Evaluate the iterated integral

1) $\int_0^{\pi/2}\int_0^2\int_9^{9-r^2} r\,dz\,dr\,d\theta$

$$\boxed{7\pi}$$

2) $\int_0^{2\pi}\int_{\pi/2}^{\pi}\int_1^2 \rho^2\sin\phi\;d\rho\,d\phi\,d\theta$

$$\boxed{\frac{14\pi}{3}}$$

Use Cylindrical coordinates

3) Evaluate $\iiint_E \sqrt{x^2+y^2}\,dV$, where E is the region that lies inside the cylinder $x^2+y^2=16$ and between the planes $z=-5$ and $z=4$.

$$\boxed{384\pi}$$

4) Evaluate $\iiint_E \sqrt{x^2+y^2}\,dV$, where E is enclosed by the paraboloid $z=1+x^2+y^2$, the cylinder $x^2+y^2=5$, and the xy-plane .

$$\boxed{\pi\left(e^6-e-5\right)}$$

5) Find the volume of the region E bounded by the paraboloids $z = x^2 + y^2$ and $z = 36 - 3x^2 - 3y^2$. Also find the centroid of E (the center of mass in the case where the density is constant).

$$\boxed{162\pi, \quad (\overline{x}, \overline{y}, \overline{z}) = (0,0,15)}$$

Use Spherical Coordinates

6) Evaluate $\iiint\limits_E \left(x^2 + y^2 + z^2\right) dV$, where E is the unit ball $x^2 + y^2 + z^2 \le 1$.

$$\boxed{\frac{4\pi}{5}}$$

7) Evaluate $\iiint\limits_E xyz\, dV$, where E lies between the spheres $\rho = 2$, $\rho = 4$ and above the cone $\phi = \dfrac{\pi}{3}$.

$$\boxed{0}$$

8) Let H be a solid hemisphere of radius a whose density at any point is proportional to its distance from the center of the base $\rho(x, y, z) = K\sqrt{x^2 + y^2 + z^2}$.

a) Find the mass of H.
b) Find the center of mass of H.
c) Find the moment of inertia of H about its axis I_z.

a) $\boxed{\frac{1}{2}\pi K a^4}$

b) $\boxed{(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{2}{5}a\right)}$

c) $\boxed{I_z = \frac{2}{9}\pi K a^6}$

9) Evaluate $\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}}\int_{x^2+y^2}^{2-x^2-y^2} \left(x^2 + y^2\right)^{3/2} \, dz\, dy\, dx$ by changing to cylindrical coordinates.

$$\boxed{\frac{8\pi}{35}}$$

10) Evaluate $\int_{-3}^{3}\int_{-\sqrt{9-x^2}}^{\sqrt{9-x^2}}\int_{0}^{\sqrt{9-x^2-y^2}} z\sqrt{x^2 + y^2 + z^2} \, dz\, dy\, dx$ by changing to spherical coordinates.

$$\boxed{\frac{243\pi}{5}}$$