Problem 8. Use vectors to show that the diagonals of a rhombus are perpendicular. Recall that a rhombus is a parallelogram with sides of equal length.

Problem 9. Consider the quadrilateral in the plane with vertices

$(-6, 0)$, $(1, -4)$, $(3, 1)$ and $(-4, 5)$.

Show that this quadrilateral is a parallelogram and find its area.

Problem 10. Find the volume of the tetrahedron with vertices

$(0, 0, 0)$, $(1, 1, 0)$, $(0, 1, 1)$ and $(1, 0, 1)$.

Problem 11. Find the distance from the point $(0, 0, 1)$ to the line

$x = 2t$, $y = 1 + 2t$, $z = 2t$.

Problem 12. Find the distance from the point $(2, 2, 3)$ to the plane $2x + y + 2z = 4$.

Problem 13. Find a plane through the points $(1, 2, 3)$ and $(3, 2, 1)$ which is perpendicular to the plane $4x - y + 2z = 7$.

Problem 14. Carefully draw the surface $x^2 + y^2 - z^2 = 1$, including its intersections with the coordinate planes.

Problem 15. Carefully draw the surface $z = 4x^2 + y^2$, including its intersections with the coordinate planes.

Problem 16. (a) Using cylindrical coordinates, sketch the surface $z = r^2$.
(b) Using cylindrical coordinates, sketch the surface $r^2 + z^2 = 1$.

Problem 17. (a) Using spherical coordinates, sketch the surface $\cos\phi = \rho \sin^2 \phi$.
(b) Using spherical coordinates, sketch the surface $\rho \cos\phi + \rho^2 \sin^2 \phi = 1$.

Problem 18. In the yz-plane, the circle with center at $y = 2$, $z = 0$ and radius 1 is rotated about the z-axis to form a donut shaped surface (called a "torus"). Carefully sketch this surface, and then find its equation in cylindrical coordinates and its equation in spherical coordinates.

*Note. **Use a full page for each sketch, make the sketches very clear and not too light, and use shading to suggest three-dimensionality.***