# 2014: Calculus and the Earth
Tuesday, April 22, 2014

| 1st Place | Cody Cox |
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| 2nd Place | Nick Vreeburg |
| 3rd Place | Phuc Ta |

1. (TCU Calculus Bee, 1776) We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of the tangent line to the graph of $y = x^{2014}$ at $(1, 1)$. Put your answer in the form $y = mx + b$.

2. (TCU Calculus Bee, 1984) Mr. T pities the fool who can't determine the area under the curve $y = 2014 \cos(x)$ between $x = 0$ and $x = \frac{\pi}{2}$.

3. (TCU Calculus Bee, 1968) In the future, the derivative of the following function at $x = -1$ will be famous for 15 minutes:
$$\frac{x + \frac{2014}{x}}{x}.$$

4. (TCU Calculus Bee, 1863) Four score and seven years ago our fathers brought forth on this continent a new integral, conceived in liberty, and dedicated to the proposition that all men are created equal:
$$\int \frac{\ln\left(x^{2014}\right)}{x} dx.$$

5. (TCU Calculus Bee, 1976) If you can figure out whether the following integral is positive, negative, or zero, that would be DY-NO-MITE!
$$\int_0^{2\pi} e^{-2014x^2} \sin(x) \ dx.$$

6. (TCU Calculus Bee, 1859) It was the best of expressions, it was the worst of expressions. Find its minimum value:
$$1 + x^2 + \left(1 + x^2\right)^2 + \left(1 + x^2 + \left(1 + x^2\right)^2\right)^2.$$

7. (TCU Calculus Bee, 1215) KNOW THAT BEFORE GOD, for the health of our soul and those of our ancestors and heirs, to the honour of God, the exaltation of the holy Church, and the better ordering of our kingdom, evaluate
$$\sum_{n=1}^{\infty} \left(\frac{2014}{x}\right)^n.$$

8. (TCU Calculus Bee, 1988) The following integral is easy – NOT!
$$\int_{-\pi}^{\pi} \sin(\sin x) \, dx.$$

9. (TCU Calculus Bee, 1975) Take it to the limit, one more time:
$$\lim_{x \to \infty} \left(1 + \frac{2}{x}\right)^{x/3}.$$

10. (TCU Calculus Bee, 1988) Read my lips: evaluate
$$\int \frac{\sin x \cdot \tan x \cdot \sec x}{\cos x \cdot \cot x \cdot \csc x} \, dx.$$

11. (TCU Calculus Bee, 1933) The only thing we have to fear are the first three nonzero terms in the Taylor series of $h(x) = x^3 \sin\left(x^3\right) - e^{x^6}$ at $x = 0$.

12. Evaluate
$$\int \left(\frac{x}{x^3 + x^2 + x + 1}\right)^{-1} dx.$$