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Quiz – January 19, 2006

Consider the region in the plane which is bounded by $y = \sqrt{\cos x}$, $x = \pi/4$, $x = \pi/2$, and $y = 0$. Revolve this region about the x -axis. Find the volume of the resulting solid.

Answer: Draw the picture. We approximate the region in the plane using rectangles as drawn. Once this rectangle is revolved across the x axis, we will have a disk. The volume of the solid is obtained by adding the volume of these discs together, and taking the limit. (In other words, we integrate.) The indicated rectangle becomes a disk of volume $\pi r^2 t$, where $t = dx$ and $r = \sqrt{\cos x}$. The volume of the solid is

$$\pi \int_{\pi/4}^{\pi/2} \cos x dx = \pi \sin x \Big|_{\pi/4}^{\pi/2} = \boxed{\pi(1 - \sqrt{2}/2)}.$$

