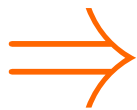


THE HIGH SCHOOL FINALS



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

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

INTEGRAL #3

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

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

$$\int \frac{x + 1}{x^2 + 2x + 2013} dx$$

INTEGRAL #6

$$\int \frac{x + 1}{x^2 + 2x + 2013}^5 dx$$

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

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

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

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

$$\int \frac{se}{-}$$

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INTEGRAL #8

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

$$= 2 \int \sec u \tan u du \quad u = \sqrt{x}; \quad du = \frac{1}{2\sqrt{x}} dx$$

$$= 2 \sec u + C$$

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

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

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

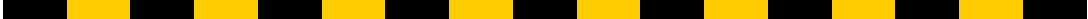
INTEGRAL #10

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

INTEGRAL #11

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

2:30

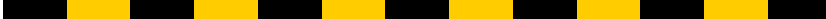




INTEGRAL #12

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

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INTI

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

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$$+ \cos x)^2 dx$$

$$+ \cos x; \quad du = (\cos x - \sin x) dx$$

$$\cos^i$$

INTEGRAL #13

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

2:30

INTEGRAL #13

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

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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 #15

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

2:30



INTEGRAL #15

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

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

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

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