1. A space probe in the shape of the ellipsoid

$$4x^2 + y^2 + 4z^2 = 16$$

enters Earth's atmosphere and its surface begins to heat. After 1 hour, the temperature at the point (x, y, z) on the probe's surface is given by

$$T(x, y, z) = 8x^2 + 4yz - 16z + 600.$$

Find the hottest point on the surface of the probe.

2. Find the volume of the largest closed rectangular box in the first octant having three faces in the coordinate planes and a vertex on the plane

$$x/a + y/b + z/c = 1.$$

where $a > 0, b > 0$ and $c > 0$.

3. Find the volume of the prism whose base is the triangle in the xy-plane bounded by the x-axis and the lines $y = x$ and $x = 1$ and whose top lies in the plane

$$z = f(x, y) = 3 - x - y.$$

4. Find the centroid ($\delta = 1$) of the solid enclosed by the cylinder $x^2 + y^2 = 4$, bounded above by the paraboloid $z = x^2 + y^2$, and bounded below by the xy-plane.

5. Find the potential and field everywhere between the spheres in a spherical capacitor, which is having two concentric spheres of radii R_1, R_2, with the inner one maintained at a potential V_0 and the outer at zero.

6. Find the divergence of these vector fields:

   (a) $Q = r\sin\theta\hat{r} + r^2 z\hat{\theta} + z\cos\theta\hat{z}$; using cylindrical co-ordinates (r, θ, z)

   (b) $T = \frac{1}{\rho^2}\cos\phi\hat{\rho} + \rho\sin\phi\cos\theta\hat{\phi} + \cos\phi\hat{\theta}$; using spherical -cordinates (ρ, ϕ, θ)