MAC 3313 Calculus 3 **Test 1** 17 Sept 1996

Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper.

1. Write the equation $x^2 + y^2 - z^2 = 16$ in both cylinderical and spherical co-ordinates.

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

3. Find an equation of the plane which contains the three points (-1,1,-1), (1,-1,2) and (4,0,3).

4. Find a unit vector perpendicular to both the line $\frac{x-2}{2} = 2y - 3 = \frac{z+1}{3}$, and the line $\langle x, y, z\rangle = \langle 2 + t, 0, -1 - 2t\rangle$

5. Find the position vector $\mathbf{r}(t)$ and velocity vector $\mathbf{v}(t)$ of a paticle that has the acceleration $\mathbf{a}(t) = \langle 0, 0, 1\rangle$, initial velocity $\mathbf{v}(0) = \langle 1, -1, 0\rangle$ and initial postion $\mathbf{r}(0) = \langle 0, 0, 0\rangle$

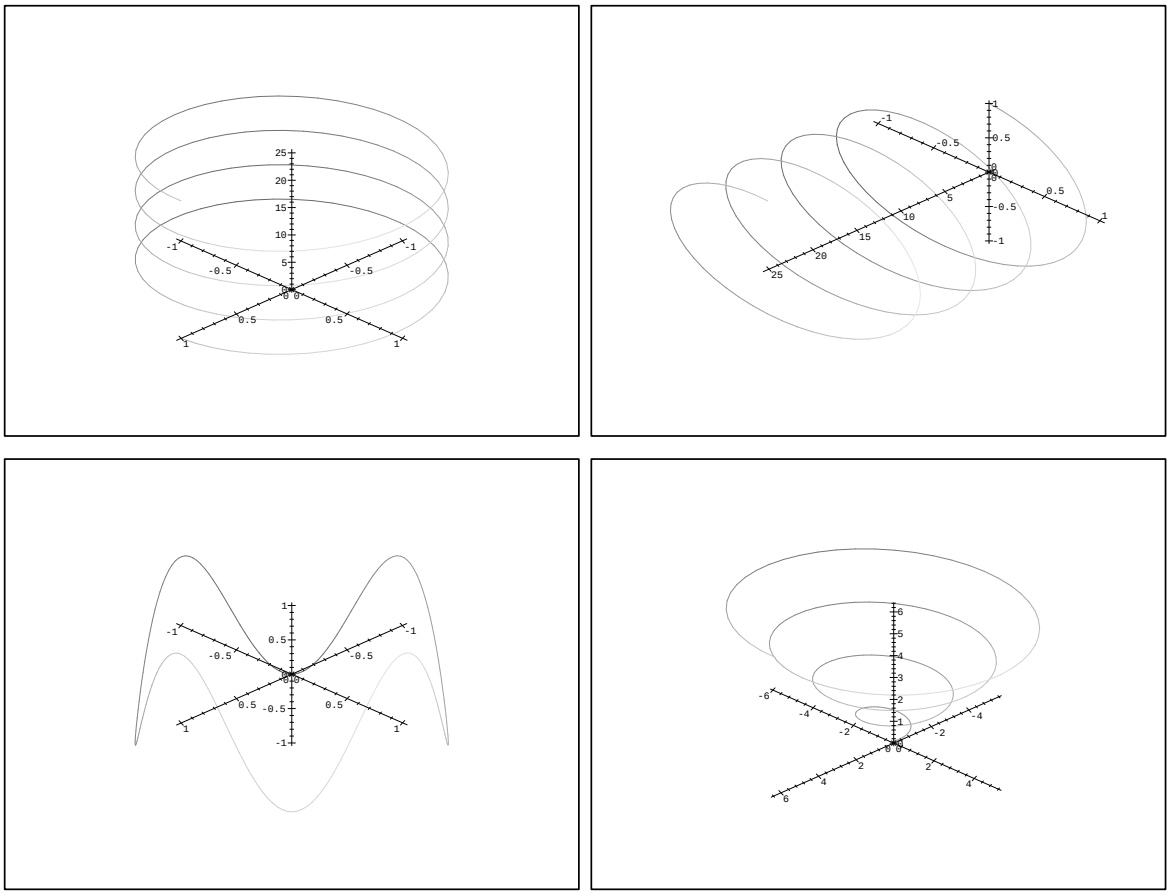
6. Find parametric equations for the line of intersection of the planes $z = x + y$ and $2x - 5y - z = 1$.

7. Find **BOTH** the equation of the plane through the point Q(2,8,5) parallel to the plane P given be the equation $x - 2y - 2z - 1 = 0$ and find the distance from Q to P.

8. Find and simplify the unit tangent vector $\mathbf{T}(t)$, the unit normal vector $\mathbf{N}(t)$ and the curvature $\kappa = |\mathbf{T}'(t)/|\mathbf{r}'(t)|$ of the space curve $\mathbf{r}(t) = \left\langle \sqrt{2}\cos t, \sin t, \sin t\right\rangle$.

9. Reduce the quadric equation below to one of the standard forms, classify the surface and sketch it. $4x^2 - y^2 + z^2 + 8x + 8z + 24 = 0$

10. Graph the curves $\langle \cos t, \sin t, \cos 4t\rangle$, $\langle \cos 4t, \sin 4t, 4t\rangle$, $\langle t\cos t, t\sin t, t\rangle$ and $\langle 4t, \sin 4t, \cos 4t\rangle$. Hint: Below are maple spacecurve plots of the functions in some order.



Maple space curve plots