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NAME (FIRST AND LAST): \_\_\_\_\_

UNI: \_\_\_\_\_

TIME IN: \_\_\_\_\_ TIME OUT: \_\_\_\_\_

## INTEGRATION BEE QUALIFYING ROUND

DURATION: ONE HOUR

COLUMBIA UNIVERSITY

FEBRUARY 28, 2025

THIS QUALIFYING TEST INCLUDES 24 INTEGRALS, ORDERED IN NO PARTICULAR ORDER. WRITE THE FINAL ANSWER IN THE SPACE PROVIDED. YOU HAVE ONE HOUR. NO CALCULATOR ALLOWED.

1.  $\int \sin(x) + \cos(x) dx$  Answer: \_\_\_\_\_.

2.  $\int x \sin(x) dx$  Answer: \_\_\_\_\_.

3.  $\int_0^2 x(x-1)(x-2) dx$  Answer: \_\_\_\_\_.

4.  $\int_1^2 (x-1)^{2025} dx$  Answer: \_\_\_\_\_.

5.  $\int \sin(3x) \cos(2x) dx$  Answer: \_\_\_\_\_.

6.  $\int \cos^4(x) - \sin^4(x) dx$  Answer: \_\_\_\_\_.

7.  $\int_0^{25} \min\{x^2, 9\} dx$  Answer: \_\_\_\_\_.

8.  $\int_{-\pi/4}^{\pi/4} \tan^3(x) dx$  Answer: \_\_\_\_\_.

9.  $\int_0^9 \sqrt{2025 - 25x^2} dx$  Answer: \_\_\_\_\_.

10.  $\int \sin(x) \cos(x) \tan^2(x) dx$  Answer: \_\_\_\_\_.

11.  $\int \frac{x^3}{x^4 - 1} dx$  Answer: \_\_\_\_\_.

12.  $\int_1^\infty \frac{x-1}{x^5-x} dx$  Answer: \_\_\_\_\_.

13.  $\int_1^e \ln(x) \left(x + \frac{1}{x}\right) dx$  Answer: \_\_\_\_\_.

14.  $\int_0^{2\pi} \sqrt{1 - \sin^2(x)} dx$  Answer: \_\_\_\_\_.

15.  $\int_0^{\pi/6} \sqrt[4]{\cos^4(x) - \cos(2x)} dx$  Answer: \_\_\_\_\_.

16.  $\int_{-10}^{10} \frac{x^2}{e^x + 1} dx$  Answer: \_\_\_\_\_.

17.  $\int_0^\infty \frac{1}{(x^2 + 1)(x^4 + 1)} dx$  Answer: \_\_\_\_\_.

18.  $\int \frac{1}{\sqrt{x+1} + \sqrt{x}} dx$  Answer: \_\_\_\_\_.

19.  $\int 2x \arcsin(x^2) dx$  Answer: \_\_\_\_\_.

20.  $\int \frac{x}{x+1} dx$  Answer: \_\_\_\_\_.

21.  $\int_0^1 \frac{\ln(1+x)}{x^2 + 2x + 1} dx$  Answer: \_\_\_\_\_.

22.  $\int_{-\pi/2}^{\pi/2} \frac{e^{1 - \frac{1}{\cos^2(x)}}}{\cos^2(x)} dx$  Answer: \_\_\_\_\_.

23.  $\int_0^{2025} [\sqrt{x}] dx$  Answer: \_\_\_\_\_.

24.  $\int \frac{2x^6 + 8}{x^7 - 2x} dx$  Answer: \_\_\_\_\_.