

THE HIGH SCHOOL 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 and will be crowned the **Integration Champion!**

INTEGRAL #1

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

2:30

INTEGRAL #1

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





INTEGRAL #1

INTEGRAL #2

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

2:30

INTEGRAL #2

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

INTEGRAL #2

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

$$= - \int \frac{d}{\cos x} \quad \left[\frac{d}{\cos x} = \cos x \quad \frac{d}{\sin x} = - \sin x \right]$$

$$= \frac{1}{\cos x} + \frac{1}{\sin x}$$

$$= \frac{1}{\cos x} + \frac{1}{\sin x}$$



INTEGRAL #3

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

INTEGRAL #3

$$\int$$



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

2:30



INTEGRAL #4

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

$$= \int \left(\frac{e^x}{e^{-x}} + \frac{e^{-x}}{e^{-x}} + \frac{e^{-x}}{e^{-x}} \right) dx$$

$$= \int \left(-e^{-x} + -e^{-x} + -e^{-x} \right) dx$$

=



INTEGRAL #5

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

2:30

INTEGRAL #5

$$\int \frac{\sqrt{\quad} + \sqrt{x}}{\sqrt{x}} dx$$

INTEGRAL #5

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

$$= \int \sqrt{\frac{1 + \sqrt{x}}{x}} dx = \int \frac{\sqrt{1 + \sqrt{x}}}{\sqrt{x}} dx$$

$$= \frac{2}{3} (1 + \sqrt{x})^{3/2} + \frac{2}{5} (1 + \sqrt{x})^{5/2} + C$$

$$= \frac{2}{3} (1 + \sqrt{x})^{3/2} + \frac{2}{5} (1 + \sqrt{x})^{5/2} + C$$

INTEGRAL #6

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

2:30

INTEGRAL #6

$$\int e^x \sin e^x \cos e^x e^x dx$$

INTEGRAL #6

$$\int e^x \sin e^x \cos e^x dx$$

$$= \int \underbrace{d(\sin e^x)}_{\substack{= \sin e^x \\ d = e^x \cos e^x dx}}$$

$$= \frac{\sin e^x}{e^x} + C \quad \text{or} \quad -\frac{\cos e^x}{e^x} + C$$

INTEGRAL #7

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

2:30

INTEGRAL #7

$$\int \frac{\cot x - \sec x}{\cot x} dx$$





INTEGRAL #9

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

$$dx \quad dx$$

INTEGRAL #8

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

$$= \int \left(\frac{(x+1)}{(x+1)(x+1)} + \frac{(x+1)}{(x+1)(x+1)} \right) dx$$

$$= \int \left(\frac{1}{(x+1)} + \frac{1}{(x+1)} \right) dx$$

$$= \frac{1}{(x+1)} + \frac{1}{(x+1)} + C$$



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INTEGRAL #9

$$\int \sqrt{\sqrt{\sqrt{x}}}$$



INTEGRAL #9

$$\int \frac{\sqrt{\tan x}}{\sin x} dx$$

$$= \int \frac{\sqrt{\tan x}}{\cos x} dx = \int \sqrt{\tan x} \sec x dx$$

$$= \int \sqrt{\tan x} \sec x dx \quad \left[= \tan x \quad \sec x dx \right]$$

$$= \frac{\tan x}{2} + \frac{1}{2} \ln |\sec x + \tan x| + C$$

INTEGRAL #10

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

2:30

INTEGRAL #10

$$\int \frac{\sqrt{x}}{x\sqrt{x} + \sqrt{x}} dx$$



$$\int \frac{\sqrt{x}}{x\sqrt{x} + \sqrt{x}} dx$$

$$= \int \frac{x}{\sqrt{x} + \sqrt{x}} dx$$

$$= \int \frac{1}{\sqrt{x}} dx \quad \left[\frac{1}{\sqrt{x}} = \frac{1}{x^{1/2}} \quad \frac{d}{dx} x^{1/2} = \frac{1}{2} x^{-1/2} dx \right]$$

$$= \frac{1}{1/2} x^{1/2} + C$$
