

Student Delegates Integration Bee Qualifier

Student Delegates

December 2020

1 Instructions

1. Welcome to the Student Delegates Integration Bee Qualifier!
2. Please make sure to have your two-device profile open at all times so we can make sure the event runs smoothly. No computational devices are allowed to be used.
3. Upon completing the integrals, please send one DM to your respective proctor with all your answers.
4. Sudden death will occur in the fashion similar to FAMAT.
5. You will have 30 minutes to complete the 20 integrals.

2 Test

1. $\int_0^{\frac{\pi}{4}} \frac{\sqrt{\tan(x)}}{\sin(2x)} dx$
2. $\int_0^{2\pi} \frac{1}{\sin^4(x)+\cos^4(x)} dx$
3. $\int_0^1 \frac{x \ln(x+\sqrt{x^2+1})}{\sqrt{1+x^2}} dx$
4. $\int_0^\infty \frac{\ln(x+1)}{x\sqrt{x}} dx$
5. $\int_0^{\frac{\pi}{2}} \frac{\sin^3(x)}{\sin(x)+\cos(x)} dx$
6. $\int_0^1 \ln(x) \sin(\ln(x)) dx$
7. $\int_0^\pi \ln(21 + 20 \cos(x)) dx$
8. $\int_0^\infty \frac{1}{(x+\sqrt{1+x^2})^2} dx$
9. $\int_0^1 \frac{e^x(x^2+1)}{(x+1)^2} dx$
10. $\int_0^{\frac{1}{2}} x \sqrt{\frac{1-x^2}{1+x^2}} dx$
11. $\int_1^2 \frac{\ln(x)}{2-2x+x^2} dx$
12. $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin(x)}}{\sqrt{\sin(x)+\sqrt{\cos(x)}}} dx$
13. $\int_1^{e^{\frac{\pi}{4}}} \frac{1}{x(1+\sin^2(\ln(x)))} dx$
14. $\int_0^{2\pi} \frac{1}{2+\sin(x)} dx$
15. $\int_0^\infty \frac{1}{x^3+1} dx$
16. $\int_0^\pi \frac{1}{\tan(x)+1} dx$
17. $\int_0^1 (x^x)^{(x^x)^{(x^x)^{\dots}}} dx$
18. $\int_{-\infty}^0 \frac{e^{2x}+e^{3x}}{e^x+e^{-x}} dx$

19. $\int_0^1 \frac{x^{2020}-1}{\ln(x)} dx$

20. $\int_1^\infty \frac{x-|x|}{x^4} dx$

Hint: $\zeta(s) = \sum_{n=1}^\infty \frac{1}{n^s}$