(1) $\cos y$

(2) $-\sin x$

(3) $\sec^2 x$

(4) $-\csc^2 x$

(5) $\sec x \cdot \tan x$

(6) $-\csc x \cdot \cot x$

(7) e^x

(8) $a^x \cdot \ln a$

(9) $\dfrac{1}{\sqrt{1-x^2}}$

(10) $\dfrac{1}{1+x^2}$

(11) $\frac{1}{x}$

(12) $a n x^{n-1}$

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(13) $f(x) \cdot g'(x) + g(x) \cdot f(x)$

(14) $\dfrac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$

(15) $f'(g(x)) \cdot g'(x)$

(16) Leibniz's Rule

$$f(v(x)) \cdot \frac{dv}{dx} - f(u(x)) \cdot \frac{du}{dx}$$

(17) $\ln|x| + C$

(18) $\frac{a}{n+1} x^{n+1} + C$

(19) $-\cos x + C$

(20) $\frac{1}{2}x - \frac{1}{4}\sin 2x + C$

(21) $\sin x + C$

(22) $\frac{1}{2}x + \frac{1}{4}\sin 2x + C$

(23) $\ln|\sec x| + C$ or $-\ln|\cos x| + C$

(24) $\tan x - x + C$

(25) $\ln|\sec x + \tan x| + C$

(26) $\tan x + C$

(27) $\sec x + C$

(28) $\ln|\csc x - \cot x| + C$

(29) $-\csc x + C$

(30) $\frac{a^x}{\ln a} + C$

(31) $e^x + C$

(32) (parts) $x \ln x - x + C$

(33) $\sin^{-1}\left(\frac{x}{a}\right) + C$

(34) $\frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + C$

(trig sub)

(35) The parts formula

$$u \cdot v - \int v \cdot du$$

$y = \ln(\sec x)$ find arclength on $[-\pi/4, \pi/4]$

$$\frac{dy}{dx} = \frac{\sec x \tan x}{\sec x} = \tan x$$

$$\text{Arclength} = \int_{-\pi/4}^{\pi/4} \sqrt{1 + \tan^2 x}\, dx$$

$$= \int_{-\pi/4}^{\pi/4} \sec x\, dx$$

$$= \left[\ln|\sec x + \tan x| \right]_{-\pi/4}^{\pi/4}$$

$$= \ln|\sqrt{2} + 1| - \ln|\sqrt{2} - 1|$$

$$= \ln\left(\frac{\sqrt{2}+1}{\sqrt{2}-1}\right)$$

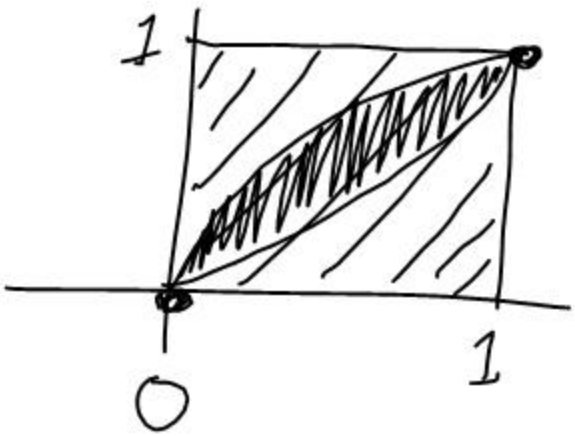
#14 plug in $\frac{1}{64}$

$$\left(\frac{1}{64}\right)^{2/3} = \left(\frac{1}{4}\right)^2 = \frac{1}{16} > \frac{1}{8^3}$$

$$\left(\frac{1}{64}\right)^{3/2} = \left(\frac{1}{8}\right)^3 = \frac{1}{8^3}$$

$$\int_0^1 \left(x^{2/3} - x^{3/2}\right) dx = \left[\frac{3}{5}x^{5/3} - \frac{2}{5}x^{5/2}\right]_0^1$$

$$= \frac{3}{5} - \frac{2}{5} = \frac{1}{5}$$



$$\int_0^{\pi} y \sin y \, dy = \left[-y\cos y\right]_0^{\pi} + \int_0^{\pi} \cos y \, dy$$

$u = y \qquad v = -\cos y$

$du = dy \qquad \int dv = \int \sin y \, dy$

$$= \left[-y\cos y + \cancel{\sin y}\right]_0^{\pi}$$

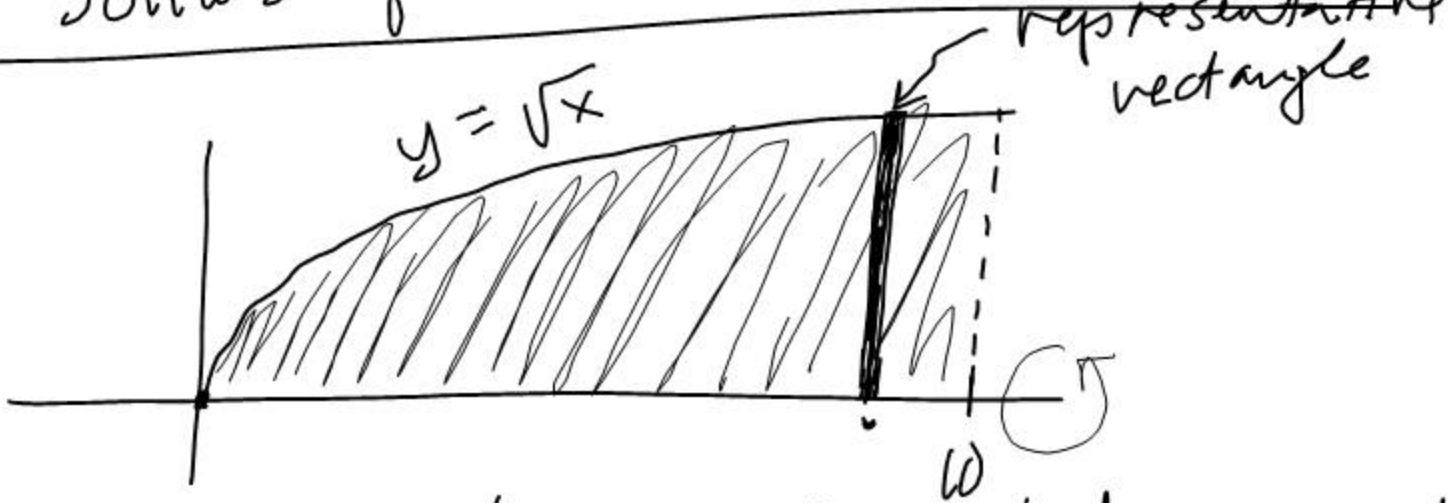
$$= -\pi \cos \pi$$

$$= \pi$$

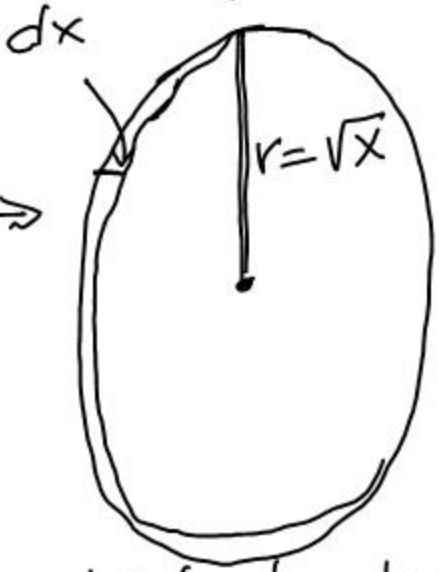
HW Find the length of $x = \frac{2}{3}(y-1)^{3/2}$ on $1 \le y \le 4$.

Volume

Solids of Revolution



Find the volume of the solid generated by rotating the shaded region around the x-axis.



Disc (thin cylinder) →

volume of <u>one</u> disc

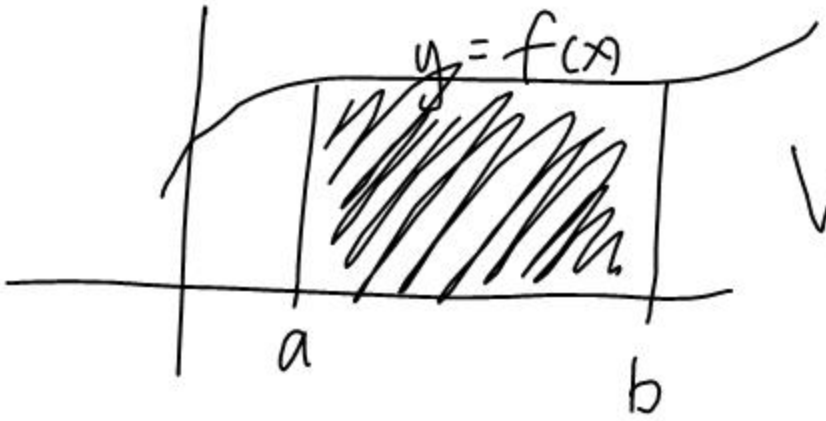
$$dV = \pi (\sqrt{x})^2 \, dx$$

↑ height (or thickness)

$$V = \int_0^{10} \pi x \, dx = \left[\frac{\pi}{2} x^2 \right]_0^{10} = 50\pi \approx 157$$

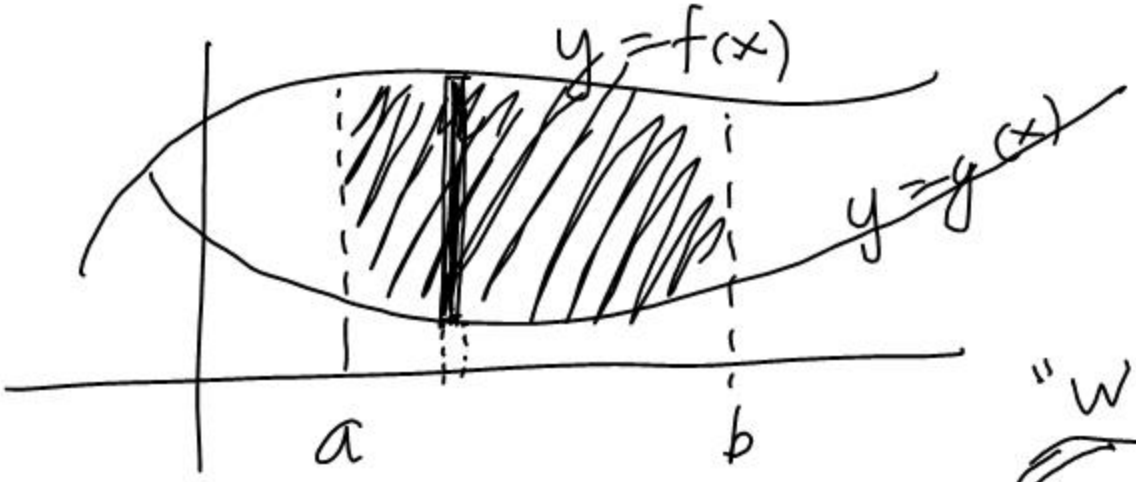
Volume

- Solids of revolution about the x-axis



$$V_x = \pi \int_a^b [f(x)]^2 \, dx$$

- rotate the area between curves



"washer"

washer method

$$V_x = \pi \int_a^b \left[(f(x))^2 - (g(x))^2 \right] dx$$