1. $\int\int\int_D 1dV, D = \{0 \leq r \leq 2 \wedge 0 \leq \theta \leq 2\pi \wedge 0 \leq z \leq r\}$
2. Bajo el paraboloide $z = 18 - 2x^2 - 2y^2$ y arriba del plano xy

   $0 = 18 - (2(x^2 + y^2)) \equiv$

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

   $x^2 + y^2 = 9$ Circunferencia de radio 3 centrada en el origen

   Al sustituir por polares D es de tipo 1

   En el plano xy la sombra que se proyecta del parboloide es $r \cdot \theta : (r, \theta) \in \mathbb{R}^3 : 0 \leq r \leq 3 \wedge 0 \leq \theta \leq 2\pi \Rightarrow$

   - $0 \leq r \leq 3$
   - $0 \leq \theta \leq 2\pi$
   - $0 \leq z \leq 18 - 2(x^2 + y^2) \overset{polares}{\equiv} 0 \leq z \leq 18 - 2r^2$

   $\int_0^3 (\int_0^{2\pi} (\int_0^{18-2r^2} 1dz) d\theta) dr$

   - $\int_0^{18-2r^2} rdz =$
     $rz|_0^{18-2r^2} =$
     $r(18 - 2r^2) - 0 =$
     $18r - 2r^3$
   - $\int_0^{2\pi} 18r - 2r^3 d\theta =$
     $18r\theta - 2r^3\theta|_0^{2\pi} =$
     $18r\theta -$
     $18r\pi - 4r^3\pi$
   - $\int_0^3 18r\pi - 4r^3\pi dr =$
     $9r^2\pi - r^4\pi|_0^3 =$
     $81\pi - 81\pi =$

   $\int_0^3 (\int_0^{2\pi} 18r - 2r^3 d\theta) dr$

   - $\int_0^{2\pi} 18r - 2r^3 d\theta =$
     $2(\int_0^{2\pi} 9r - r^3 d\theta) =$
     $2(9r\theta - \theta r^3|_0^{2\pi}) =$
     $2(18r\pi - 2\pi r^3) =$
     $4(9r\pi - \pi r^3) =$
   - $4(\int_0^3 9r\pi - \pi r^3 dr) =$
     $4(\frac{9\pi}{2} r^2 - \frac{\pi}{4} r^4|_0^3) =$
     $4(\frac{81\pi}{2} - \frac{81\pi}{4}) =$
     $2 \cdot 81\pi - 81\pi = 81\pi$

3. Encerrado por el hiperboloide $-x^2 - y^2 + z^2 = 1$ y el plano $z = 2$

   - $z^2 - 1 = x^2 + y^2 \overset{z=2}{\equiv} 3 = x^2 + y^2$ Circunferencia de radio $\sqrt{3}$ centrado en $(0, 0)$
   - $z = 2$

   $\int_0^{\sqrt{3}} (\int_0^{2\pi} 1d\theta) dr$

   - $\int_0^{2\pi} rd\theta =$
     $r\theta|_0^{2\pi} =$
     $2r\pi$
   - $\int_0^{\sqrt{3}} 2r\pi dr =$
     $r^2\pi|_0^{\sqrt{3}} =$
     3π

4. 1er octante $= \int_2^4 (\int_0^{\frac{\pi}{2}} (\int_r^{\sqrt{16-r^2}} r dz) d\theta) dr$

   - $\int_r^{\sqrt{16-r^2}} r dz =$
     $rz|_r^{\sqrt{16-r^2}} =$
     $r\sqrt{16-r^2} - r^2$
   - $\int_0^{\frac{\pi}{2}} r\sqrt{16-r^2} - r^2 d\theta =$
     $r\sqrt{16-r^2}\theta - r^2\theta\Big|_0^{\frac{\pi}{2}} =$
     $\frac{r\sqrt{16-r^2}\pi}{2} - \frac{r^2\pi}{2}$
   - $\int_2^4 \frac{r\sqrt{16-r^2}\pi}{2} - \frac{r^2\pi}{2} dr =$
     - $\int \frac{r\sqrt{16-r^2}\pi}{2} dr = \frac{\pi}{2} \int r(16-r^2)^{\frac{1}{2}} dr =$
       $\frac{(16-r^2)^{\frac{3}{2}}}{3} + C$
       $(\frac{(16-r^2)^{\frac{3}{2}}}{3})_r = \frac{1}{3} \cdot \frac{3(16-r^2)^{\frac{1}{2}} 2r}{2}$
     - $\int \frac{r^2\pi}{2} dr = \frac{r^3\pi}{6} + C$

     $\frac{\pi(16-r^2)^{\frac{3}{2}}}{6} - \frac{r^3\pi}{6}\Bigg|_2^4 =$
     $\frac{\pi(16-4^2)^{\frac{3}{2}}}{6} - \frac{4^3\pi}{6} - (\frac{\pi(16-2^2)^{\frac{3}{2}}}{6} - \frac{2^3\pi}{6}) =$
     $-\frac{32\pi}{3} - \frac{12^{\frac{3}{2}}\pi}{6} + \frac{4\pi}{3} = \star \Rightarrow$
     $V = 8 \cdot \star$