Integration Bee Answer Key

HMMT November 2022

Qualifiers

1. $\frac{20}{7}$

2. $\frac{4+\log(9/5)}{8}$

3. e^{e^x}

4. $-\sin(e^{\cos x})$

5. $\frac{2}{3}\left(x^{\frac{3}{2}}+(x+1)^{\frac{3}{2}}\right)$

6. 180

7. $\frac{(\log\log x)^2}{2}$

8. $\frac{1}{3}(\sin^3(x)-\cos^3(x))$

9. $-\pi$

10. $\frac{\sqrt{3}}{4}$

11. $\frac{x^{21}}{21(x+1)^{21}}$

12. $e^x(x\log x+1)$

13. $\sin(\sqrt{x^2+1})-\sqrt{x^2+1}\cos(\sqrt{x^2+1})$

14. $\sqrt{2}\log\left(\sec\left(\frac{x}{2}\right)+\tan\left(\frac{x}{2}\right)\right)$

15. $\frac{\pi^2}{84}$

16. $\approx 102\,797.71$

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Finals

Sample

[1] 1011

[2] $\frac{1}{2023}$

Semifinal 1

[1] $-\frac{1}{2}x^{-\log x}$

[2] $\frac{4+\pi^2}{16}$

[3] 10.23

Semifinal 2

[1] $2-\sqrt{2}$

[2] $\frac{155}{6}$

[3] $\log(2+\log 2)$

Final

[1] $\frac{\arctan(x+1)+\arctan(x-1)}{2}$

[2] $5\sqrt{5}-1$

[3] e^{xe^x}

[4] $\frac{x^2}{\log x}$

[5] $2\sqrt{x+1}\arcsin x+4\sqrt{1-x}$

Sudden Death

[1] 96

[2] 0.5

[3] $\frac{\log(3/2)}{4}$

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