2011 Calculus Bee

Tuesday, April 19, 2011

Winners:

First Place	*Brian Preskitt*
Second Place	*Jason Lam*
Third Place	*Yajing Yang*

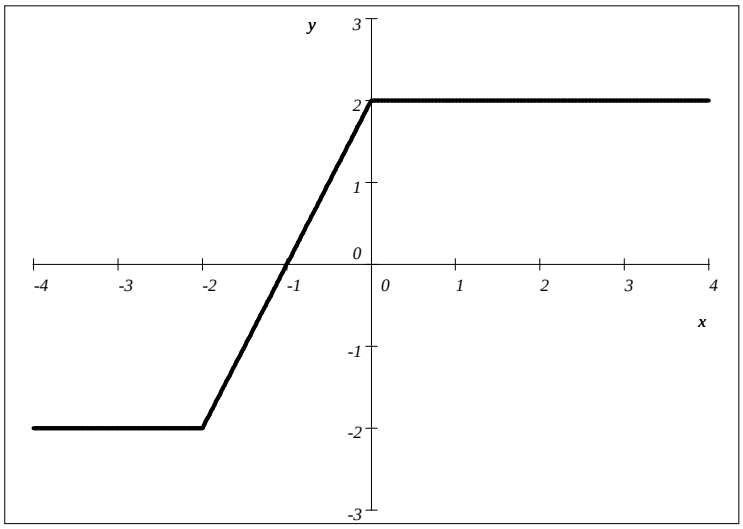
1. *Find* $g'(0)$ *if*

$$g(x) = e^{2011x} - x^{2011}\sin(e^{2011x}).$$

2. *Find*

$$\int \frac{\tan(x)}{\cos(x)}dx.$$

3. *Consider the graph of* $y = f(x)$ *below. Find* $\int_{-2}^{2} f(x)\,dx$.



4. *If*

$$\int_0^a x^{2011}dx = a^{2011},$$

for some $a > 0$, *then find* a.

5. *Evaluate*

$$\lim_{x\to 0^+}(1+\sin x)^{1/x}.$$

6. *Evaluate* $\int \dfrac{1}{1+\frac{1}{1+2x^2}}\,dx$.

7. *The graph of the function* $g(x) = ax^3 + bx^2 + cx + d$ *passes through* $(0,0)$, *has* $(1,1)$ *as a point of inflection, and has a tangent line with slope* 3 *at the point of inflection. Find* a, b, c, d.

8. *Find the minimum value of*

$$(x^{2011} - 1)^4 + (x^{2011} - 2)^4.$$

9. *Evaluate* $g'(2011)$ *if*

$$g(x) = \ln\big((x-2010)(x-2009)(x-2008)\big).$$