

## 2013: The Calculus Games

Tuesday, April 23, 2013

Winners:

First Place	Vicky Xue
Second Place	Brian Preskitt
Third Place	Anh Nguyen

1. Evaluate  $\int_0^{2013} \ln 2013 \, dx$ .

2. Compute and simplify  $f'(x)$  for  $f(x) = \frac{x^2 + 1}{x}$ .

3. Find the equation of the line tangent to  $y = x(x + 1)$  at  $x = 1$ . Write the equation in the form  $y = mx + b$ .

4. Find

$$\int_{\int_0^2 x \, dx}^{\int_0^2 (x+1) \, dx} (x + 2) \, dx.$$

5. Find the value of  $x$  at which  $x\sqrt{1 - x^4}$  achieves its maximum.

6. Find the area of the region between the curves  $y = x^4$  and  $y = 20 - x^2$ .

7. For what  $x$  does  $\sum_{n=0}^{\infty} \left(\frac{x^2 + 6x - 1}{6}\right)^n$  converge?

8. Find the smallest positive  $x$ -value of a critical point of  $\sin x + \sin x \cos x$ .

9. Evaluate  $\lim_{x \rightarrow \infty} (\sqrt[3]{x^3 + 2x^2 + 3x + 4} - x)$ .

10. Evaluate  $\frac{d}{dx} \int_{x^2}^{x^3} e^{u^2} \, du$ .

11. Evaluate and simplify

$$\frac{d}{dx} \cos(\arcsin(x)).$$

12. Find  $c$  so that the tangent line to  $y = e^{2x}$  at  $x = c$  passes through the origin.

13. Evaluate  $\int_0^{\infty} \frac{x^2}{(x + 1)^5} \, dx$ .