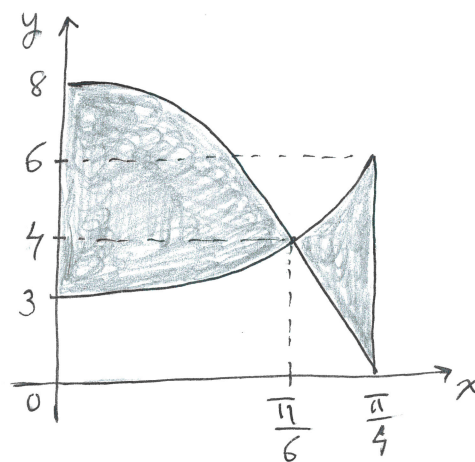


3a. Find the area of the region between the curves $y = 3 \sec^2 x$ and $y = 8 \cos 2x$ for $0 \leq x \leq \pi/4$.

$$\begin{aligned}
 \text{Area} &= \int_0^{\pi/6} (8 \cos 2x - 3 \sec^2 x) dx + \int_{\pi/6}^{\pi/4} (3 \sec^2 x - 8 \cos 2x) dx \\
 &= \left[4 \sin 2x - 3 \tan x \right]_0^{\pi/6} + \left[3 \tan x - 4 \sin 2x \right]_{\pi/6}^{\pi/4} \\
 &= 4 \sin \frac{\pi}{3} - 3 \tan \frac{\pi}{6} + 3 \tan \frac{\pi}{4} - 4 \sin \frac{\pi}{2} - 3 \tan \frac{\pi}{6} + 4 \sin \frac{\pi}{3} \\
 &= 4 \cdot \frac{\sqrt{3}}{2} - 3 \cdot \frac{1}{\sqrt{3}} + 3 \cdot 1 - 4 \cdot 1 - 3 \cdot \frac{1}{\sqrt{3}} + 4 \cdot \frac{\sqrt{3}}{2} \\
 &= 2\sqrt{3} - 1
 \end{aligned}$$



3b. Evaluate the integral $\int \left(x^3 + 1 - \frac{2}{x^3} \right) \sqrt{x^2 + \frac{2}{x}} dx$.

$$\int \left(x^3 + 1 - \frac{2}{x^3} \right) \sqrt{x^2 + \frac{2}{x}} dx = \int \left(x - \frac{1}{x^2} \right) \left(x^2 + \frac{2}{x} \right) \sqrt{x^2 + \frac{2}{x}} dx$$

$$= \int u^{3/2} \cdot \frac{1}{2} du = \frac{1}{2} \cdot \frac{u^{5/2}}{5/2} + C = \frac{1}{5} \cdot \left(x^2 + \frac{2}{x} \right)^{5/2} + C$$

$$u = x^2 + \frac{2}{x}$$

$$du = \left(2x - \frac{2}{x^2} \right) dx$$