MAC 2313 Calculus 3 **Test 1** 15 Sept 1998

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper. Do **NOT** write on this page. Calculators can be used for graphing and calculating only.

1. Find the velocity, acceleration and speed of the curve $e^t\mathbf{i} + t\sqrt{2}\mathbf{j} + e^{-t}\mathbf{k}$.

2. Find the curvature $\kappa = |\mathbf{r}'(t) \times \mathbf{r}''(t)|/|\mathbf{r}'(t)|^3$ of the space curve $\mathbf{r}(t) = \langle \sin t, \cos t, \sin t \rangle$.

3. CAREFULLY plot the point P with rectangular coordinates $(2, 2, 2\sqrt{2})$. Find BOTH cylinderical and spherical co-ordinates of P. (If you like you can trace the axis at the bottom of the page. Marks on this page will not be graded.)

4. Find and SIMPLIFY the equation of the plane which contains the three points (2,1,-3), (5,-1, 4) and (2,-2,4).

5. Write down equations for each of the following:
   i. Any hyperboloid of one sheet.
   ii. Any hyperboloid of two sheets.
   iii. Any parabolic cylinder.
   iv. Any ellipsoid centered at the origin which is "bigger" in the x-direction than in either the y or z direction.
   v. A monkey saddle.

6. Find where the two lines $\langle 1, 1, 0 \rangle + t \langle 1, -1, 2 \rangle$ and $\langle 2, 0, 2 \rangle + s \langle -1, 1, 0 \rangle$ intersect AND find the equation of the plane containing both lines.

7. Find the scalar and vector projections of $\mathbf{b} = 4\mathbf{i} - \mathbf{j}$ onto $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j}$.

8. Rewrite the parametric equation (now in rectangular coordinates) $\langle \cos t, \sin t, t \rangle$ as parametric equations in both cylinderical and sphercial coordinates.

9. Identify the surface whose equation is $\rho^2(\sin^2\phi\cos^2\theta - \cos^2\phi) = 4$. Sketch it.

10. Find parametric equations of the line through the point $(0, 1, 2)$ that is perpendicular to the line $x = 1 + t, y = 1 - t, z = 2t$ and intersects this line.