** 26 Jan 2005

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. Find the equation of the plane (below left) and the sphere (below right).





2. Using vector operations write $\vec{a} = \langle 3, -1, 4\rangle$ as the sum of two vectors, one parallel (say $\vec{v}$), and one perpendicular (say $\vec{w}$) to $\vec{b} = \langle -3, 6, 2\rangle$.

3. A treasure map reads start at the big X, face due east, rotate $\pi/3$ counter-clockwise, walk 10 paces, then walk 5 paces due north and finally dig a hole 3 paces deep. Write the vector $\vec{v}$ that goes from the big X to the bottom of the hole and find the exact simplified value of the length squared $\|\vec{v}\|^2$. (The x-axis points East, the y-axis points North, and the z-axis points up.)

4. True or False and a brief reason why or why not.

   (a) The vector $\langle 1, 0, 1\rangle$ is a unit vector.

   (b) The planes $x + 3y - 2z = 10$ and $-2x - 6y + 4z = 5$ are parallel.

   (c) The point $P(1, -1, 0)$ in rectangular coordinates is the same as the point $Q(\sqrt{2}, 3\pi/4, 0)$ in spherical coordinates.

   (d) The point $(\sqrt{5}, \pi, -\pi)$ is a valid point in spherical coordinates.

   (e) The equation $x^2 + y^2 - z^2 = 1$ and the z-axis intersect in two points.

   (f) The rectangular equation $x^2 + y^2 + z^2 - z = 0$ in spherical coordinates is $\rho = \cos\phi$.

   (g) The cylindrical equation $z = r^2$ is the equation of a cone.

   (h) The rectangular equation $x = 4$ in cylindrical coordinates is $r = 4\sec\theta$.

   (i) If $\vec{u} \perp \vec{v}$ and both are unit vectors, then so is $\vec{u} \times \vec{v}$

   (j) If $\vec{u}$ and $\vec{v}$ and both are unit vectors, then $\vec{u} \cdot \vec{v}$ is $\sin\theta$.

5. Find parametric equations of the line of intersection of the two planes $x - y - z = 1$ and $11x + 5y - 5z = 20$.