Why more is better: The power of multiple proofs

Prime Time Talk: Thursday, July 31, 2014
Steven Miller (sjm1@williams.edu)

Feel free to contact me with any questions about mathematics, from research project to classes to colleges; I'm also happy to put you in touch with my students. Below are some useful excerpts from the talk.

1. Webpage: The talk is online here:
    http://web.williams.edu/Mathematics/sjmiller/public_html/math/talks/MoreBetterPowerMultipleProofs_Hampshire2014.pdf

2. Dimensional analysis: The discriminant of a quadratic $ax^2 + bx + c$ is $b^2 - 4ac$; what do you think the discriminant of the cubic $x^3 + ax + b$ is? What are possibilities? (To simplify things we have changed variables to make the leading coefficient 1 and eliminated the quadratic piece; can you justify that?) If you don't know what the discriminant is, investigate!

3. Examine the different cases for the baseball formula and see which of the four possibilities those cases eliminate.

4. Can you easily find the integral of $x^{17} e^{ax}$?

5. "Finish" the attack on Stirling by showing / proving that the limit of

$$\lim_{k \to \infty} \left((2^k)^{2^{k-1}} / (2^k - 1)!! \right)^{1/2^{k-1}} = e.$$

6. Look at the geometric irrationality proofs at **http://arxiv.org/abs/0909.4913** and try to extend. Can you get other square-roots? Can you get a cube-root? Can you do something with tetrahedral?

I'd be very happy to work with anyone on (5) and (6).