

Student Delegates Integration Bee Finals

Student Delegates

January 16, 2021

Introduction

Welcome everyone to the 1st Student Delegates Integration Bee Finals! We are so glad that you chose to participate in this event!

Scoring

The scoring for the following rounds will be as follows.

Setup

Ready?

Please hold a thumbs up to your camera if your set-up is ready, and you are ready to begin competing!

Integral 1

$$\int_0^{\frac{\pi}{4}} \ln \left(\frac{\sec^2(x) - 2}{\tan(x) - 1} \right) dx$$

Integral 1 Answer

$$\frac{\pi \ln 2}{8}$$

Integral 2

$$\int_{\pi-1}^{\pi+1} \frac{e^{\cos(x)} \cos^3(x) + \cot(x)}{\cot(x)} dx$$

Integral 2 Answer

2

Integral 3

$$\int_0^{\pi} \frac{x \sin(x)}{1 + \cos^2(x)} dx$$

Integral 3 Answer

$$\frac{\pi^2}{4}$$

Integral 4

$$\int_{\ln(3)}^{\ln(5)} \frac{4e^{3x}}{e^{2x} - 2e^x + 1} dx$$

Integral 4 Answer

$$9 + 8 \ln(2)$$

Integral 5

$$\int_0^8 \frac{1}{\sqrt{1 + \sqrt{1 + x}}} dx$$

Integral 5 Answer

$$\frac{4\sqrt{2} + 8}{3}$$

Integral 6

$$\int_0^2 \sqrt{(2-x)(\sqrt{x} + \sqrt{x+2})} dx$$

Integral 6 Answer

$$\frac{3\pi}{2}$$

Integral 7

$$\int_3^4 \arcsin\left(\frac{\sqrt{x}}{2}\right) dx$$

Integral 7 Answer

$$\frac{2\pi}{3} - \frac{\sqrt{3}}{2}$$

Integral 8

$$\int_{-20}^{20} (20 - |x|) dx$$

Integral 8 Answer

400

Integral 9

$$\int_0^{\frac{\pi}{2}} \frac{x}{\tan(x)} dx$$

Integral 9 Answer

$$\frac{\pi \ln(2)}{2}$$

Integral 10

$$\int_{2020}^{2021} \tan^{-1}(x) + \cot^{-1}(x) \, dx$$

Integral 10 Answer

$$\frac{\pi}{2}$$

Integral 11

$$\int_0^{\frac{\pi}{2}} \ln(4 \sin(x)) \, dx$$

Integral 11 Answer

$$\frac{\pi \ln(2)}{2}$$

Integral 12

$$\int_{\frac{1}{2}}^2 \frac{x^2 + 1}{x^2(x^{2020} + 1)} dx$$

Integral 12 Answer

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

Integral 13

$$\int_0^1 \sqrt{(x-1)^3 + 1} + x^{\frac{2}{3}} - (1-x)^{\frac{3}{2}} - \sqrt[3]{1-x^2} \, dx$$

Integral 13 Answer

$$\frac{1}{5}$$

Integral 14

$$\int_0^1 (e-1)\sqrt{\ln(1+ex-x)} + e^{x^2} dx$$

Integral 14 Answer

e

Integral 15

$$\int_{2^5}^{3^5} \frac{1}{x - x^{\frac{3}{5}}} dx$$

Integral 15 Answer

$$\frac{5}{2} \ln \left(\frac{8}{3} \right)$$

Integral 16

$$\int_0^{\infty} \frac{\ln(x)}{x^2 + 4} dx$$

Integral 16 Answer

$$\frac{\pi \ln(2)}{4}$$

Integral 17

$$\int_0^1 \left[\sin \left(\frac{\pi}{x} \right) \right] dx$$

Integral 17 Answer

$$1 - \log(2)$$

Integral 18

$$\int_0^{\frac{\pi}{2}} \frac{1}{\left(\sqrt{\sin(x)} + \sqrt{\cos(x)}\right)^4} dx$$

Integral 18 Answer

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

Integral 19

$$\int_0^{\infty} \frac{dx}{\left(x + \frac{1}{x}\right)^2}$$

Integral 19 Answer

$$\frac{\pi}{4}$$

Integral 20

$$\int_0^{\frac{1}{2}} \frac{1 + \sqrt{3}}{\sqrt[4]{(1+x)^2(1-x)^6}} dx$$

Integral 20 Answer

2

Integral 21

$$\int_0^{\infty} \frac{\cos(\pi x) - \cos(ex)}{x} dx$$

Integral 21 Answer

$$\ln\left(\frac{e}{\pi}\right)$$

Integral 22

$$\int_0^{\infty} \frac{\ln(x^2 + 1)}{x^2 + 1} dx$$

Integral 22 Answer

$$\pi \ln(2)$$

Integral 23

$$\int_0^1 x \left\{ \frac{1}{x} \right\} \left[\frac{1}{x} \right] dx$$

Integral 23 Answer

$$\frac{\pi^2}{12} - \frac{1}{2}$$

Integral 24

$$\int_0^{\pi} \arctan(3^{\cos(x)}) dx$$

Integral 24 Answer

$$\frac{\pi^2}{4}$$

Integral 25

$$\int_0^1 \arctan\left(\frac{1}{x^2 - x + 1}\right) dx$$

Integral 25 Answer

$$\frac{\pi}{2} - \ln(2)$$

Integral 26

$$\int_0^1 \ln(x) \ln(1-x) dx$$

Integral 26 Answer

$$2 - \frac{\pi^2}{6}$$

Integral 27

$$\int_0^{\infty} \frac{\arctan(x)}{\sqrt{x}(1+x)} dx$$

Integral 27 Answer

$$\frac{\pi^2}{4}$$

Integral 28

$$\int_0^{\pi} \frac{\ln\left(1 + \frac{\cos(x)}{2021}\right)}{\cos(x)} dx$$

Integral 28 Answer

$$\pi \arcsin\left(\frac{1}{2021}\right)$$

Integral 29

$$\int_0^{\frac{\pi}{2}} \cot(x) \ln(\sec(x)) \, dx$$

Integral 29 Answer

$$\frac{\pi^2}{24}$$

Integral 30

$$\int_2^4 \frac{\sqrt{\ln(9-x)}}{\sqrt{\ln(9-x)} + \sqrt{\ln(x+3)}} dx$$

Integral 30 Answer

1

Integral 30

$$\int_2^4 \frac{\sqrt{\ln(9-x)}}{\sqrt{\ln(9-x)} + \sqrt{\ln(x+3)}} dx$$

Integral 30 Answer

1

Integral 30

$$\int_2^4 \frac{\sqrt{\ln(9-x)}}{\sqrt{\ln(9-x)} + \sqrt{\ln(x+3)}} dx$$

Integral 30 Answer

1

Integral 31

$$\int_1^2 \frac{dx}{x^2 - x\sqrt{x^2 - 1}}$$

Integral 31 Answer

$$\frac{3\sqrt{3} + 3 - \pi}{3}$$

Integral 32

$$\int_0^{2\pi} \sqrt{1 + \sin\left(\frac{x}{2}\right)} dx$$

Integral 32 Answer

8

Integral 33

$$\int_1^e x(\ln(x))^2 dx$$

Integral 33 Answer

$$\frac{e^2 - 1}{4}$$

Integral 34

$$\int_0^8 \frac{\cos(\sqrt{x})}{\sqrt{x}} dx$$

Integral 34 Answer

$$2 \sin(2\sqrt{2})$$

Integral 35

$$\int_0^4 \frac{|x-1|}{|x-2|+|x-3|} dx$$

Integral 35 Answer

$$2 + \frac{9}{4} \ln(3) - \frac{3}{4} \ln(5)$$

Integral 36

$$\int_0^{\frac{\pi}{2}} \frac{\cos(x)}{2 - \cos^2(x)} dx$$

Integral 36 Answer

$$\frac{\pi}{4}$$

Integral 37

Integral 37 Answer

Integral 38

Integral 38 Answer

Integral 39

Integral 39 Answer

Integral 40

Integral 40 Answer

Integral 33

Integral 33 Answer

Integral 33

Integral 33 Answer

Integral 33

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