2. Let V be the volume of the solid bounded by the cylinder $x^2+y^2=1$ on the sides, the plane $z=y$ at the top, and the xy-plane at the bottom.

a. Only three of ❶-❹ will be graded. Mark the ones you want to be graded by putting a ✗ in the corresponding ☐s.

❶ ☒ Express V in terms of iterated integrals in Cartesian coordinates by filling in the rectangles.

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

❷ ☒ Express V in terms of iterated integrals in Cartesian coordinates by filling in the rectangles.

$$V = \int_{\boxed{0}}^{\boxed{1}} \int_{\boxed{z}}^{\boxed{1}} \int_{\boxed{-\sqrt{1-y^2}}}^{\boxed{\sqrt{1-y^2}}} dx\, dy\, dz$$

❸ ☒ Express V in terms of iterated integrals in cylindrical coordinates by filling in the rectangles.

$$V = \int_{\boxed{0}}^{\boxed{\pi}} \int_{\boxed{0}}^{\boxed{1}} \int_{\boxed{0}}^{\boxed{r\sin\theta}} r\, dz\, dr\, d\theta$$

❹ ☐ Express V in terms of iterated integrals in spherical coordinates by filling in the rectangles.

$$V = \int_{\boxed{}}^{\boxed{}} \int_{\boxed{}}^{\boxed{}} \int_{\boxed{}}^{\boxed{}} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$$

b. Compute V.

$$V = \int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}}\int_{0}^{y} dz\, dy\, dx = \int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}} z\Big]_{z=0}^{z=y} dy\, dx$$

$$= \int_{-1}^{1}\int_{0}^{\sqrt{1-x^2}} y\, dy\, dx = \int_{-1}^{1} \frac{1}{2}y^2\Big]_{y=0}^{y=\sqrt{1-x^2}} dx$$

$$= \frac{1}{2}\int_{-1}^{1}(1-x^2)\, dx = \frac{1}{2}\left[x-\frac{1}{3}x^3\right]_{-1}^{1} = \frac{1}{2}\left(1-\frac{1}{3}-(-1)+\frac{1}{3}\cdot(-1)\right) = \frac{2}{3}$$