1) Compute the volume using spherical coordinates: Inside the cone with central angle $\pi/3$ and inside a central sphere of radius 3.

2) Interchange the limits giving the integral for $dxdydz$, $dxdzdy$, $dydzdx$, $dydxdz$, $dzdxdy$:

$$
\int_0^1 \int_x^1 \int_0^y dzdydx
$$

3) Use cylindrical coordinates to compute the volume of a region bounded by $z = 2$, $z = x^2 + y^2$.

4) Use integration to find the volume of the tetrahedron with vertices $(0, 0, 0), (1, 0, 0), (0, 1, 0), (0, 0, 1)$.

5) Find the center of mass for the quarter sphere i.e., the part of the unit sphere in the first octant.
6) Use Green's theorem to compute \( \int_{\mathcal{C}} P(x, y) + Q(x, y) \, dy \), where \( \mathcal{C} \) is the unit circle and

\[
\text{a)} P = 2y, Q = -2x, \quad \quad \quad \text{b)} P = x^2y, Q = \sin(y).
\]

7) Determine if \( \mathbf{F}(x, y) = (2xy^3 + 2xy + y \cos(xy)) \mathbf{i} + (3x^2y^2 + x^2 + x \cos(xy) + 1) \mathbf{j} \) is conservative and find the potential function if it is conservative.

8) Compute the line integral \( \int_{\mathcal{C}} z^2y^2 \, dx + (x + y + z) \, dy + dz \) for the line from \((2, 1, 0)\) to \((-1, 3, 2)\).

9) Use the Stokes' to calculate \( \int_{\mathcal{S}} \nabla \times \mathbf{F} \cdot \mathbf{n} \, dS \) for the sphere of radius 1, where \( \mathbf{F} = \langle -z, y, x \rangle \).

10) Use the divergence theorem to compute \( \int_{\mathcal{S}} \mathbf{F} \cdot \mathbf{n} \, dS \) over the unit sphere where \( \mathbf{F} = \langle x^2, y^2, z \rangle \) (Hint: use spherical coordinates for the volume integral).