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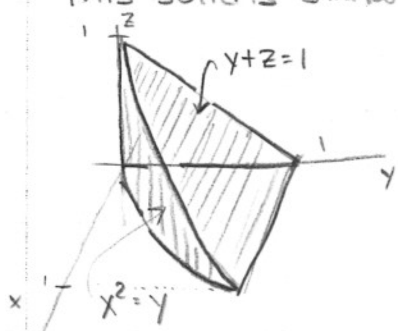
QUIZ: APRIL 7th

Write, but do not evaluate, an integral to describe the mass of the given solid.

1. The solid enclosed by the planes $y+z=1$, $x=0$, $y=0$, $z=0$, and the surface $x^2=y$, with density $\delta(x,y,z) = 1-y^2$

This solid is similar to the one in 15.7 #31.



Any of the six below is correct:

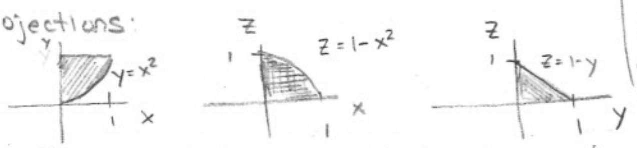
$$\int_0^1 \int_{x^2}^1 \int_0^{1-y} 1-y^2 \; dz\,dy\,dx \qquad \int_0^1 \int_0^{1-y} \int_0^{\sqrt{y}} 1-y^2 \; dx\,dz\,dy$$

$$\int_0^1 \int_0^{\sqrt{y}} \int_0^{1-y} 1-y^2 \; dz\,dx\,dy \qquad \int_0^1 \int_0^{1-z} \int_0^{\sqrt{y}} 1-y^2 \; dx\,dy\,dz$$

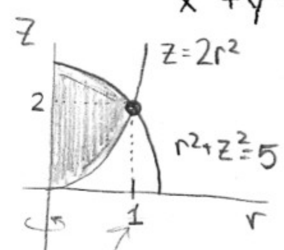
$$\int_0^1 \int_0^{1-x^2} \int_{x^2}^{1-z} 1-y^2 \; dy\,dz\,dx$$

$$\int_0^1 \int_0^{\sqrt{1-z}} \int_{x^2}^{1-z} 1-y^2 \; dy\,dx\,dz$$

Projections:



2. The solid bounded above by the sphere $x^2+y^2+z^2=5$ and below by the paraboloid $z=2x^2+2y^2$, with density $\delta(x,y,z) = \dfrac{z}{x^2+y^2}$.



why 1? See here

$2r^2 = \sqrt{5-r^2}$

$4r^4 = 5-r^2$

$4r^4+r^2-5=0$

Quadratic formula

$r^2 = \dfrac{-1 \pm \sqrt{1+80}}{8}$

$\rightarrow r=1.$

$$\int_0^{2\pi} \int_0^1 \int_{r^2}^{\sqrt{5-r^2}} \frac{z}{r^2} \cdot r \; dz\,dr\,d\theta$$

Don't forget to convert $\dfrac{z}{x^2+y^2}$ into cylindrical coordinates.

In rectangular:

$$\int_{-1}^1 \int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} \int_{2x^2+2y^2}^{\sqrt{5-x^2-y^2}} \frac{z}{x^2+y^2} \; dz\,dy\,dx$$