

THE HIGH SCHOOL FINALS



The finals are conducted in rounds. One at a time, each

INTEGRAL #1

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

2:30

INTEGRAL #1

$$\int$$

INTEGRAL #1

$$\int (x^2 + 1)(x^3 + 3x)^4 dx$$

$$\left[u = x^3 + 3x, \quad du = (3x^2 + 3) dx = 3(x^2 + 1) dx \right]$$

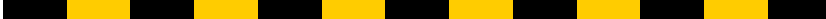
$$= \frac{1}{3} \int u^4 du$$

$$= \frac{u^5}{15} + C = \frac{(x^3 + 3x)^5}{15} + C$$

INTEGRAL #2

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

2:30





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

$$= \int \frac{\sec^2 x}{\sqrt{1 + \tan x}} dx$$

$$= \int \frac{1}{\sqrt{u}} du \quad [u = 1 + \tan x, \quad du$$



INTEGRAL #3

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

2:30

INTEGRAL #3



INTEGRAL #4

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

2:30

INTEGRAL #4

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

INTEGRAL #4

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

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

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

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

INTEGRAL #5

**READY,
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2:30

INTEGRAL #5

$$\int (x + 1)(e^x + 1) dx$$

$$\left[\begin{array}{l} \text{integrate by parts:} \\ u = x + 1 \\ du = dx \end{array} , \begin{array}{l} dv = (e^x + 1) dx \\ v = e^x + x \end{array} \right]$$

$$= (x + 1)(e^x + x) - \int (e^x + x) dx$$

$$= (x + 1)(e^x + x) - e^x - \frac{x^2}{2} + C = xe^x + \frac{x^2}{2} + x + C$$

INTEGRAL #6

**READY,
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2:30

INTEGRAL #6

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

INTEGRAL #6

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

$$= \frac{1}{2} \int u du \quad [u = x^2 + \sin 2x, \quad du = (2x + 2 \cos 2x) dx]$$

$$= \frac{u^2}{4} + C$$

$$= \frac{(x^2 + \sin 2x)^2}{4} + C$$

INTEGRAL #7

**READY,
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2:30

INTEGRAL #7

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

INTEGRAL #7

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

$$= \int (u-2)^2 \sqrt{u} \, du \quad [u = x+2, \quad du = dx]$$

$$= \int \left(u^{5/2} - 4u^{3/2} + 4u^{1/2} \right) du$$

$$= \frac{2(x+2)^{7/2}}{7} - \frac{8(x+2)^{5/2}}{5} + \frac{8(x+2)^{3/2}}{3} + C$$

INTEGRAL #8

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

2:30

INTEGRAL #8

$$\int \frac{4x^2 + 4x + 5}{4x^2 + 4x + 1} dx$$

INTEGRAL #9

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

2:30

INTEGRAL #9

$$\int \sqrt{1 + x^{-2/3}} \, dx$$

INTEGRAL #9

$$\int \sqrt{\quad} \quad$$