2024 Calculus Bee
Tuesday, April 23, 2024

1st Place	Duc Toan Nguyen
2nd Place	Hieu Pham
3rd Place	Balaji Kannan

1. Find the minimum value of $x^4 - 20x^2 + 24$.
2. Compute $\displaystyle\int_3^7 \sqrt{4-(t-5)^2}\; dt$.
3. Evaluate $\displaystyle\int_{-2024\pi}^{2024\pi} z^{51}\cos(17z)\; dz$.
4. At what point do the tangent lines at $x = -1$ and $x = 2$ to $y = x^2$ intersect?
5. Evaluate $\displaystyle\sum_{n=2}^{\infty} 2^{-2n+1}$
6. Evaluate $\displaystyle\int_0^2 \max\{x, x^2\}\; dx$
7. Evaluate $\displaystyle\lim_{a\to x}\frac{x^2-a^2}{x-a}$.
8. Let $\displaystyle R_n = \sum_{k=1}^{2n} \frac{1}{1+\frac{k}{n}}\cdot\frac{1}{n}$ for all natural numbers n. Compute $\displaystyle\lim_{n\to\infty} R_n$.
9. Find the area of the set $\left\{(x,y) : -\frac{1}{2}x \le y \le 3\sqrt{x} \text{ and } (x-4)^2 + y^2 \ge 1 \text{ and } x \le 4\right\}$.
10. Find the maximum value of $2\sin x + 3\cos x$. Simplify your answer.
11. Evaluate $\displaystyle\int_1^4 \frac{1}{x+\sqrt{x}}\; dx$.
12. Find $\displaystyle\sum_{k=0}^{\infty}\frac{(-2)^k}{(2k)!}$
13. For what value(s) a is the line through (a, a^2) and $(2, 3)$ tangent to $y = x^2$?