PART 1

1. Find the volume of the domain bounded from above by the sphere $x^2+y^2+z^2=a^2$ and from below by the cone $z^2\sin^2\alpha=(x^2+y^2)\cos^2\alpha$ where α is a constant such that $0\le\alpha\le\pi$. Deduce the volume of the sphere.

2. Evaluate the following triple integrals:

   $\iiint_D z^2dxdydz$; $\iiint_D (x^2+y^2+z^2)dxdydz$ with $D=\{x\ge 0; y\ge 0; z\ge 0; x+y+z\le 1\}$

3. Evaluate $\iiint_D\left(1-\frac{x^2}{a^2}-\frac{y^2}{b^2}-\frac{z^2}{c^2}\right)dxdydz$ with $D=\{(x,y,z)\in R^3 / \frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}\le 1\}$

4. Evaluate the volume of the domain D bounded by:

   $y=\sqrt{x};\ y=2\sqrt{x};\ x+z=6;\ z=0$

5. Evaluate the volume of the domain D bounded by the surfaces:

   $2(x^2+y^2)-z^2=0$ and $(x^2+y^2)-z^2+a^2=0$

6. D is the common part between: $2az\ge x^2+y^2$ and $x^2+y^2+z^2\le 3a^2$

   Evaluate: $\iiint_D (x+y+z)^2dxdydz$

7. Evaluate the volume of the region bounded by:

   $0\le x\le 1;\ x^2+y^2-x\le 0;\ 0\le z\le\sqrt{1-x^2-y^2}$

8. Let A be the region bounded by the surfaces:

   $\{y=1, y=-x, x=0, z=0$ and $z=-x.\}$. Evaluate: $\iiint_A e^{x+y+z}dxdydz$

9. Evaluate, using spherical coordinates, the volume inside the cone:

   $\sqrt{x^2+y^2}\le z\le 1$

10. Let A be the region bounded by the 2 concentric spheres of radius a and 1, with 0<a<1. Evaluate the triple integral of: $f(x,y,z)=\frac{1}{\sqrt{x^2+y^2+z^2}}$

11. Evaluate the triple integral of $f(x,y,z)=x^2$ over a portion of the cylinder: $x^2+y^2=a^2$, between the two planes: z = 0 and z = b>0.

12. Evaluate the volume of the region bounded by the cylinder y = cosx, and the planes: z = y, x = 0, $x=\pi/2$, and z = 0.

13. Evaluate, using cylindrical coordinates, the volume of the part of the sphere $x^2+y^2+z^2=a^2$ inside the cylinder: r = a sint.

14. Evaluate the volume of the region bounded by: $r^2 = 16$, and by the planes: $z = 0$, and $y = 2z$.

15. Let $D = \{x \geq 0, y \geq 0, z \geq 0, x + y + z \leq 1\}$. Evaluate $\iiint_D \frac{dxdydz}{(x+y+z)^2}$ by dividing the domain using planes such: $x + y + z = \mu$.

16. Evaluate the volume bounded by a sphere (S) and 2 planes that's intersection is tangent to (S).

17. Evaluate the volume of the domain defined by the following inequalities:

$$0 \leq \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} \leq 1; \quad -h \leq z \leq h$$

PART 2

18. Evaluate the mass of the ball of radius a>0, if the density at each point is equal to a constant * the distance to the origin.

19. Find the moment of inertia:

    a) Of a circular cone of height h, radius a and constant density d, with respect to a base diameter.

    b) Of an homogenous cylinder of height h and radius with respect to a base diameter..

20. Let's consider the homogenous solid bounded by the ellipsoid: $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} \leq 1$

    a) Find the coordinated of the center of gravity of the solid situated in the first octant.

    b) Evaluate the moment of inertia of the whole solid with respect to the x axis.