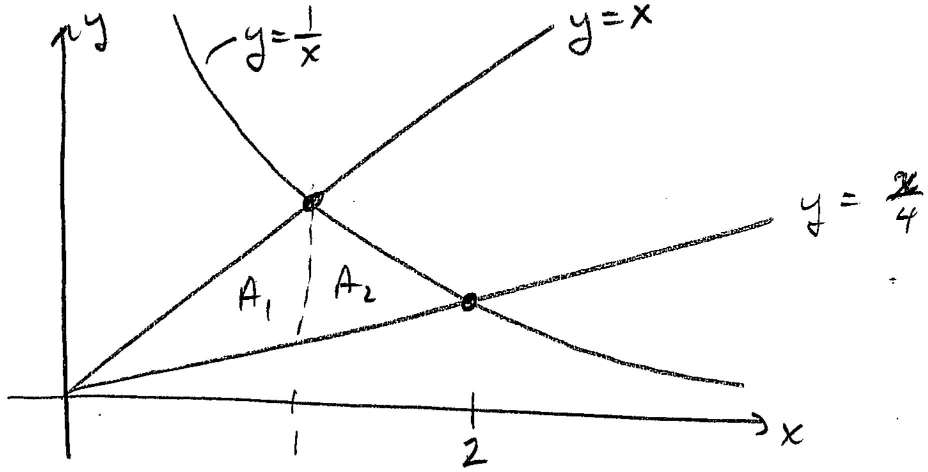
(1) [8 points] Determine the area in the first quadrant enclosed by $y = 1/x$, $y = x$ and $y = x/4$.



$$A_1 = \int_0^1 \left(x - \frac{x}{4}\right)dx = \frac{3}{4}\int_0^1 x\,dx = \frac{3}{4}\left[\frac{x^2}{2}\right]_0^1 = \frac{3}{8}$$

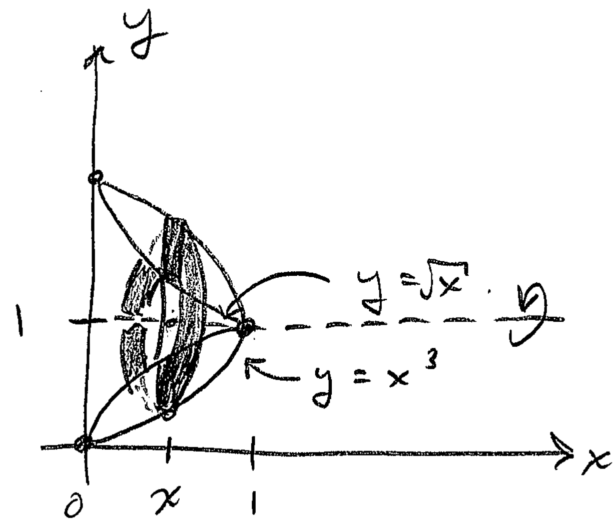
$$A_2 = \int_1^2 \frac{1}{x} - \frac{x}{4}\,dx = \left[\ln|x| - \frac{x^2}{8}\right]_1^2$$

$$= \left(\ln(2) - \frac{1}{2}\right) - \left(\cancel{\ln(1)}^{\,0} - \frac{1}{8}\right)$$

$$= \ln(2) - \frac{3}{8}$$

$$\therefore\ A = A_1 + A_2 = \frac{3}{8} + \ln(2) - \frac{3}{8} = \boxed{\ln(2)}$$

(2) [7 points] The region in the first quadrant enclosed by $y = x^3$ and $y = \sqrt{x}$ is rotated about the line $y = 1$. Determine the volume of the resulting solid. (Note: the two given curves intersect at $(0, 0)$ and $(1, 1)$.)



Washer method:

$$V = \int_0^1 \pi\left[(1-x^3)^2 - (1-x^{1/2})^2\right] dx$$

$$= \pi \int_0^1 \cancel{1} - 2x^3 + x^6 - \cancel{1} + 2x^{1/2} - x \quad dx$$

$$= \pi\left[-\frac{2}{4}x^4 + \frac{x^7}{7} + \frac{4}{3}x^{3/2} - \frac{x^2}{2}\right]_0^1$$

$$= \pi\left[\frac{-1}{2} + \frac{1}{7} + \frac{4}{3} - \frac{1}{2}\right]$$

$$= \pi\left[\frac{-21 + 6 + 56 - 21}{42}\right]$$

$$= \frac{20\pi}{42} = \boxed{\frac{10\pi}{21}}$$