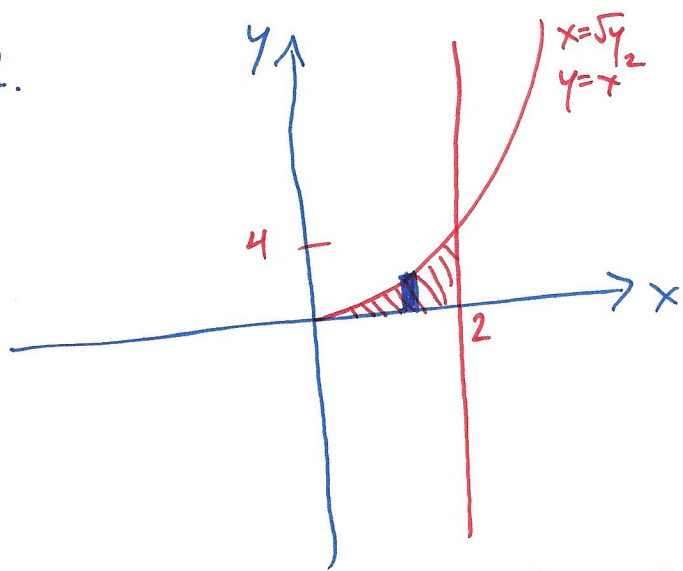


12.



After reversing the order of integration, we obtain

$$\begin{aligned}
 & \int_0^2 \int_0^{x^2} \sqrt{1+x^3} \, dy \, dx \\
 &= \int_0^2 \left[y \sqrt{1+x^3} \right]_{y=0}^{y=x^2} dx \\
 &= \int_0^2 \left[x^2 \sqrt{1+x^3} - 0 \right] dx \\
 &= \int_0^2 x^2 \sqrt{1+x^3} \, dx \\
 &= \frac{1}{3} \int_1^9 \sqrt{u} \, du \\
 &= \frac{1}{3} \left[\frac{2}{3} u^{3/2} \right]_1^9 \\
 &= \frac{2}{9} [27 - 1]
 \end{aligned}$$

$$\begin{aligned}
 \text{Let } u &= 1+x^3 \\
 du &= 3x^2 dx \\
 \frac{1}{3} du &= x^2 dx
 \end{aligned}$$

$$\begin{aligned}
 x=0 &\rightarrow u=1 \\
 x=2 &\rightarrow u=9
 \end{aligned}$$

$$\boxed{= \frac{52}{9}}$$