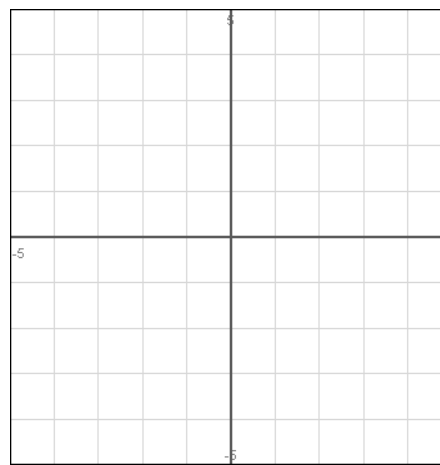


## Finding Volumes of Solids Using the Shell Method

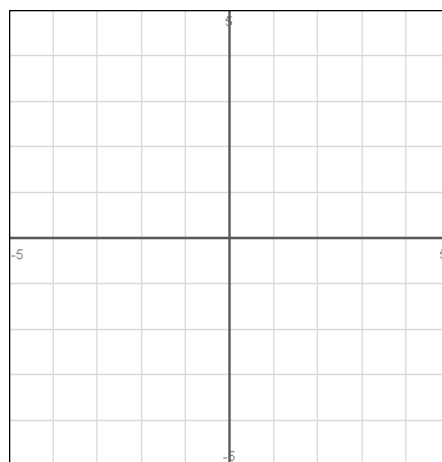
$$\text{Vertical Shell: Volume} = \int_a^b 2\pi \cdot (\text{Shell Radius}) \cdot (\text{Shell Height}) dx = \int_a^b 2\pi \cdot x \cdot f(x) dx$$

$$\text{Horizontal Shell: Volume} = \int_c^d 2\pi \cdot (\text{Shell Radius}) \cdot (\text{Shell Height}) dy = \int_c^d 2\pi \cdot y \cdot f(y) dy$$

1. The region bounded by the curve  $y = \sqrt{x}$ , the  $x$ -axis and the line  $x = 4$  is revolved about the line  $y$ -axis to generate a solid. Find the volume.



2. The region bounded by the curve  $y = \sqrt{x}$ , the  $x$ -axis and the line  $x = 4$  is revolved about the  $x$ -axis to generate a solid. Find the volume.



3. The region in the first quadrant bounded by the parabola  $y = x^2$ , the  $y$ -axis, and the line  $y = 4$  is revolved about the line  $x = 2$  to generate a solid. Find the volume.

