INTEGRATION BEE
Qualifying Round

Duration: ONE HOUR

Columbia University   February 23, 2024

this qualifying test includes 24 integrals. solve as many integrals as you can in one hour. write the final answer in the space provided. no calculator allowed.

1. $\int \dfrac{\sin^2(x)}{\cos(x)}\,dx$

Answer: _____.

2. $\int \dfrac{\sqrt{x^2+1}}{x}\,dx$

Answer: _____.

3. $\int e^{\sqrt{x}}\,dx$

Answer: _____.

4. $\int \dfrac{x^5}{x^4+1}\,dx$

Answer: _____.

5. $\int \dfrac{\arcsin(\sqrt{x})}{\sqrt{x}}\,dx$

Answer: _____.

6. $\int \dfrac{e^x+1}{e^x-1}\,dx$

Answer: _____.

7. $\int \sqrt{e^x\sqrt{e^x}}\,dx$

Answer: _____.

8. $\int \dfrac{1}{1+\sin(x)+\cos(x)}\,dx$

Answer: _____.

9. $\int \dfrac{1}{\cos(x)\cos(2x)}\,dx$

Answer: _____.

10. $\int \sqrt{1+\tan^2(x)}\,dx$

Answer: _____.

11. $\int \sin\left(x - \frac{\pi}{8}\right) \sin(x) \sin\left(x + \frac{\pi}{8}\right) \, dx$ Answer: _____.

12. $\int e^x \tanh(x) \, dx$ Answer: _____.

13. $\int \frac{\tan^2(x)}{\tan(x) - x} \, dx$ Answer: _____.

14. $\int \frac{1}{x^4 + 4} \, dx$ Answer: _____.

15. $\int_0^{\sqrt{\pi/2}} x^3 \sin(x^2) \, dx$ Answer: _____.

16. $\int_0^{\pi/2} \ln(\sin(x)) \, dx$ Answer: _____.

17. $\int_0^{\infty} \frac{1}{\sqrt{x}(x + 1)} \, dx$ Answer: _____.

18. $\int_0^1 \sqrt{x - x^2}$ Answer: _____.

19. $\int_0^{\pi} \sin^5(x) \cos^3(x) \, dx$ Answer: _____.

20. $\int_0^1 \frac{x\sqrt{x} - 1}{\sqrt{x} - 1} \, dx$ Answer: _____.

21. $\int_{-4}^4 ||||x - 1| - 1| - 1| - 1| \, dx$ Answer: _____.

22. $\int_{-\infty}^{\infty} \frac{1}{x^2 + \pi x + \pi^2} \, dx$ Answer: _____.

23. $\int_0^1 \sqrt{1 - x^2} \, dx$ Answer: _____.

24. $\int_{-1}^1 (1 + \sqrt[3]{x})^3 \, dx$ Answer: _____.