

# < ⇒ < G7< OOL FOI N8 ON9



You will have  $\int_0^1 x^n dx$  to evaluate each of the fifteen definite integrals that will be displayed one at a time on this screen. At the end of the two minutes, all hands must go up and judges will grade your answers immediately. For each correct answer, you will receive one raffle ticket to be entered for prizes that will be drawn after dinner.

At most five participants will move to the Finals – to be determined by the total number of correct answers and tiebreaking criteria if necessary.

**≠NH9; F5L #%**

**≠NH9; F5L #%**

$$\int_0^{\pi/2} (2 \sin x + 3 \cos x) dx$$

**NH9; F5L #%**

$$\int_0^2 (2 \sin x + 3 \cos x) dx$$
$$= \left[ -2 \cos x \right]$$

**≠NH9; F5L #&**

**F958Y,**

**; 9HG9H...**

**&\$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**≠NH9; F5L #&**

$$\int_1^2 x^2 \left( x - \frac{1}{x} \right) dx$$

**≠NH9; F5L #&**

$$\int_1^2 x^2 \left( x - \frac{1}{x} \right) dx$$

$$= \int_1^2 (x^3 - x) dx$$

$$= \left[ \frac{x^4}{4} - \frac{x^2}{2} \right]_1^2$$

$$= \frac{9}{4}$$

NIP F5I #1

**F958Y,**

**; 9HG9H...**

**& \$\$**



**≠NH9; F5L #'**

$$\int_{-1}^1 \sqrt[3]{\frac{x+1}{2}} dx$$

**≠NH9; F5L #'**

$$\int_{-1}^1 \sqrt[3]{\frac{x+1}{2}} dx$$

$$= 2 \int_0^1 \sqrt[3]{u} du \quad \left[ u = \frac{x+1}{2}; \quad du = \frac{1}{2} dx \right]$$

$$= 2 \left[ \frac{3u^{4/3}}{4} \right]_0^1$$

$$= \frac{3}{2}$$

**≠NH; F5L #(**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ %( I of G =NH9; F5H=ON 699**

**19; F5L #1**

$$\int_0^4 \tan^2 x \sec^2 x \, dx = 4 \tan^2 0$$

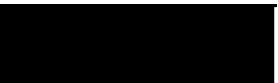
**NH9; F5L #1**

$$\int_0^{\pi/4} \tan^2 x \sec^2 x \, dx$$

$$= \int_0^1 u^2 \, du \quad [ u = \tan x; \quad du = \sec^2 x \, dx ]$$

$$= \left[ \frac{u^3}{3} \right]_0^1$$

$$= \frac{1}{3}$$



**≠NH<sub>9</sub>; F**

**19; F5L #)**

2

$$\int_1^2 \frac{3x^4 + 5x^2 + 2}{x^2} dx$$

$$= \int_1^2 \left( \frac{3x^4}{x^2} + \frac{5x^2}{x^2} \right)$$



**≠NH9; F5L #\***

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**≠NH9; F5L #\***

$$\int_{-1}^0 (x + 2)(x^2 + 4x + 3)^2 dx$$

$\neq \text{NH9;}$

$$\int_{-1}^0 (x + 2) \sqrt{x^2 + 4x + 4} \, dx$$

$$[ u = x^2 + 4x + 4 \quad du = 2x + 4 \, dx = 2(x + 2) \, dx ]$$

$$= \frac{1}{2} \int_0^3 u^{\frac{1}{2}} \, du$$

$$= \frac{1}{2} \left[ \frac{2}{3} u^{\frac{3}{2}} \right]_0^3 = \frac{1}{2} \cdot \frac{2}{3} \cdot \frac{3\sqrt{3}}{2} = \frac{\sqrt{3}}{2}$$

**≠NH9; F5L #+**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**≠NH9; F5L #+**

$$\int_{2=}^{3=} \frac{1}{x^2} \sin \frac{1}{x} dx$$

**NH9; F5L #+**

$$\int_{2=}^{3=} \frac{1}{x^2} \sin \frac{1}{x} dx$$

$$= - \int_{=2}^{=3} \sin u du \quad \left[ u = \frac{1}{x}; \quad du = -\frac{1}{x^2} dx \right]$$

$$= \left[ \cos u \right]_{=2}^{=3}$$

=

**≠NH; F5L #,**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**≠NH9; F5L #,**

$$\int_1^9 \frac{(1 - \sqrt{x})^3}{\sqrt{x}}$$



**≠NH9; F5L #,**

$$\int_1^9 \frac{(1 - \sqrt{x})^3}{\sqrt{x}} dx$$

$$= -2 \int_0^{-2} u^3 du \quad \left[ u = 1 - \sqrt{x}; \quad du = -\frac{1}{2\sqrt{x}} dx \right]$$

$$= -2 \left[ \frac{u^4}{4} \right]_0^{-2}$$

$$= \boxed{-8}$$

**NH; F5L #-**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**NH9; F5L #**

$$\int_0^{\pi/2} \cos x \sqrt{1 + \sin x} dx$$

**NH9; F5L #**

$$\int_0^3 \cos x \sqrt{1 + \sin x} dx$$

$$= \int_1^0 \sqrt{u} du \quad [u = 1 + \sin x; \quad du = \cos x dx]$$

$$= \left[ \frac{2u^{3/2}}{3} \right]_1^0$$

$$= -\frac{2}{3}$$

**≠NH9; F5L #%**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**∓NH9; F5L #%\$**

$$\int_0^1 x e^x dx$$

**\$ % ( I of G = NH9; F 5 H**

**∓NH9; F5L #%\$**

$$\int_0^1 xe^x dx$$

$$\left[ \begin{array}{l} \text{integrate by parts:} \\ u = x \quad ; \quad dv = e^x dx \\ du = dx \quad ; \quad v = e^x \end{array} \right]$$

$$= \left[ xe^x \right]_0^1 - \int_0^1 e^x dx$$

$$= e - \left[ e^x \right]_0^1 = \boxed{1}$$

**≠NH9; F5L #%%**



**≠NH9; F5L #%%**

$$\int_0^1 \left( \sqrt{x^3} + \sqrt[3]{x^2} + \sqrt[4]{x} \right) dx$$

**≠NH9; F5L #%%**

$$\int_0^1 \left( \sqrt{x^3} + \sqrt[3]{x^2} + \sqrt[4]{x} \right) dx$$

$$= \int_0^1 \left( x^{3=2} + x^{2=3} + x^{1=4} \right) dx$$

$$= \left[ \frac{2x^{5=2}}{5} + \frac{3x^{5=3}}{5} + \frac{4x^{5=4}}{5} \right]_0^1$$

$$= \frac{9}{5}$$

**≠NH9; F5L #%&**

**F958Y,**

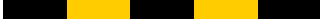
**; 9HG9H...**

**&\$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**≠NH9; F5L #%&**

$$\int_0^{\pi/3} \frac{1}{\cos 2x + \sin^2 x} dx$$



**≠NH; F5L #%**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**& \$ % ( I of G = NH9; F5H = ON 699**

**≠NH9; F5L #%**

$$\int_1^2 x \sqrt[3]{x-1} dx$$

**≠NH9; F5L #%**

$$\int_1^2 x \sqrt[3]{x-1} dx$$

$$= \int_0^1 (u+1)u^{1=3} du \quad [u = x-1; x = u+1; du = dx]$$

$$= \int_0^1 (u^{4=3} + u^{1=3}) du$$

$$= \left[ \frac{3u^{7=3}}{7} + \frac{3u^{4=3}}{4} \right]_0^1 = \frac{33}{28}$$



**≠NH; F5L #%**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**∓NH9; F5L #%**

$$\int_0^1 (x - 1)(x + 1)(x^2 + 1)(x^4 + 1) dx$$

**‡NH; F5L #%**

$$\int_0^1 (x - 1)(x + 1)(x^2 + 1)(x^4 + 1) dx$$

$$= \int_0^1 (x^2 - 1)(x^2 + 1)(x^4 + 1) dx$$

$$= \int_0^1 (x^4 - 1)(x^4 + 1) dx$$

$$= \int_0^1 (x^8 - 1) dx = \left[ \frac{x^9}{9} - x \right]_0^1 = \boxed{-\frac{8}{9}}$$

**≠NH; F5L #%**

**F958Y,**

**; 9HG9H...**

**& \$\$**

**≠NH9; F5L #%**

$$\int_0^{\ln 2} e^{2x} \sqrt{e^x - 1} dx$$

D; F5L #%

$$\int_0^{\ln 2} e^{2x} \sqrt{e^x - 1} dx$$

$$\int_0^{\ln 2} e^x \cdot e^x \sqrt{e^x - 1} dx$$

$$[ u = e^x - 1; \quad e^x = u + 1; \quad e^x dx = du ]$$

$$= - \int_0^1 (u + 1) \sqrt{u} du = - \left[ \frac{2u^{5/2}}{5} + \frac{2u^{3/2}}{3} \right]_0^1 = \boxed{16}$$