MAC 2313 Calculus 3 **Mini-Test 2** 4 Feb 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. Show the limit below does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^3 + y^3}$$

2. Consider the equation $x^2 + 4y^2 - z^2 = 1$ and its graph.
   (a) Identify the graph by name.
   (b) Which of the three x-axis, y-axis or z-axis does not intersect the graph?
   (c) Carefully do a 2D plot of the $z = 0$ contour of this equation (in the xy-plane).
   (d) Carefully do a 2D plot of the $y = 0$ section of this equation (in the xz-plane).
   (e) Carefully do a 2D plot of the $z = \sqrt{3}$ contour of this equation (in the xy-plane).

3. A particle moves at a constant speed along a line from the point $P = (1, -1, 2)$ to the point $Q = (5, 3, 0)$. Find the parametric equation of the line if
   (a) It takes five seconds to go from P to Q.
   (b) The speed of the particle is 5 units per second.

4. Consider the following equations in polar coordinates.
   (I) $r = 2$ (II) $r = 2\sec\theta$ (III) $r = 2\sin\theta$ (IV) $r = 2\csc\theta$ and (V) $r = \tan\theta\sec\theta$.
   Match the equations above with five of the equations in rectangular coordinates below.
   (A) $y = 2$ (B) $x^2 = y$ (C) $x^2 - 2x + y^2 = 0$ (D) $x^2 + y^2 = 2$
   (E) $x^2 + y^2 = 4$ (F) $y^2 = x$ (G) $x = 2$ (H) $x^2 - 2y + y^2 = 0$

5. Consider the parametric equation $\vec{r}(t) = \langle t\cos t, t\sin t, t\rangle$ whose graph is pictured below.
   (a) Compute the velocity (by hand).
   (b) Compute and simplify the speed (by hand). [All the trig functions will convenietly disappear.]
   (c) Use the TI-89 to find the exact arclength of the curve from $t = 0$ to $t = 1$.
   (d) Find parametric equations of the tangent line to the curve at $t = 1$.
   (e) Show each point of our curve is on the cone $x^2 + y^2 = z^2$.