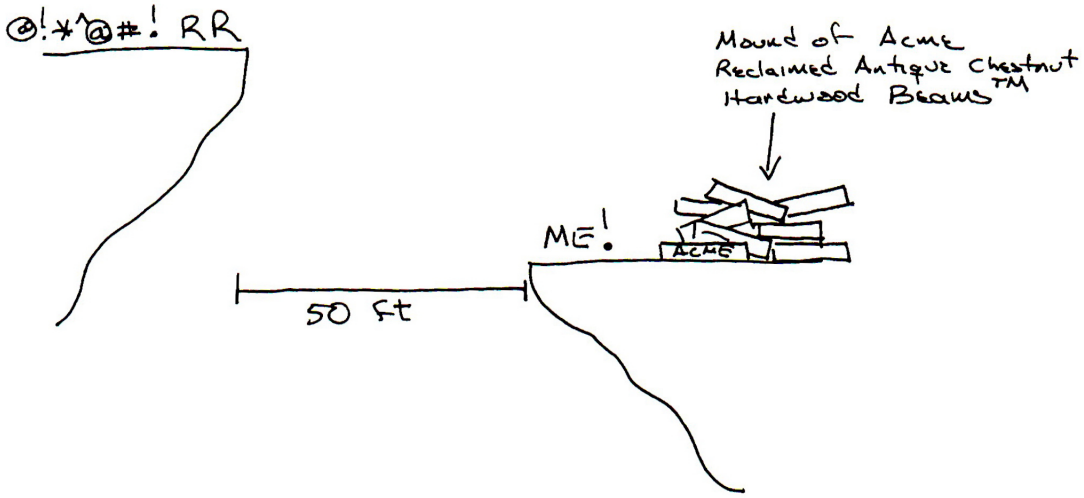
Wile E Coyote
Bleached Bones, AZ
November 8, 2010

Math 104 Students
Wheaton College
Norton, MA 02766

Dear Calculus Students:

HELP ME!! For the last two months, I've had this series of recurring nightmares that are about to drive me crazy. When I went looking for help, your enterprising and resourceful professor naturally referred me to you.

The scenario is nearly always the same. I'm standing at the edge of a cliff in the desert (as usual) looking up across a chasm at that `@!*^@#!` Roadrunner, who is on a cliff on the other side, staring down at me, sticking out his tongue and doing his little superiority dance. Piled up next to me is a giant mound of Acme Reclaimed Antique Chestnut Hardwood Beams^{TM}, each of which is two feet long and four inches high. I start stacking the beams, one on top of another, gradually extending out over the edge of the cliff toward the `@!*^@#!` Roadrunner.



Here is where it gets really weird. I don't have any nails, or glue, or any way to hold the Acme Reclaimed Antique Chestnut Hardwood Beams^{TM} together, yet I'm still able to stack the beams, and it seems like I'm getting closer to the other side. This is where I absolutely need your help. I've gotta know: Do I ever get to the `@!*^@#!` Roadrunner? Do I have any chance? If I do get there, how many beams do I need to use?

All of my dreams have this same basic format, but I don't always know how long the beams are or how wide the chasm is. You gotta help me figure out whether or not I get the silly bird in all these dreams, and if do, how many beams I will need.

I know this is a busy time of the semester for you, but I've got to have your answer by November 19. I can't take this much longer.

Hungry as ever,
Wile E. Coyote

A Few Comments From Your Enterprising and Resourceful Professor

- The most important feature in stacking the beams is that the center of mass of the entire stack of beams stays over solid ground, no matter how much is hanging over the edge of the cliff. You can assume that the beams are uniform so that the center of mass of each beam will be at the center of the beam.

  Since you are only concerned about the horizontal location, you can find the center of mass of the stack by taking the average of the locations of the centers of mass of each beam in the stack.

- In order to get started, you may want to think about building the stack as follows.
  - Place the first beam so that it overhangs the edge of the cliff as much as possible.
  - Place the second beam *underneath* the first beam so that its left edge is lined up with the edge of the cliff.
  - Now calculate the center of mass of this stack of two beams. This determines how far left you can shift this stack before it will tumble over the edge of the cliff. Shift it.
  - Repeat the last two steps by placing the third beam underneath the two-beam stack so that it is lined up with the edge of the cliff, calculate the center of mass of this three-beam stack, and then shift this three beam stack left as far as possible.
  - Continue the process by adding an additional beam under the existing stack and determining how far you can shift the new stack.
  - You should see a pattern that emerges that will allow you to create a function $h(n)$ that indicates how far a stack of n beams can extend over the edge of the cliff.