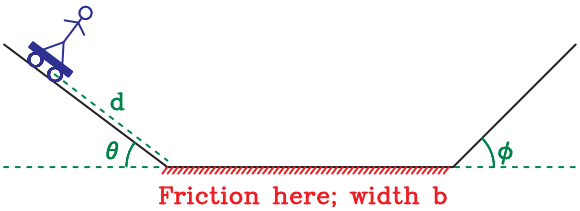
Physics 211 Exam 3, Question 5

This is not the full exam; this is part 5 of 5. The full instructions are in part 1; read them before you begin.

A skateboarder of mass m is standing on the edge of a drainage channel, as shown. The left side, where the skateboarder starts, is elevated at an angle θ; the right side is elevated at an angle ϕ. The slopes on either side are smooth, and the skateboard moves over them with essentially no friction, but the flat bottom of width b is covered with a little sand, and the skateboard experiences a small amount of rolling friction there, with μ_k known.



The skateboarder starts a distance d up the left-hand side. They roll down the left side, across the sand-filled bottom, and up the right side.

(*Give your answers to the first two parts in terms of the variables above, along with g.*)

a) Determine the maximum distance d_2 that the skateboarder makes it up the right side. (This is the diagonal distance, not the height.) *(10 points)*

(This problem continues on the next page.)

b) After rolling up and back down the right side, the skateboarder will come back to the left side. How far will they travel back up the left side? *(5 points)*

c) Suppose that you know numeric values as follows:

- $m = 75$ kg
- $\theta = 30°$
- $\phi = 40°$
- $\mu_r = 0.05$
- $d = 4$ m
- $b = 7$ m

How many times will the skateboarder travel across the sandy bottom of the channel before coming to rest? Explain the approach behind your solution fully. *(10 points)*