

$$f(x) = g(x) \text{ when } \frac{1}{4} + \sin(\pi x) = 4^{-x}.$$

f and g intersect when $x = 0.178218$ and when $x = 1$.
Let $a = 0.178218$.

$$(a) \int_0^a (g(x) - f(x)) dx = 0.064 \text{ or } 0.065$$

3 : $\left\{ \begin{array}{l} 1 : \text{limits} \\ 1 : \text{integrand} \\ 1 : \text{answer} \end{array} \right.$

$$(b) \int_a^1 (f(x) - g(x)) dx = 0.410$$

3 : $\left\{ \begin{array}{l} 1 : \text{limits} \\ 1 : \text{integrand} \\ 1 : \text{answer} \end{array} \right.$

$$(c) \pi \int_a^1 ((f(x) + 1)^2 - (g(x) + 1)^2) dx = 4.558 \text{ or } 4.559$$

3 : $\left\{ \begin{array}{l} 2 : \text{integrand} \\ 1 : \text{limits, constant, and answer} \end{array} \right.$

(a) $f(x) = 4 \Rightarrow x = 0, 2.3$

$$\begin{aligned}\text{Volume} &= \pi \int_0^{2.3} [(4+2)^2 - (f(x)+2)^2] dx \\ &= 98.868 \text{ (or } 98.867\text{)}\end{aligned}$$

4 : $\begin{cases} 2 : \text{integrand} \\ 1 : \text{limits} \\ 1 : \text{answer} \end{cases}$

(b) $\text{Volume} = \int_0^{2.3} \frac{1}{2}(4-f(x))^2 dx$
 $= 3.574 \text{ (or } 3.573\text{)}$

3 : $\begin{cases} 2 : \text{integrand} \\ 1 : \text{answer} \end{cases}$

(c) $\int_0^k (4-f(x)) dx = \int_k^{2.3} (4-f(x)) dx$

2 : $\begin{cases} 1 : \text{area of one region} \\ 1 : \text{equation} \end{cases}$

(a) $\text{Area} = \int_0^2 (2x - x^2) dx$
 $= x^2 - \frac{1}{3}x^3 \Big|_{x=0}^{x=2}$
 $= \frac{4}{3}$

3 : $\begin{cases} 1 : \text{integrand} \\ 1 : \text{antiderivative} \\ 1 : \text{answer} \end{cases}$

(b) $\text{Volume} = \int_0^2 \sin\left(\frac{\pi}{2}x\right) dx$
 $= -\frac{2}{\pi} \cos\left(\frac{\pi}{2}x\right) \Big|_{x=0}^{x=2}$
 $= \frac{4}{\pi}$

3 : $\begin{cases} 1 : \text{integrand} \\ 1 : \text{antiderivative} \\ 1 : \text{answer} \end{cases}$

(c) $\text{Volume} = \int_0^4 \left(\sqrt{y} - \frac{y}{2}\right)^2 dy$

3 : $\begin{cases} 2 : \text{integrand} \\ 1 : \text{limits} \end{cases}$