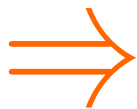


THE HIGH SCHOOL FINALS



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

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

INTEGRAL #1

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

$$= \int (x^2 - 4)(x^2 + 4) \, dx$$

$$= \int (x^4 - 16) \, dx$$

$$= \frac{x^5}{5} - 16x + C$$

INTEGRAL #2

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

2:30

INTEGRAL #2

$$\int x^2 \sin(x^3) dx$$

INTEGRAL #2

$$\int x^2 \sin(x^3) dx$$

$$= \frac{1}{3} \int \sin u \, du \quad \{u = x^3; \quad du = 3x^2 dx\}$$

$$= \frac{1}{3}(-\cos u) + C$$

$$= -\frac{\cos(x^3)}{3} + C$$

INTEGRAL #3

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

2:30

INTEGRAL #3

$$\int \left(\frac{x^2}{2} - \frac{2}{x^2} \right)^2 dx$$

INTEGRAL #3

$$\int \left(\frac{x^2}{2} \right)$$

INTEGRAL #4

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

2:30

INTEGRAL #4

$$\int \frac{\sin x}{\sqrt{2 + \cos x}} dx$$

INTEGRAL #4

$$\int \frac{\sin x}{\sqrt{2 + \cos x}} dx$$

$$= - \int \frac{1}{\sqrt{u}} du \quad \left\{ \begin{array}{l} u = \\ u = \\ u \end{array} \right.$$

INTEGRAL #5

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

2:30

INTEGRAL #5

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



INTEGRAL #6

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

2:30

INTEGRAL #6

$$\int \left(\frac{x+1}{x^2+2x+2013} \right)^5$$

INTEGRAL #6

$$\int \left(\frac{x+1}{x^2+2x+2013} \right)^5 dx$$

$$= \frac{1}{2} \int \frac{1}{u^5} du$$

$$\left[u = x^2 + 2x + 2013; \quad du = (2x + 2) dx = 2(x + 1) dx \right]$$

$$= -\frac{1}{4}$$

INTEGRAL #7

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

2:30

INTEGRAL #7

$$\int \frac{1}{\sqrt{x} (2013 + \sqrt{x})^5} dx$$

INTEGRAL #7

$$\int \frac{1}{\sqrt{x} (2013 + \sqrt{x})^5} dx$$

$$= 2 \int \frac{1}{u^5} du \quad \left\{ u = 2013 + \sqrt{x}; \quad du = \frac{1}{2\sqrt{x}} dx \right\}$$

$$= 2 \int u^{-5} du = \frac{2u^{-4}}{-4} + C = -\frac{1}{2u^4} + C$$

$$= -\frac{1}{2(2013 + \sqrt{x})^4} + C$$

INTEGRAL #8

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

2:30

INTEGRAL #8

$$\int \frac{se}{\quad}$$

S

E

2

0

1

INTEGRAL #8

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

$$= 2 \int \sec u \tan u \, du \quad \left[\begin{array}{l} u = \sqrt{x}; \quad du = \frac{1}{2\sqrt{x}} dx \end{array} \right]$$

$$= 2 \sec u + C$$

$$= 2 \sec \sqrt{x} + C$$

INTEGRAL #9

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

2:30

INTEGRAL #9

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

INTEGRAL #9

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

$$= \frac{1}{2} \int \sqrt{u} \, du \quad [u = e^{2x} + 1; \quad du = 2e^{2x} \, dx]$$

$$= \frac{u^{3/2}}{3/2} + C$$

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

INTEGRAL #10

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

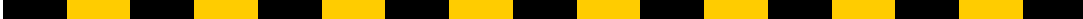
INTEGRAL #10

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

INTEGRAL #11

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

2:30

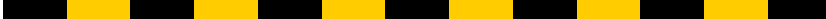




INTEGRAL #12

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

2:30



INT

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

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

=

$$= \int \cos^2 x dx + \int \sin^2 x dx + \int \sin 2x dx$$

=

100

COS

i

INTEGRAL #13

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

2:30

INTEGRAL #13

$$\int \cos x \cos 2x \, dx$$

INTEGRAL #13

$$\int \cos x \cos 2x \, dx$$

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

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

INTEGRAL #14

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

2:30

INTEGRAL #14

$$\int \frac{1}{x^3} \sqrt{1 + \frac{1}{x^2}} dx$$

INTEGRAL #14

$$\int \frac{1}{x^3} \frac{r}{1 + \frac{1}{x^2}} dx$$

$$= -\frac{1}{2} \int u^{1/3} du \quad \left\{ u = 1 + \frac{1}{x^2}; \quad du = -\frac{2}{x^3} dx \right.$$

INTEGRAL #15

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

2:30



INTEGRAL #15

$$\int x \cos^2(x^2) \sin(x^2) dx$$

$$= -\frac{1}{2} \int u^2 du \quad \{u = \cos(x^2); \quad du = -2x \sin(x^2) dx\}$$

$$= -\frac{u^3}{6} + C$$

$$= -\frac{\cos^3(x^2)}{6} + C$$