1) Evaluate the integral $\iiint_E (xz - y^3)\,dV$, where $E = \{(x, y, z) \mid -1 \le x \le 1,\ 0 \le y \le 2,\ 0 \le z \le 1\}$.

$$\boxed{-8}$$

2) Evaluate the iterated integral:

a) $\int_0^1 \int_0^z \int_0^{x+z} 6xz\ dy\,dx\,dz$

b) $\int_0^1 \int_0^z \int_0^y ze^{-y^2}\ dx\,dy\,dz$

a) $\boxed{1}$

b) $\boxed{\dfrac{1}{4e}}$

3) Evaluate the triple integral:

a) $\iiint_E 2x\,dV$ where, $E=\left\{(x,y,z)\,|\,0\le y\le 2,\ 0\le x\le \sqrt{4-y^2},\ 0\le z\le y\right\}$

b) $\iiint_E 6xy\,dV$, where E lies under the plane $z=1+x+y$ and above the region in the xy-plane bounded by the curves $y=\sqrt{x},\ y=0,\ x=1$.

c) $\iiint_E xz\,dV$, where E is the solid tetrahedron with vertices $(0,0,0)$, $(0,1,0)$, $(1,1,0)$, and $(0,1,1)$.

d) $\iiint_E x^2e^y\,dV$, where E is bounded by the parabolic cylinder $z=1-y^2$ and the planes $z=0,\ x=1,\ x=-1$.

e) $\iiint_E x\,dV$, where E is bounded by the paraboloid $x=4y^2+4z^2$ and the plane $x=4$.

a) $\boxed{4}$

b) $\boxed{\dfrac{65}{28}}$

c) $\boxed{\dfrac{1}{120}}$

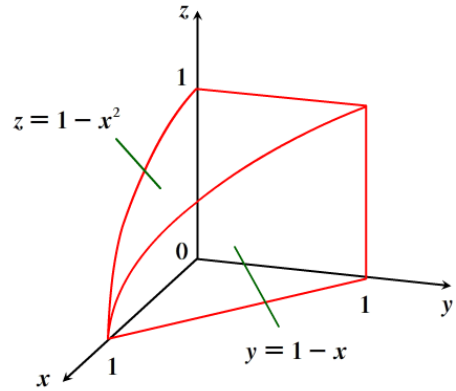
d) $\boxed{\dfrac{8}{3e}}$

e) $\boxed{\dfrac{16\pi}{3}}$

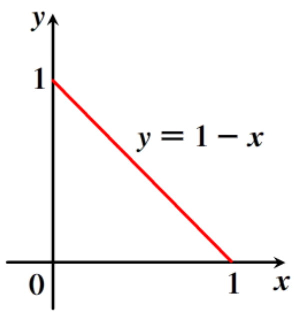
4) Use a triple integral to find the volume of the solid enclosed by the cylinder $x^2 + y^2 = 9$ and the planes $y + z = 5$ and $z = 1$. [Hint: use polar coordinates after integrating with respect to z]

$$\boxed{36\pi}$$

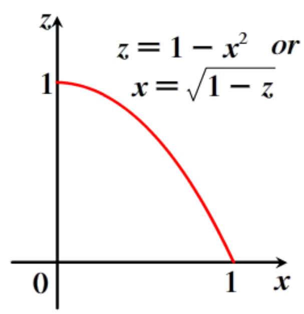
5) **Express** the iterated integral $\iiint_E dV$, where E is the solid drawn below, draw the projections of the solid onto each of the coordinate planes to aid you in expressing the following iterated integrals. **<u>Do not solve the iterated integrals</u>**.



xy-plane

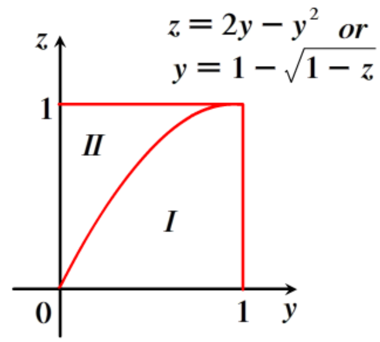


xz-plane



yz-plane

[Hint: 2 regions on this projection]



a) $\iiint_E dy\,dx\,dz$ $\boxed{\int_0^1\int_0^{\sqrt{1-z}}\int_0^{1-x} dy\,dx\,dz}$

b) $\iiint_E dz\,dx\,dy$ $\boxed{\int_0^1\int_0^{1-y}\int_0^{1-x^2} dz\,dx\,dy}$

c) $\iiint_E dz\,dy\,dx$ $\boxed{\int_0^1\int_0^{1-x}\int_0^{1-x^2} dz\,dy\,dx}$

d) $\iiint_E dy\,dz\,dx$ $\boxed{\int_0^1\int_0^{1-x^2}\int_0^{1-x} dy\,dz\,dx}$

e) $\iiint_E dx\,dy\,dz$ $\boxed{\int_0^1\int_0^{1-\sqrt{1-z}}\int_0^{\sqrt{1-z}} dx\,dy\,dz + \int_0^1\int_{1-\sqrt{1-z}}^1\int_0^{1-y} dx\,dy\,dz}$

f) $\iiint_E dx\,dz\,dy$ $\boxed{\int_0^1\int_0^{2y-y^2}\int_0^{1-y} dx\,dz\,dy + \int_0^1\int_{2y-y^2}^1\int_0^{\sqrt{1-z}} dx\,dz\,dy}$

6) Find the moments of inertia for a cube of constant density k and side length L if one vertex is located at the origin and three edges lie along the coordinate axes.

$$\boxed{I_z = I_y = I_z = \frac{2}{3}kL^5}$$

7) The joint density function for random variables X, Y, and Z is:

$$f(x, y, z) = \begin{cases} Cxyz & \text{if } 0 \le x \le 2,\ 0 \le y \le 2,\ 0 \le z \le 2 \\ 0 & \text{otherwise} \end{cases}$$

a) Find the value of the constant C.
b) Find $P(X \le 1,\ Y \le 1,\ Z \le 1)$
c) Find $P(X + Y + Z \le 1)$

a) $\boxed{C = \frac{1}{8}}$
b) $\boxed{\frac{1}{64}}$
c) $\boxed{\frac{1}{5760}}$