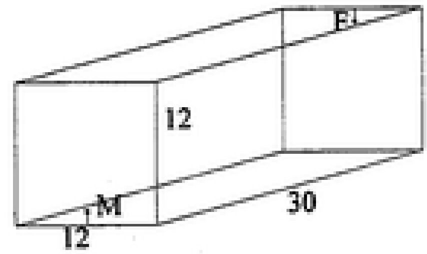
From Peter D. Taylor "Problems for High School Math: In Process"
(Queen's University, Dept. of Math., 4th Printing, 2002)

# Two ants

A rectangular room has dimensions 12×12×30 (feet). There is a vertical line running up the middle of each of the square walls. A male ant is on one of these lines, 1 foot from the floor, and a female ant is on the other, 1 foot from the ceiling. How far does the male have to crawl to get to the female? We will, of course, assume that the male follows the shortest route to get to the female, given that he has to stick to the floor, the walls or the ceiling. That is, although some male ants have wings and can fly, this one cannot.




*This problem is found in Ball and Coxeter* Mathematical Recreations & Essays *[University of Toronto Press, 12th ed. 1974. page 120] and they attribute it to H.E. Dudeney. A similar question appeared in print in the London Daily Mail in February of 1905.*

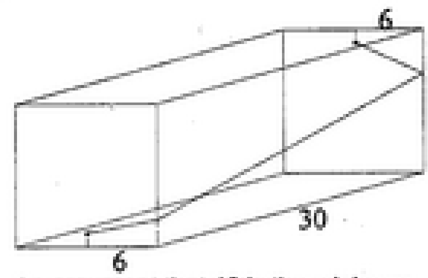
I wander among the groups and find that they have all identified the obvious "floor-endwall" route which runs down the line to the floor, across the floor, and up the opposite line to the female: a total distance of 1+30+11 = 42 feet.

However, they know that I have a fondness for mathematical trickery, so they spend some time trying to find other paths. But they do not succeed.

*I throw the problem out to the class and await their results which I expect will be not long in coming. Indeed, I intend to use this problem as a warm-up and move quickly on to some juicier problem of the same type (e.g. Problem 3).*

In fact, someone volunteers to "prove" that 42 is the shortest distance, and comes resolutely to the board. He argues as follows, using the 3-dimensional picture as an aid.

An alternative to the "floor-endwall" route would be to use one of the side walls. Now to get over to the side wall requires at least 6 feet, and then to get to the other side of the room requires at least 30 feet, and then at least 6 feet must again be used to get back to the vertical line. That's 42 feet right there, and we haven't even made allowance for the change in height.




An argument that 42 is the minimum distance.

Hmm. An interesting argument. What about the ceiling—is that another alternative?

Well, if you're going to go over to the side wall, you'd never want to use the ceiling, as that would take you too high, and you'd just have to come back down.

Seems quite convincing. I take a vote: *how many think that the minimum distance is 42*? Every hand goes up—it's unanimous!

*I stand at the front staring at the class, and they stare back at me expectantly. The argument seems fine—why am I not saying anything?*