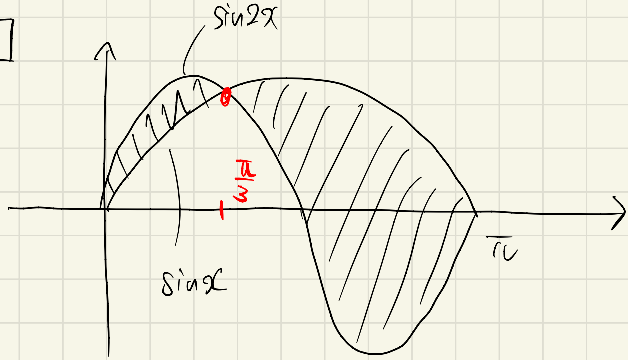
$\boxed{1}$



$\sin 2x = \sin x$

$2\sin x\cos x - \sin x = 0$

$\sin x(2\cos x - 1) = 0$

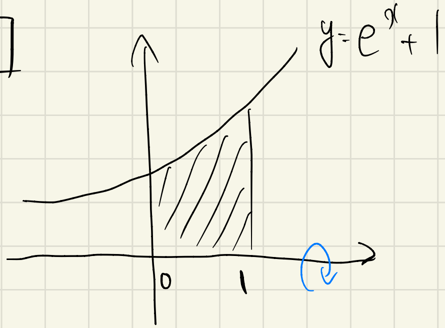
$\sin x = 0,\ \cos x = \frac{1}{2}$

$$\therefore S = \int_0^{\frac{\pi}{3}} (\sin 2x - \sin x)\,dx + \int_{\frac{\pi}{3}}^{\pi} (\sin x - \sin 2x)\,dx$$

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

$$= \frac{5}{2} \,//$$

$\boxed{2}$



$\int_a^b \pi y^2 dx$

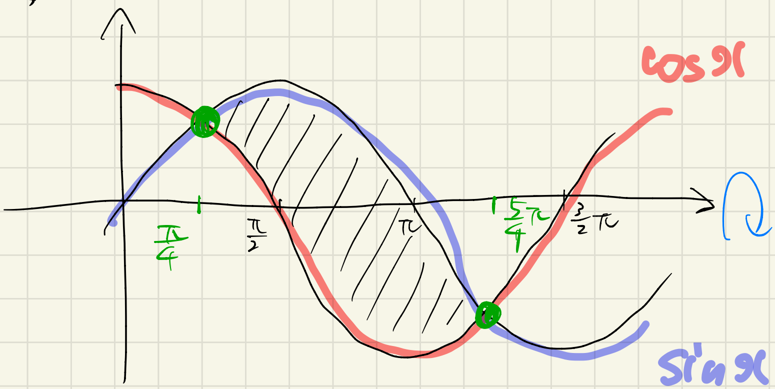
$$V = \int_0^1 \pi y^2 dx = \pi \int_0^1 (e^x+1)^2 dx$$

$$\frac{V}{\pi} = \int_0^1 (e^{2x} + 2e^x + 1)\,dx$$

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

$$\therefore V = \left(\frac{e^2}{2} + 2e - \frac{3}{2}\right)\pi \,//$$

$\boxed{3}$



● $\sin x = \cos x$

$\tan x = 1$

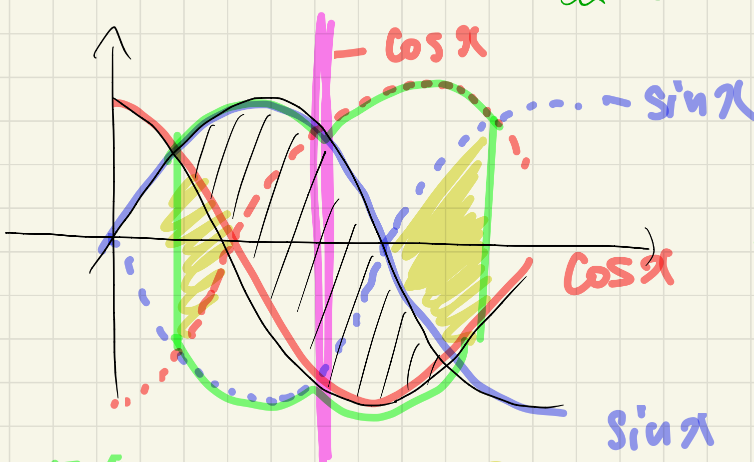
$x = \frac{\pi}{4}, \frac{3}{4}\pi$

$\sin x - \cos x = 0$

$\sqrt{2}\sin\left(x - \frac{\pi}{4}\right) = 0$

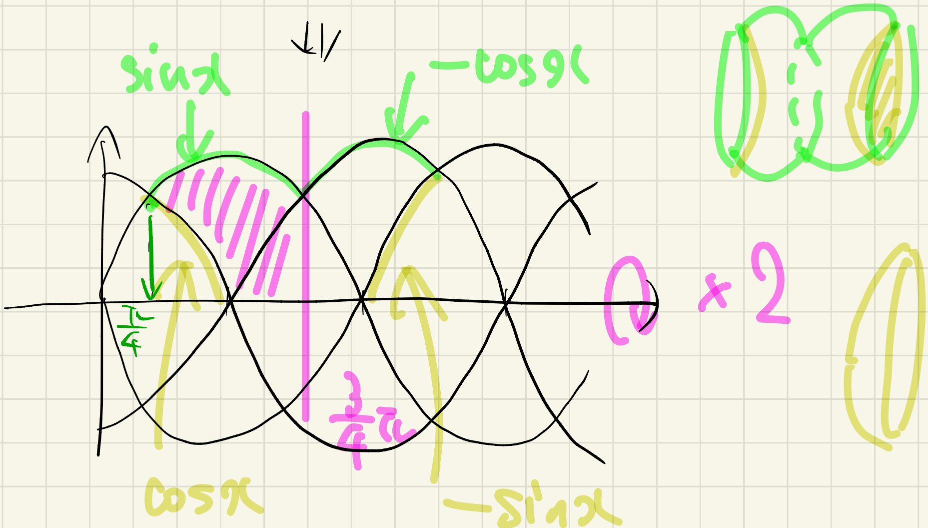
$x - \frac{\pi}{4} = 0, \pi, \cdots$

$x = \frac{\pi}{4}, \frac{5}{4}\pi$



輪郭部をとる

輪郭部－空洞



$$-\cos x = \sin x$$

$$\tan x = -1 \qquad x = \frac{3}{4}\pi$$

$$\frac{V}{2\pi} = \int_{\frac{\pi}{4}}^{\frac{3}{4}\pi} \underbrace{\sin^2 x}_{\Leftarrow\ \frac{1-\cos 2x}{2}}\, dx - \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \underbrace{\cos^2 x}_{\Leftarrow\ \frac{1+\cos 2x}{2}}\, dx$$

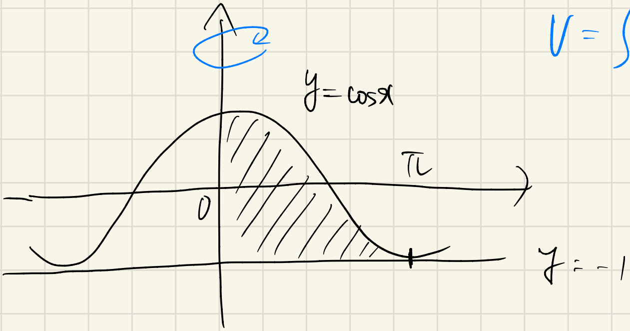
$$= \frac{1}{2}\left[x - \frac{1}{2}\sin 2x\right]_{\frac{\pi}{4}}^{\frac{3}{4}\pi} - \frac{1}{2}\left[x + \frac{1}{2}\sin 2x\right]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$$

$$= \frac{\pi + 6}{8}$$

$$\therefore V = \frac{\pi^2 + 6\pi}{4}$$ //

$\boxed{4}$

$V = \int_a^b \pi x^2 \, dy$



$V = \int_{-1}^{1} \pi x^2 \, dy \quad \therefore \quad \dfrac{V}{\pi} = \int_{-1}^{1} x^2 \, dy$

xにそろえる

~~yにそろえる~~

$y = \cos x$ より

$dy = -\sin x \, dx$

y	$-1 \to 1$
x	$\pi \to 0$

$\therefore \quad \dfrac{V}{\pi} = \int_{\pi}^{0} x^2 \cdot (-\sin x) \, dx$

$= \int_0^{\pi} x^2 \sin x \, dx$

ここで　$\int x^2 \underbrace{\sin x}_{(-\cos x)'} \, dx$

$= x^2 \cdot (-\cos x) - \int 2x \cdot (-\cos x) \, dx$

$= -x^2 \cos x + 2 \int x \, (\sin x)' \, dx$

$= -x^2 \cos x + 2 \left\{ x \sin x - \int 1 \cdot \sin x \, dx \right\}$

$$= -x^2\cos x + 2x\sin x + 2\cos x + C$$

$\therefore \int_0^{\pi} x^2 \sin x \, dx$

$$= \left[-x^2\cos x + 2x\sin x + 2\cos x \right]_0^{\pi} = \pi^2 - 4$$

$\therefore V = \pi^3 - 4\pi$ //

$\int_0^{\pi} x^2 \sin x \, dx$

$$= \left[x^2(-\cos x) \right]_0^{\pi} - \int_0^{\pi} 2x \cdot (-\cos x) \, dx$$

$$= \pi^2 + 2\int_0^{\pi} x\cos x \, dx$$

$$= \pi^2 + 2\left\{ \left[x\sin x \right]_0^{\pi} - \int_0^{\pi} \sin x \, dx \right\}$$

$\boxed{5}$ $L = \int_0^{\sqrt{3}} \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} \, dt$

$6t$

$3-3t^2$

$$= \int_0^{\sqrt{3}} \sqrt{(6t)^2 + (3-3t^2)^2} \, dt$$

$$= \int_0^{\sqrt{3}} \sqrt{36t^2 + 9 - 18t^2 + 9t^4} \, dt$$

$$= \int_0^{\sqrt{3}} \sqrt{(3+3t^2)^2} \, dt$$

$$= \int_0^{\sqrt{3}} \left| 3+3t^2 \right| dt \qquad \sqrt{a^2} = a \quad \times$$

$$= \int_0^{\sqrt{3}} (3+3t^2)\, dt \qquad \sqrt{a^2} = |a|$$

$$= 6\sqrt{3} \;//$$

(参考) 瞬間部分積分

$$f \xrightarrow[\int]{} f_1 \xrightarrow[\int]{} f_2 \xrightarrow[\int]{} f_3$$

$$f \xrightarrow[\prime]{} f^1 \xrightarrow[\prime]{} f^2 \xrightarrow[\prime]{} f^3$$

$$\left(\begin{array}{lll} f(x) = x^2 & f_1 = \frac{1}{3}x^3 & f_2 = \frac{1}{12}x^4 \\ & f^1 = 2x & f^2 = 2 \end{array} \right)$$

$$\boxed{\int f g = f g_1 - f^1 g_2 + f^2 g_3 - f^3 g_4 + \cdots}$$

$$\int x^2 \sin x \, dx$$

$$= x^2 \cdot (-\cos x) - 2x(-\sin x) + 2(\cos x) \;//$$

$$= -x^2 \cos x + 2x \sin x + 2\cos x + C \;//$$