1. Use the cross product to calculate the area of the triangle with vertices \((1, 1, 1), (2, 3, 2),\) and \((3, -1, 4)\).

2. At what point do the curves \(\vec{r}_1 (t) = < t, t^2, t^3 >\) and \(\vec{r}_2 (t) = < 1 + t, 4t, 8t^2 >\) intersect? Find their angle of intersection to the nearest degree.

3. Find an equation for the planes consisting of all points that are equidistant from the points \((1, 2, 3)\) and \((-1, 1, -1)\).

4. For \(0 \leq t \leq 1\) a particle moves with position vector given by \(\vec{r} (t) = 2t^{3/2} \vec{i} + \cos 2t \vec{j} + \sin 2t \vec{k}\). Find the initial speed of the particle and the total distance it travels.

5. Find the points on the ellipsoid \(x^2 + \frac{y^2}{4} + \frac{z^2}{9} = 1\) where the tangent plane is parallel to the plane \(z = x + y\).

6. Find and classify the critical points of \(f(x, y) = x^4 - 8xy + 2y^2 - 3\).

7. A cardboard box without a lid is to have a volume of 32,000 \(cm^3\). Find the dimensions that minimize the amount of cardboard used.

8. Find the volume of the solid bounded by the paraboloid \(z = 10 - 3x^2 - 3y^2\) and the plane \(z = 4\).

9. Find the area of the part of the surface \(z = x + y^2\) that lies above the triangle with vertices \((0, 0), (1, 1),\) and \((0, 1)\).

10. Evaluate \(\iiint_{E} y \, dV\) where \(E\) is the solid tetrahedron with vertices \((0, 0, 0), (1, 0, 0), (0, 1, 0),\) and \((0, 0, 2)\).