

2012 Calculus Bee  
Tuesday, April 24, 2012

Winners:

First Place	Brian Preskitt
Second Place	Janson Oyler
Third Place	Vicky Xue

(1) Find

$$\frac{d}{dx} \left( x^{2012} + \pi^{2012} \sin \left( \frac{\pi\sqrt{2}}{17} \right) \right).$$

(2) Find the  $x$ -value of the maximum of the function  $x^{503}e^{-2012x}$ .

(3) Find

$$\int_{-\pi}^{\pi} (x^2 + \sin(x^3)) dx.$$

(4) Write the equation of the tangent line to the function  $f(x) = 2012 + x - 6x^2 - x^3$  that has the largest possible slope. Give your answer in the form  $y = mx + b$ .

(5) Evaluate and simplify

$$\sum_{n=2}^{\infty} \frac{1}{(n+2012)(n+2011)}.$$

(6) Consider the region  $R$  bounded by  $y = 5 - x^2$  and  $y = 4$ . Find the volume of the solid of revolution generated by revolving  $R$  around the  $y$ -axis.

(7) Let

$$g(x) = \begin{cases} -2 & \text{if } x \leq -2 \\ x & \text{if } -2 < x \leq 2 \\ -x + 4 & \text{if } 2 < x \leq 3 \\ 1 & \text{if } x > 3 \end{cases}$$

Find  $\int_{-5}^5 g(x) dx$ .

(8) Let  $y = \int_{-1}^x \frac{t^3}{t^{10}+5} dt$ . Find the equation of the tangent line to the curve when  $x = 1$ .