Math Contest possible problems:

D = DeMeo H = Hayes L = Liu Ny = Nyikos Sa = Savu Su = Sun T = Thorne W = Wu

1. You have two boxes. Each of them has a square base and is half as tall as it is wide.

   If the larger box is two inches wider than the smaller box, and has a volume 244 cm^2 greater, what is the width of the smaller box?

   (a) 4 in (b) 6 in (c) 8 in (d) 10 in (e) 12 in

   Answer: (c)

2. You are walking through the woods with a wolf, a goat, and a cabbage. You come across a river and you must get across the river with all three. There is a boat which you can use, but you can only bring one of the wolf, the goat, or the cabbage at a time.

   They may be together around you, but you cannot leave the wolf behind with the goat, nor the goat with the cabbage. How many total trips across the river are required to transport yourself, the wolf, the goat, and the cabbage to the opposite side?

   (a) 5 (b) 7 (c) 9 (d) 13 (e) none; it is impossible

   Answer: (b)

3. Starting with an equilaterial triangle, you inscribe a circle in the triangle, and then inscribe an equilateral triangle inside the circle. You then repeat this process four more times, so that you end up drawing five triangles in addition to the one you started with.

   What is the ratio of the areas between the largest and smallest triangles?

   (a) 32 (b) 243 (c) 1024 (d) 59049 (e) 1048576

4. You play on a game show with the following rules. You are shown four prizes with different prices. You are given four price tags which give the prices of the prizes, but you don't know which tag goes with which prize.

   You are asked to match the price tags to the prizes, and for each correct match, you win the prize. Unfortunately you have no idea how much any of the prizes cost, and so you place the price tags randomly.

   What is the most likely number of prizes you will win?

   (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

   Answer: (a)
   Remark. This question is more interesting and more difficult with 5 prizes. In that case the answer is 1.

5. Consider the set of all positive solutions (x, y) to the equation $x^2 = y^4 + 2$. What is the sum of all the possible values of y?

(a) 0 (b) 7 (c) 41 (d) 1096 (e) 37118240

Answer: (a)