## 2010 TCU Calculus Bee Friday, April 23, 2010

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Winners:	
First Place	Yajing Yang
Second Place	Brian Preskitt
Third Place	Wenting Yu

- **1**. Evaluate  $\frac{d}{dx}(e^{2010\cdot T\cdot C\cdot U\cdot x})$ , where T, C, and U are positive constants.
- **2**. Evaluate  $\int_{0}^{2\pi} \sin^2(2010x) dx$ .
- **3**. Find and simplify  $\frac{d}{dx}(\sin x \cdot \cos x \cdot \tan x \cdot \cot x \cdot \sec x \cdot \csc x)$  for  $0 < x < \pi/2$ .
- **4**. Find  $\int_{e^3}^{e^5} \frac{5}{x} dx$ , and simplify your answer.
- **5.** Find  $\frac{d^{2010}}{dx^{2010}} \left( \left( x^2 + 1 \right)^{1004} \right)$ .
- **6.** Suppose  $\sum_{n=2}^{\infty} (c \cdot 3^{-n}) = 2$ . Find c.
- **7.** Evaluate  $\int \left(\frac{x^2+1}{x}\right)^{-1} dx$ .
- **8**. Let  $G(x) = (x 1)(x 2)\cdots(x 2009)(x 2010)$ . Find G'(2010).
- **9**. Find the maximum area of a rectangle in the first quadrant with one corner being the origin and the opposite corner on the curve  $y = \frac{1}{1+2x^2}$ .
- **10**. Find the x-value of the point on  $y = x^2$  where its tangent line is perpendicular to the tangent line at the point (3, 9).
- **11.** Evaluate  $\int 2^{\ln x} dx$ .
- **12.** Evaluate  $\lim_{n \to \infty} (\sin \frac{\pi}{n} + \cos \frac{\pi}{n})^n$ .
- **13**. Find the value of p that maximizes  $p^{2003}(1-p)^{2010}$  on the interval  $0 \le p \le 1$ .