

## Round 1

$$\int (3x^2 - 4x + 5)dx$$

$$\int \tan x(\sin 2x + \cos x)dx$$

$$\int \frac{1}{\sqrt{x^{-2} - x^2}}dx$$

$$\int \sqrt{1 - x^2}dx$$

$$\int \sec x dx$$

$$\int_0^{\frac{1}{2}} \frac{x^2 + 3}{x^3 - 6x^2 + 11x - 6} dx$$

$$\int \frac{1}{\sqrt{x}(x+1)} dx$$

$$\int_{-\infty}^{\infty} \frac{x^2 - 1}{(x^2 + 1)^2} dx$$

$$\int 10^x dx$$

$$\int \frac{1}{e^x + e^{-x}} dx$$

## Round 2

$$\int \sin(x)\cos(x) + 2023dx$$

$$\int \frac{2\cos^2(x)}{1 + \cos(x)}dx$$

$$\int_0^{\frac{\pi}{2}} \frac{\sin^4(x)}{\sin^4(x) + \cos^4(x)}dx$$

$$\int_{-\pi}^{\pi} x \sin^2(x) \cos^5(x)dx$$

$$\int \frac{1}{x\sqrt{1 - (\ln x)^2}}dx$$

$$\int_0^3 \frac{x^3 + 3}{x^2 - 1}dx$$

$$\int (3x^2 - 1) \ln(x + 1)dx$$

$$\int \frac{x^2 - 1}{x^2 + 1} \frac{1}{\sqrt{1 + x^4}}dx$$

$$\int \frac{1}{1 + x^4}dx$$

$$\int \frac{\sin(x)}{\cos(x + \frac{\pi}{3})}dx$$

## Semi-finals round 1

$$\int_2^{\infty} \ln \left( 1 - \frac{1}{[x]^2} \right) dx$$

$$\int \cot^5 x dx$$

$$\int \frac{e^x + 1}{e^{2x} + 1} dx$$

### Tiebreaker:

Let  $(x, y)$  be parametrically defined as  $(a \cos \theta, b \sin \theta)$  where  $0 \leq \theta \leq \pi$ . Define a function  $f$  such that  $y = f(x)$  for all values of  $x$ . Find

$$\int_{-a}^a f(x) dx$$

## Semi-finals round 2

$$\int \frac{x^3 + x}{x^6 - 3x^4 + 3x^2 - 1} dx$$

$$\int_0^1 \frac{1}{[\frac{1}{x}]} dx$$

$$\int \frac{\sqrt{x}}{1 + \sqrt[3]{x}} dx$$

### Tiebreaker:

$$\int (21x^{2023} - 420x^{69}) \ln x dx$$

## Finals

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\cos x}{1 + e^{\frac{1}{x}}} dx$$

Define the function  $f_1(x) = e^x$  and any subsequent function  $f_n(x) = e^{f_{n-1}(x)}$  where  $n \in \mathbb{N}$ . Find

$$\int f_n(x) f_{n-1}(x) \dots f_1(x) dx$$

$$\int \frac{\cos^{1010} x}{\sin x \sqrt{\sin^{2022} x - \cos^{2022} x}} dx$$