2023 Integration Bee

PSS x MUMS

Rules

$\ln = \log = \log_e$

$+C$ is not required for indefinite integrals. (because its often wrong)
For real x, $\log(x) := \log|x|$
Accidental domain restrictions are OK.
Integrals may be improper or principal value.

If the integral truly doesn't converge then say that.

$$\int_0^{2023} \sin\left(\frac{\pi}{2}\lfloor x \rfloor\right) + \cos\left(\frac{\pi}{2}\lfloor x \rfloor\right) \mathrm{d}x \tag{1}$$

1

$$\int_0^{23} \lfloor x \rfloor \{x\} \, \mathrm{d}x \tag{2}$$

where $\{x\}$ is the fractional part of x, $\{x\} := x - \lfloor x \rfloor$

$$\frac{253}{2}$$

$$\int_0^1 \left(\sqrt{2x - x^2} + \sqrt{1 - x^2} - 1 \right) \mathrm{d}x \tag{3}$$

$$\frac{\pi - 2}{2}$$

$$\int_0^{3\pi} \left(\sin x + \frac{1}{2} \operatorname{sgn} \sin x \right) \mathrm{d}x \tag{4}$$

$$\frac{4+\pi}{2}$$

$$\int_{-2}^{1} \sqrt{8 - 2x^2}\,\mathrm{d}x \tag{5}$$

$$\sqrt{2}\left(\frac{4\pi}{3}+\frac{\sqrt{3}}{2}\right)$$

$$\int_0^{2023} e^{x-\lfloor x \rfloor} \, \mathrm{d}x \tag{6}$$

$$2023\,(e-1)$$

$$\int \frac{x^2 \sec^2(\arctan x) \cos(\arcsin x)}{\left(1+x^2\right)\sqrt{1-x^2}}\,\mathrm{d}x \tag{7}$$

$$\frac{1}{3}x^3$$

$$\int_{-\sqrt{2}}^{\sqrt{2}} \left\{ \sqrt{2 - x^2} \right\} \mathrm{d}x \tag{8}$$

where $\{x\}$ is the fractional part of x, $\{x\}:=x - \lfloor x \rfloor$

$$\pi - 2$$

$$\int_{\sqrt[3]{\log 3}}^{\sqrt[3]{\log 4}} \frac{x^2 \sin\left(x^3\right)}{\sin\left(x^3\right) + \sin\left(\log 12 - x^3\right)} \, \mathrm{d}x \tag{9}$$

$$\frac{1}{6}\log\frac{4}{3}$$

$$\int_0^{2023} (2023 - x)^{2023} \, \mathrm{d}x \tag{10}$$

$$\frac{2023^{2024}}{2024}$$

$$\int_0^2 \max(1, x, x^2, \sin x, \log x, e^x - 1)\,\mathrm{d}x \tag{11}$$

$$2 \log 2 + e^2 - 4$$

$$\int_0^\infty \{x\}\, e^{-\lfloor x \rfloor}\, \mathrm{d}x \tag{12}$$

where $\{x\}$ is the fractional part of x, $\{x\} := x - \lfloor x \rfloor$

$$\frac{e}{2e-2}$$

$$\int_{-\pi/3}^{\pi/3} \sin(\tan x) \cos x \, \mathrm{d}x \tag{13}$$

0

$$\int_0^{10} \left(x + x^2 + \left| x^2 - x \right| + \frac{22}{30} \right) \mathrm{d}x \tag{14}$$

$$\frac{2023}{3}$$

$$\int_0^7 \sqrt{196 - x^2}\,\mathrm{d}x \tag{15}$$

$$\frac{49\sqrt{3}}{2} + \frac{49\pi}{3}$$

$$\int_0^1 x^2(1-x)^4\,\mathrm{d}x \tag{16}$$

$$\frac{1}{105}$$

$$\int_0^{\pi/2} \min(\sin x, \cos x, \tan x, \sec x, \csc x)\, \mathrm{d}x \qquad (17)$$

$$2 - \sqrt{2}$$

$$\int \frac{1}{x\left(x^{2023}+1\right)} \mathrm{d}x \tag{18}$$

$$\frac{-1}{2023} \log\left(1 + \frac{1}{x^{2023}}\right)$$

$$\lim_{n\to\infty} \int_0^x \mathrm{d}\sigma_1 \int_0^{\sigma_1} \mathrm{d}\sigma_2 \cdots \int_0^{\sigma_{n-1}} \mathrm{d}\sigma_n \, e^{\sigma_n} \qquad (19)$$

0

$$\int_0^{2023} x^3 - \lfloor x \rfloor x \lceil x \rceil \, \mathrm{d}x \tag{20}$$

$$\frac{2023^2}{4}$$

$$\int_0^\infty x^{2023} e^{-x} \, \mathrm{d}x \tag{21}$$

2023!

$$\lim_{n\to\infty} \frac{1}{n!} \int_0^x (x-t)^n \, e^t \, \mathrm{d}t \tag{22}$$

0

$$\int_0^\pi \sin x \, \mathrm{d}x + \int_0^\pi \sin 2x \, \mathrm{d}x - \int_0^\pi \sin 3x \, \mathrm{d}x - \int_0^\pi \sin 4x \, \mathrm{d}x + \int_0^\pi \sin 5x \, \mathrm{d}x + \int_0^\pi \sin 6x \, \mathrm{d}x - \ldots \quad (23)$$

$$\frac{\pi}{2}$$

$$\int \frac{(x-1)\,e^x}{x^2}\,\mathrm{d}x \tag{24}$$

$$\frac{e^x}{x}$$

$$\underbrace{\int \cdots \int}_{n} \log x \, \mathrm{d}x^n \tag{25}$$

$$\frac{x^n}{n!}\left(\log(x) - \sum_{k=1}^{n} \frac{1}{k}\right)$$

$$\int_{-2023}^{2023} \frac{\mathrm{d}x}{1+e^{\pi x}} \tag{26}$$

2023

$$\int_{-\infty}^{\infty} e^{x-e^{2x}}\,\mathrm{d}x \tag{27}$$

$$\frac{\sqrt{\pi}}{2}$$

$$\lim_{n\to\infty} \int_{-\infty}^{\infty} \frac{\sin(nx)}{x} e^{-x^2} \, \mathrm{d}x \tag{28}$$

π

$$\int_{-3}^{3} \frac{\sqrt{9-x^2}}{1+e^{\sin x}}\,\mathrm{d}x \tag{29}$$

$$\frac{9\pi}{4}$$

$$\int_0^1 \frac{1}{1 - \log(x)} + e^{1-1/x} \, \mathrm{d}x \tag{30}$$

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