Bonus Puzzle #2

MATH 125 — Calculus I
due Friday, Apr 19

Please print your name:

Puzzle. Dog Elvis (remember him from class?) loves playing fetch. When you throw the ball, you and Elvis are standing at the water's edge. You know that Elvis runs at about 7 m/s on land, and that his swimming speed is about 1.1 m/s.

(a) If you throw the ball 10m deep into the sea and 15m down the shore (so that it is at a distance of $\sqrt{10^2+15^2}$ meters), which path should Elvis take if his goal is to minimize the time to the ball? [*Solution.* 13.41m on land]

Some researchers suggest that Elvis does not solve the Calculus problem posed in (a) but instead "optimizes its behavior on a moment-to-moment basis".

(b) At the moment that Elvis starts running down the shore, at which speed does he approach the ball? [*Solution.* 5.82m/s]

(c) Suppose Elvis runs down the shore. At which speed does he approach the ball when he has covered x meters? [Check your answer: When $x=15$ the speed has to be zero.]

Bonus challenge. The researchers think that Elvis may run down the shore until the speed with which he approaches the ball decreased to his swimming speed. If that is the case, at which point should Elvis jump into the water? Compare with the path in (a).

Elvis himself

"Finally, for those intrigued by this general study, there are further experiments that are available [...] Even more interesting, one might test to determine whether the optimal path is found by six-year-old children, junior high aged pupils, or college students. For the sake of their pride, it might be best not to include professors in the study."

To collect a bonus point (worth 1% towards a midterm exam, or an extra dropped quiz, whichever is more valuable):

- Send me an email with your solution to the bonus challenge (the boxed part).
- Include some words of explanation (in particular, your answer to (c)).
- Send that email by Friday, Apr 19.

The story appears in the article: *Do Dogs Know Calculus?* Timothy J. Pennings. http://www.maa.org/features/elvisdog.pdf

The picture shows Pennings' dog indeed. http://www.maa.org/mathland/mathtrek_02_20_06.html

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