2020 MathSoc Integration Bee
Qualifiers Questions

1. [3] $\displaystyle\int_{503}^{507} x \, \mathrm{d}x$
2. [3] $\displaystyle\int 3^{\ln x} \, \mathrm{d}x$
3. [3] $\displaystyle\int \sqrt{e^x} \, \mathrm{d}x$
4. [4] $\displaystyle\int \sqrt{e^x - 1} \, \mathrm{d}x$
5. [4] $\displaystyle\int \cos(\ln x) \, \mathrm{d}x$
6. [4] $\displaystyle\int \frac{e^{2x}}{\sqrt{1 - e^{4x}}} \, \mathrm{d}x$
7. [4] $\displaystyle\int_{-7\pi/4}^{7\pi/4} \frac{4x \cos x}{x^2 - \sin|x| + \cos|x|} \, \mathrm{d}x$
8. [4] $\displaystyle\int_0^{\pi/2} \frac{\sin^k x}{\sin^k x + \cos^k x} \, \mathrm{d}x$, $k \in \mathbb{Z}$
9. [4] $\displaystyle\int \left(e^x + e^{-x}\right)^{-1} \, \mathrm{d}x$
10. [4] $\displaystyle\int \sec^2(x) \sec^2(\tan(x)) \sec^2(\tan(\tan(x))) \, \mathrm{d}x$
11. [5] $\displaystyle\int_0^2 \lfloor x \rfloor - 2\left\lfloor \frac{x}{2} \right\rfloor \, \mathrm{d}x$
12. [5] $\displaystyle\int_0^{\sqrt{3}/4} \frac{2x \sin^{-1}(2x)}{\sqrt{1 - 4x^2}} \, \mathrm{d}x$
13. [5] $\displaystyle\int_0^1 \sin^{-1}\sqrt{x} \, \mathrm{d}x$
14. [5] $\displaystyle\int_0^{\pi/2} \frac{1}{1 + \tan^4 x} \, \mathrm{d}x$
15. [6] $\displaystyle\int_0^{3\pi/2} \sin^{-1}(\sin x) \, \mathrm{d}x$
16. [6] $\displaystyle\int_1^{\infty} \frac{\mathrm{d}x}{x(x^2 + 1)}$
17. [7] $\displaystyle\int_0^{\pi/2} \frac{1}{1 + \sin x} \, \mathrm{d}x$
18. [7] $\displaystyle\int e^{\cos^{-1} x} \, \mathrm{d}x$
19. [8] $\displaystyle\int_0^{\pi/2} \frac{25}{(3\cos x + 4\sin x)^2} \, \mathrm{d}x$
20. [8] $\displaystyle\int \frac{1}{x^7 + x} \, \mathrm{d}x$

2020 MathSoc Integration Bee
Team Standoff Questions

- Team A Question 1:
$$\int \frac{x-1}{x+x^2\ln x}\,\mathrm{d}x$$
- Team A Question 2:
$$\int_0^2 \sin^2\left(\frac{\pi\,|x-1|}{2}\right)\,\mathrm{d}x$$
- Team A Question 3:
$$\int_0^{1/4} e^{\sqrt{x}}\,\mathrm{d}x$$
- Team B Question 1:
$$\int \frac{1}{\sqrt{x-x^2}}\,\mathrm{d}x$$
- Team B Question 2:
$$\int_0^{\pi/4} \ln\left(1+\tan x\right)\,\mathrm{d}x$$
- Team B Question 3:
$$\int_0^{\pi/2} \frac{\cos^2 x}{\sin x+\cos x}\,\mathrm{d}x$$
- Team C Question 1:
$$\int \frac{x^2-1}{x^4+1}\,\mathrm{d}x$$
- Team C Question 2:
$$\int_{-1}^{1} \sum_{k=0}^{9} kx^k\,\mathrm{d}x$$
- Team C Question 3:
$$\int_{-1}^{1} \tan^{-1}\left(2^x\right)\,\mathrm{d}x$$
- Team D Question 1:
$$\int \sqrt{\frac{x}{1-x^3}}\,\mathrm{d}x$$
- Team D Question 2:
$$\int \frac{1}{x^2\left(x^4+1\right)^{3/4}}\,\mathrm{d}x$$
- Team D Question 3:
$$\int_1^{e^2} \frac{\ln\left(1+\ln x\right)}{x}\,\mathrm{d}x$$

2020 MathSoc Integration Bee
Semi-Finals Questions

- Round 1 Question 1:

$$\int \frac{x^2}{(x\sin x+\cos x)^2}\,\mathrm{d}x$$

- Round 1 Question 2:

$$\int_0^1 x^m\,(\ln x)^n\;\mathrm{d}x, \quad m,n\in\mathbb{Z}^+$$

- Round 1 Question 3:

$$\int_{403}^{405} \frac{\sqrt{\ln\left(2020-x\right)}}{\sqrt{\ln\left(2020-x\right)}+\sqrt{\ln\left(1212+x\right)}}\,\mathrm{d}x$$

- Round 2 Question 1:

$$\int_0^\infty x^{2n}e^{-x^2}\;\mathrm{d}x, \quad n\in\mathbb{Z}^+$$

- Round 2 Question 2:

$$\int_{1/\pi}^{1/e} \ln\left\lfloor\frac{1}{x}\right\rfloor\,\mathrm{d}x$$

- Round 2 Question 3:

$$\int_0^1 \sin\left(x\right)\sinh\left(x-1\right)\;\mathrm{d}x$$

2020 MathSoc Integration Bee
Runner Up Questions

- Harder Integral:

$$\int_0^1 \frac{\sqrt{1-x^2}+\sin^{-1}\sqrt{\dfrac{1+x}{2}}}{\left|\sin\left(\tan^{-1}\left(\sqrt{1-x^2}/x\right)\right)\right|}\,\mathrm{d}x$$

- Easier Integral:

$$\int_1^3 3^{\sqrt{4x-3}}\,\mathrm{d}x$$

2020 MathSoc Integration Bee
Finals Questions

- Question 1:

$$\int \frac{x}{\sqrt{x}} \frac{\sqrt[3]{x}}{\sqrt[4]{x}} \frac{\sqrt[5]{x}}{\sqrt[6]{x}} \cdots \, \mathrm{d}x$$

- Question 2:

$$\int e^{x^x} \ln\left(e^{x^{2x}} x^{x^{2x}}\right) \, \mathrm{d}x$$

- Question 3:

$$\int \frac{1}{x} \prod_{k=1}^{\infty} \left(1 - \tan^2\left(\frac{x}{2^k}\right)\right) \, \mathrm{d}x$$

- Question 4:

$$\int_0^{\infty} \frac{x}{\sqrt{e^x - 1}} \, \mathrm{d}x$$

- Question 5:

$$\int_0^1 x^m (1-x)^n \, \mathrm{d}x, \quad m, n \in \mathbb{Z}^+$$