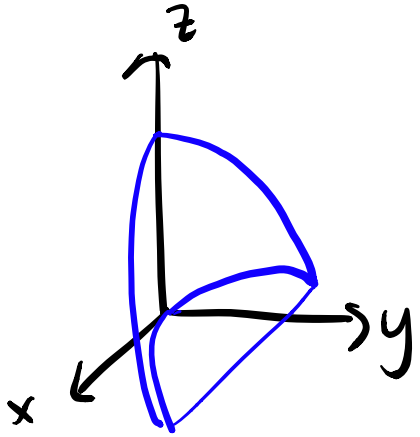
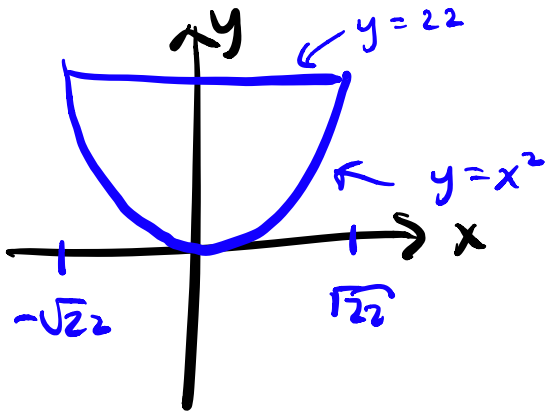
* 14.7.63, 16.4.20, 16.4.47, 16.4.22

16.4.20

Volume bdd by $y=x^2$, $z=22-y$, $z=0$

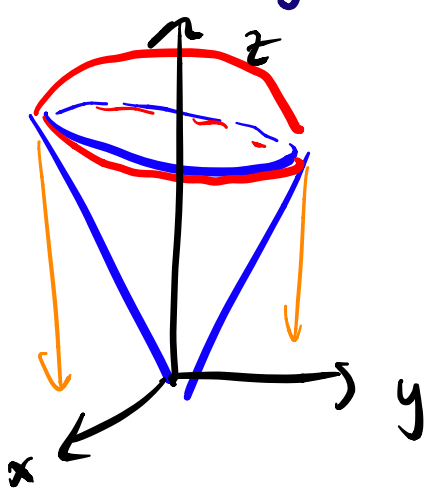




$$2\int_{0}^{\sqrt{22}}\int_{x^2}^{22}\int_{0}^{22-y} 1 \, dz\, dy\, dx$$

16.4.22

Vol bdd below by $z=\sqrt{x^2+y^2}$ and above by $x^2+y^2+z^2=18$

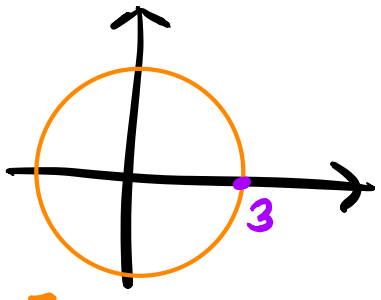


Cylindrical

$$x^2 + y^2 + \overbrace{(x^2+y^2)}^{z^2} = 18$$

$$2(x^2+y^2) = 18$$

$$x^2 + y^2 = 9$$



intersection of cone and sphere

Cone: $z = \sqrt{x^2+y^2} = r$

Sphere: $z = \sqrt{18-(x^2+y^2)} = \sqrt{18-r^2}$

$$\int_0^{2\pi}\int_0^{3}\int_r^{\sqrt{18-r^2}} r \, dz \, dr \, d\theta$$

Spherical

$0 \le \varphi \le \frac{\pi}{4}$

$0 \le \theta \le 2\pi$

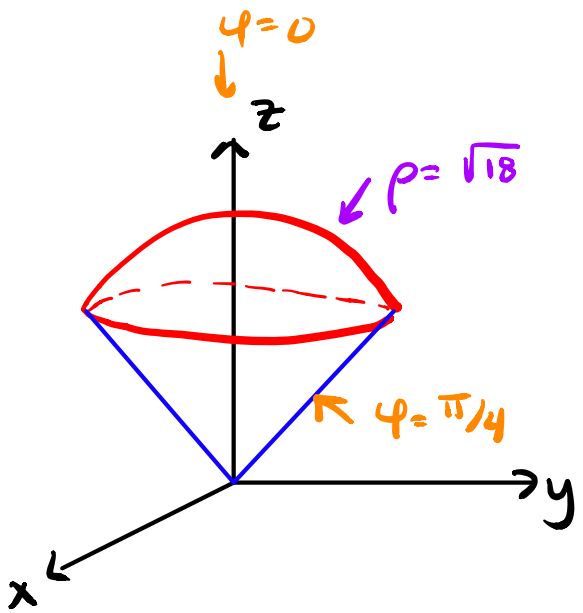
$0 \le \rho \le \sqrt{18}$

$z = \sqrt{x^2+y^2}$

$z = \sqrt{\rho^2 \sin^2\varphi}$

$\rho\cos\varphi = \rho\sin\varphi$

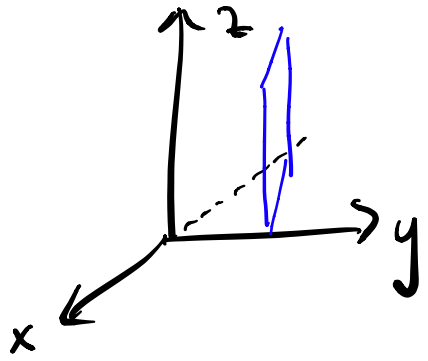
$\Rightarrow \varphi = \pi/4$

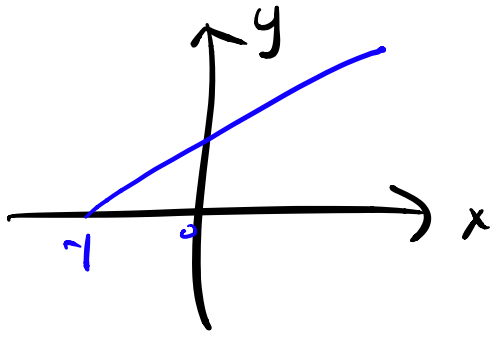


$$\int_0^{2\pi}\int_0^{\pi/4}\int_0^{\sqrt{18}} \rho^2\sin\varphi \, d\rho \, d\varphi \, d\theta$$

16.4.47

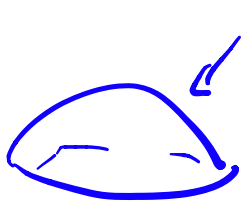
$$\int_0^7 \int_{-1}^{0} \int_0^{2x+2} dy\,dx\,dz \rightarrow \iiint dz\,dx\,dy$$





$$\int_0^2 \int_{\frac{y-2}{2}}^{0} \int_0^7 dz\,dx\,dy$$

*14.7.63



$$\int_0^{2\pi} \int \int_{\frac{1}{\cos\varphi}}^{2} \rho^2 \sin\varphi\,d\rho\,d\varphi\,d\theta$$

$$x^2+y^2+z^2=2$$

$$x^2+y^2=1$$

$$\rho^2\sin^2\varphi=1$$

$$\sin^2\varphi=\frac{1}{4} \rightarrow \sin\varphi=\frac{1}{2} \rightarrow \varphi=\frac{\pi}{6}$$