

THE COLLEGE FINALS



The Finals will be conducted in rounds. One at a time, each remaining contestant will have **two and a half minutes** to compute an indefinite integral. If answered correctly, the contestant remains in the competition. Once every remaining contestant has attempted one problem, a round is completed. If during any round, all contestants are unable to complete a problem correctly, all contestants will remain in the competition for another round.

The last person remaining wins an additional \$75

INTEGRAL #1

**READY,
GET SET,...**

2:30



INTEGRAL #1

INTEGRAL #1

$$\int \frac{1}{\cos x} \sin x \, dx$$

$$\int \frac{1}{\cos x} \frac{\sin x}{\cos x} \, dx$$

$$\int \sec x \tan x \, dx$$

$$\ln|\sec x \tan x| + C$$

INTEGRAL #2

**READY,
GET SET,...**

2:30



INS

INTEGRAL #2

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

$$\frac{1}{2} \int \frac{1}{u^2 - 1} du$$

1





INTEGRAL #3

$$\int \sin^4 x \cos^3 x \, dx$$

$$\int \sin^4 x \cos^2 x \cos x \, dx = \int \sin^4 x (1 - \sin^2 x) \cos x \, dx$$

$$\int_0^1 u^4 - u^6 \, du \quad u = \sin x, \quad du = \cos x \, dx$$

$$\frac{\sin^5 x}{5} - \frac{\sin^7 x}{7} + C$$

INTEGRAL #4

**READY,
GET SET,...**

2:30

INTEGRAL #4

$$\int \frac{\ln \ln x}{x \ln x} dx$$

INTEGRAL #4

$$\int \frac{\ln \ln x}{x \ln x} dx$$

$$\int u du \quad u = \ln \ln x, \quad du = \frac{1}{x \ln x} dx$$

$$\frac{u^2}{2} + C$$

$$\frac{\ln \ln x^2}{2} + C$$

INTEGRAL #5

**READY,
GET SET,...**

2:30

INTEGRAL #5

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



INTEGRAL #6

**READY,
GET SET,...**

2:30

INTEGRAL #6

$$\int \sec x \tan^5 x \, dx$$

INTEGRAL #6

$$\int \sec x \tan^5 x \, dx$$

$$\int \tan^4 x \cdot \sec x \tan x \, dx = \int \sec^2 x (1 - \tan^2) \cdot \sec x \tan x \, dx$$

$$\int u^2 (1 - u^2) \, du \quad u = \sec x, \quad du = \sec x \tan x \, dx$$

$$\int u^4 - 2u^2 + 1 \, du$$

$$\frac{\sec^5 x}{5} - \frac{2 \sec^3 x}{3} + \sec x + C$$

INTEGRAL #7

**READY,
GET SET,...**

2:30

INTEGRAL #7

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

INTEGRAL #7

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

$x = \sin \theta$, $dx = \cos \theta d\theta$, $\frac{1}{x^2} = \frac{1}{\cos^2 \theta}$

$$\int \frac{1}{\sin^2 \theta \cos \theta} \cdot \cos \theta d\theta = \int \frac{1}{\sin^2 \theta} d\theta$$

$$\int \csc^2 \theta d\theta = -\cot \theta + C$$

$$\frac{\sqrt{1-x^2}}{x} + C$$





INTEGRAL #8

$$\int \frac{x}{x^2 - x - 6} dx$$

$$\int \frac{3}{5} \cdot \frac{1}{x - 3} - \frac{2}{5} \cdot \frac{1}{x - 2} dx$$



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INTEGRAL #9

$$\int \frac{\ln \tan x}{\sin x \cos x} dx$$

INTEGRAL #10

**READY,
GET SET,...**

2:30

INTEGRAL #10

$$\int \frac{1}{1 - \sin^2 x} e^{\tan x} dx$$

INTEGRAL #10

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

$$\int \frac{1}{\cos^2 x} e^{\tan x} dx = \int 1 \cdot e^{\tan x} \sec^2 x dx$$

$$\int 1 \cdot e^u du \quad u = \tan x, \quad du = \sec^2 x dx$$

$$\tan x \cdot e^{\tan x} + C$$

INTEGRAL #11

**READY,
GET SET,...**

2:30

INTEGRAL #11

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

INTEGRAL #11

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

INTEGRAL #12

$$\int \frac{\ln x}{x \ln^2 x} dx$$

INTEGRAL #12

$$\int \frac{\ln x}{x \ln^2 x} dx$$

$$\int \frac{\ln x}{x \ln^2 x} dx$$

$$\frac{1}{2} \int \frac{1}{u} du \quad u = \ln^2 x, \quad du = \frac{2 \ln x}{x} dx$$

$$\frac{\ln u}{2} + C$$

$$\frac{\ln |\ln^2 x|}{2} + C$$

INTEGRAL #13

**READY,
GET SET,...**

2:30



INTEGRAL

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INTEGRAL #14

**READY,
GET SET,...**

2:30

INTEGRAL #14

$$\int \frac{1}{x^3 - 1} dx$$







INTEGRAL #15

$$\int \ln^p \frac{x^2 - 1}{x^2 + 1} dx$$

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