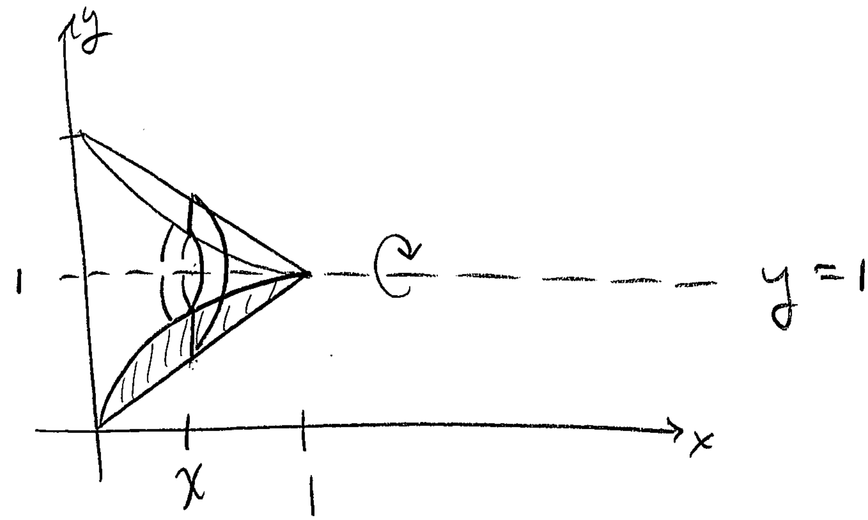
(1) [7] The region bounded by the curves $y = x$ and $y = \sqrt{x}$ is rotated about the line $y = 1$. Determine the volume of the resulting solid. (The disk method would work best here.)



$$A(x) = \pi(1-x)^2 - \pi(1-\sqrt{x})^2$$

$$\therefore\ V = \int_0^1 \pi(1-x)^2 - \pi(1-\sqrt{x})^2\, dx$$

$$= \pi \int_0^1 \cancel{1} - 2x + x^2 - \cancel{1} + 2\sqrt{x} - x\, dx$$

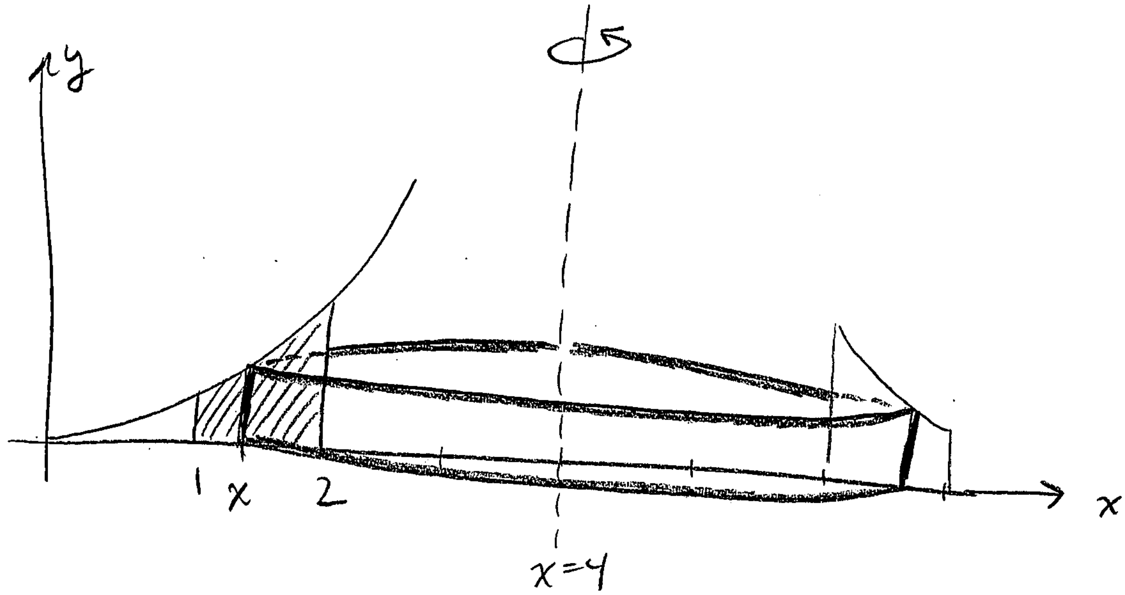
$$= \pi \left[\frac{x^3}{3} - 3\frac{x^2}{2} + 2\frac{x^{3/2}}{3/2} \right]_0^1$$

$$= \pi \left[\frac{1}{3} - \frac{3}{2} + \frac{4}{3} \right]$$

$$= \pi \left[\frac{2 - 9 + 8}{6} \right]$$

$$= \boxed{\frac{\pi}{6}}$$

(2) [8] The region bounded by the curves $y = x^2$, $y = 0$, $x = 1$ and $x = 2$ is rotated about the line $x = 4$. Determine the volume of the resulting solid. (Cylindrical shells would be best here.)



$$V = \int_1^2 2\pi\,(4-x)\,x^2\,dx$$

$$= 2\pi \int_1^2 4x^2 - x^3\,dx$$

$$= 2\pi \left[\frac{4}{3}x^3 - \frac{x^4}{4}\right]_1^2$$

$$= 2\pi \left[\left(\frac{32}{3} - 4\right) - \left(\frac{4}{3} - \frac{1}{4}\right)\right]$$

$$= \cancel{2}\pi \;\frac{128 - 48 - 16 + 3}{\cancel{12}\ 6}$$

$$= \frac{67\pi}{6}$$