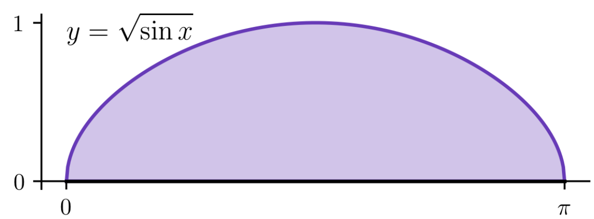
# The Disk and Washer Methods

*We practice setting up calculations related to the disk and washer methods*

**Example 1.** *Suppose the region below the graph $y = \sqrt{\sin x}$ and above the $x$-axis between $x = 0$ and $x = \pi$ is revolved around the $x$-axis. Compute the volume of the resulting solid.*




- *Because the axis of rotation lies perfectly along the boundary of the region, the (disk ✓/ washer) method can be used.*
- *The radius $R$ is the length of a (horizontal/ vertical ✓) extending from the axis to the graph $y = \sqrt{\sin x}$.*
- *Thus we know that the radius $R$ must equal*

  ***Multiple Choice:***

  (a) $R(x) = \sqrt{\sin x} - 0 = \sqrt{\sin x}$ ✓

  (b) $R(y) = \arcsin y^2 - 0 = \arcsin y^2$

- *We conclude that*

$$V = \int_{\boxed{0}}^{\boxed{\pi}} \pi \left( \boxed{\sqrt{\sin x}} \right)^2 d\boxed{x} = \boxed{2\pi}.$$

**Example 2.** *Suppose the region between the graphs $y = x/2$ and $y = x^2/4$ is revolved around the axis $x = 0$. Compute the volume of the resulting solid.*

Learning outcomes:
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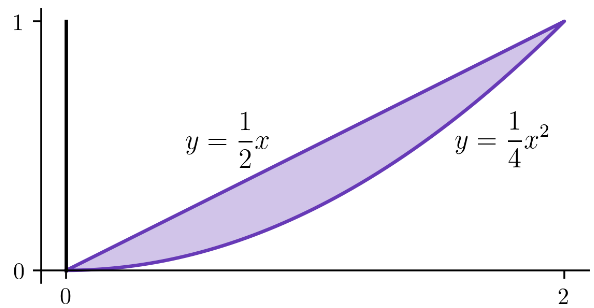


- *Because the axis of rotation does not lie along the boundary of the region, the ( disk/ washer ✓) method can be used.*
- *In this case, radius will equal the length of a ( horizontal ✓/ vertical ) extending from the axis to the graphs $y = x/2$ and $y = x^2/4$.*
- ***Multiple Choice:***
  (a) $R_{\text{outer}}(x) = x/2$ *and* $r_{\text{inner}}(x) = x^2/4$
  (b) $R_{\text{outer}}(y) = 2\sqrt{y}$ *and* $r_{\text{inner}}(y) = 2y$ ✓
- *We conclude that*

$$V = \int_{\boxed{0}}^{\boxed{1}} \pi \left[ \left( \boxed{2\sqrt{y}} \right)^2 - \left( \boxed{2y} \right)^2 \right] d\boxed{y} = \boxed{\frac{2\pi}{3}}.$$