

1. Let R be the region between the curves $y = 2 \cos(x/2)$ and $y = \sin(x)$ for $0 \leq x \leq \pi$.

- Let V be the volume obtained by rotating R about the x -axis.
- Let W be the volume obtained by rotating R about the y -axis.

a. Express V as an integral using the washer method.

$$V = \pi \int_0^{\pi} \left((2 \cos(\frac{x}{2}))^2 - (\sin(x))^2 \right) dx$$

b. Express W as an integral using the cylindrical shells method.

$$W = 2\pi \int_0^{\pi} x \cdot (2 \cos(\frac{x}{2}) - \sin(x)) dx$$

c. Compute either ☒ V or ☐ W .

[Indicate the one you choose to compute by putting a **X** in the ☐ to the left of it. Choose only one. You will get points only for the one you choose. If you mark both or neither, then this part won't be graded.]

$$V = \pi \int_0^{\pi} (4 \cos^2(\frac{x}{2}) - \sin^2 x) dx = \pi \int_0^{\pi} \left(4 \cdot \frac{1 + \cos x}{2} - \frac{1 - \cos 2x}{2} \right) dx$$

$$= \pi \int_0^{\pi} \left(\frac{3}{2} + 2 \cos x + \frac{1}{2} \cos 2x \right) dx$$

$$= \pi \cdot \left[\frac{3}{2} x + 2 \sin x + \frac{1}{4} \sin 2x \right]_0^{\pi}$$

$$= \pi \cdot \left\{ \left(\frac{3}{2} \pi + 2 \sin \pi + \frac{1}{4} \sin 2\pi \right) - \left(0 + 2 \sin 0 + \frac{1}{4} \sin 0 \right) \right\}$$

$$= \pi \cdot \left(\frac{3}{2} \pi - 0 \right) = \frac{3}{2} \pi^2$$