INTEGRATION BEE 2022 WRITTEN EXAM ANSWERS

CLEARLY write your first and last name at the top of this page. Otherwise, on this page you should write only your final answers next to the corresponding problems and box them. There is no penalty for an incorrect answer. Unless otherwise specified, assume natural domain restrictions; no need to include them in your answer. Answers must be given in CLOSED FORM (no infinite series)! +C is not necessary.

(1) $2022^2 \sin(\frac{x}{2022}) + C$

(2) $\sin x \ln x + C$

(3) 0

(4) $\pi/4$

(5) $\frac{\ln^2(x)}{2} + C$

(6) $2(x-1)e^x + C$

(7) $\frac{\ln(x^2+1)}{2} + C$

(8) $-\cos(e^x) + C$

(9) $\ln(|\ln(x)|) + C$

(10) $\frac{x^{n+1}\ln(x)}{n+1} - \frac{x^{n+1}}{(n+1)^2} + C$

(11) $\cos(\cos(x)) + C$

(12) $\frac{\sqrt{\pi}}{2}$

(13) $\dfrac{2x^{\frac{5}{2}}(5\ln(x)-2)}{25}+C$

(14) $\arctan x\sqrt{\tan x}+C$

(15) π

(16) $2\ln 2019$

(17) $x^{e^x}+C$

(18) $2f(0)$

(19) $\dfrac{x\ln(x)(4x^2+6x+3)}{3}-\dfrac{4x^3+9x^2+9x}{9}+C$

(20) $\dfrac{1}{2}$

(21) $\dfrac{1}{3}$

(22) $\ln|x+\sqrt{x^2+2}|+\ln|x+\sqrt{x^2-2}|+C$

(23) $\dfrac{\arctan\left(\frac{2x-2}{4}\right)}{16}+\dfrac{x-5}{8x^2-16x+40}+C$

(24) $2\sin x+x+C$

(25) $\dfrac{1}{2}\pi\ln(2022)$

(26) $\dfrac{1}{3}$

(27) $\dfrac{\arctan\left(\frac{1-3\tan(x/2)}{2\sqrt{2}}\right)}{\sqrt{2}}-\dfrac{2\arctan\left(\frac{1-2\tan(x/2)}{\sqrt{3}}\right)}{\sqrt{3}}+C$

(28) $-\dfrac{2}{\sqrt{2022}}\tanh^{-1}\left(\dfrac{\sqrt{2022-2x}}{\sqrt{2022}}\right)+C$

(29) $$-\frac{\pi}{4}$$

(30) $$\frac{\pi^2}{6} - \log(\frac{1}{3})\log(\frac{2}{3})$$