Integration Bee Qualifiers

HMMT November 2025

November 7, 2025
7:00 - 9:00 PM

Instructions

- You will have **30 minutes** to complete **20 integration problems**.
- Each integral, except for the last question which serves as the tiebreaker, is worth equal points.
- All logarithms are base e.
- You may omit the constant of integration (i.e., the $+C$) or the absolute values in the logarithms for indefinite integrals.
- You may leave your answers unsimplified, as long as they don't contain integrals, summations, or limits.

Do NOT turn over until you are told to begin.

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1 $\displaystyle\int_1^{10} \lfloor x \rfloor^3 \, dx$

2 $\displaystyle\int (x^{\sin x})^{\sin x} (x^{\cos x})^{\cos x} \, dx$

3 $\displaystyle\int \frac{1 - x + x^2}{1 - x} \, dx$

4 $\displaystyle\int_{-2025}^{2025} |2025 + x| - |2025 - x| \, dx$

5 $\displaystyle\int_{-\infty}^{\infty} \min(e^x, e^{-x}) \, dx$

6 $\displaystyle\int_0^{\pi} \left\lceil \sqrt{2} \sin x \right\rceil \, dx$

7 $\displaystyle\int \frac{\log(\sec x - \tan x)}{\log(\sec x + \tan x)} \, dx$

8 $\displaystyle\int_{-1}^{1} (2025x^{2025} + 1)\sqrt{1 - x^2} \, dx$

9 $\displaystyle\int \log\log x + \frac{1}{\log x} \, dx$

10 $\displaystyle\int \sin x \log(\sec x + \tan x) \, dx$

11 $\displaystyle\int \frac{\log x}{x^2(\log x - 1)^2} \, dx$

12 $\displaystyle\int_{-\infty}^{\infty} \frac{\arctan(e^x)}{1 + x^2} \, dx$

13 $\displaystyle\int (2x - 1)\sqrt[x]{e} \, dx$

14 $\displaystyle\int_0^1 \frac{\log x}{\sqrt{1 - x}} \, dx$

15 $\displaystyle\int e^x \tan x(\tan x + 1) \, dx$

16 $\displaystyle\int \frac{2x - 3}{x(x^3 - x + 1)} \, dx$

17 $\displaystyle\int \frac{1 + \sin^2 x}{\cos^3 x} \, dx$

18 $\displaystyle\int_0^{\infty} x^{\sqrt{2} - 1 - \log x} \, dx$

19 $\displaystyle\int_0^{\infty} \sum_{y \mid 2025} \frac{1}{(2025 + x^2)(2025 + xy)} \, dx$

20 Estimate

$$\int_0^{\pi} (\csc x)^{\sin x} \, dx.$$

(For the tiebreaker, if you answer A and the answer is actually B, your score will be $\min(A/B, B/A)$. **You may submit your guess unevaluated**, like $\pi^{10}/2025$.)

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Integration Bee Finals

HMMT November 2025

November 8, 2025

Format

- **2 minutes** per integral.
- We will check the result after two minutes.
- **Semifinal:** best of 3 integrals.
- **Final:** best of 5 integrals.
- If there is a tie, we will run a sudden death round.
- All logarithms are base e.
- You may omit the constant of integration (i.e., the $+C$) or the absolute values in the logarithms for indefinite integrals.
- You may leave your answers unsimplified, as long as they don't contain integrals, summations, or limits.

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Integration Bee Finals

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Sample

1 $\displaystyle\int_0^1 2025x\,dx$

2 $\displaystyle\int_0^1 x^{2025}\,dx$

Semifinal 1

1 $\displaystyle\int (\sin x + x\cos x)\log x\,dx$

2 $\displaystyle\int e^{x^2/2}(x+1)^2\,dx$

3 $\displaystyle\int_0^1 x(x-1)^9(x+2)^{19}\,dx$

Semifinal 2

1 $\displaystyle\int x\log(1+x^4)\,dx$

2 $\displaystyle\int \frac{xe^x-1}{(e^x+1)^2}\,dx$

3 $\displaystyle\int_0^{2\pi} (1+2\cos 2x+3\sin 3x)^2\,dx$

Audience Round

1 $\displaystyle\int_0^1 x(x^{101}+x)^{98}\,dx$

Final

1 $\displaystyle\int \log\left(\sqrt[x-1]{x+1}\cdot\sqrt[x+1]{x-1}\right)\,dx$

2 $\displaystyle\int_0^{\pi/4} \sqrt{\tan^3 x}+\sqrt{\cot x}\,dx$

3 $\displaystyle\int_0^{\pi/4} \left(\frac{\tan x-1}{\tan x+1}\right)^2\,dx$

4 $\displaystyle\int_0^{\infty} \frac{1-e^{-x^2}}{x^2}\,dx$

5 $\displaystyle\int \frac{x\sin x+\cos x+1}{(x+\sin x)^2}\,dx$

Sudden Death

1 $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} (\log_{\sin x}(\tan x)-1)(\log_{\cos x}(\cot x)-1)\,dx$

2 $\displaystyle\int_0^{\frac{\pi}{3}} \sec^3 x\tan^3 x\,dx$

3 $\displaystyle\int_0^{\frac{\pi}{2}} \frac{\sin^6 x+\cos^6 x-1}{\sin^4 x+\cos^4 x-1}\,dx$

4 $\displaystyle\int_0^{\infty} \frac{1}{e^{2x}+2e^x+1}\,dx$

5 $\displaystyle\int_{-2025}^{2025} x\cdot\lfloor x-\tfrac{1}{2}\rfloor\cdot\lceil x+\tfrac{1}{2}\rceil\,dx$

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