Open Ended Problem #9
The Prince of Persia
GROUP WORK OKAY, Due 11/22/24 at beginning of class
(Don't be afraid to "Google" good assumptions!)

The Prince of Persia

Unable to stop a pebble from hitting the sand trap, Dastan falls along with the coursing sand into a chasm by way of a slanted stone wall. By the end of his slide, the sand is moving at a nice even pace, with Dastan moving at the same speed as the sand on the surface. At the end, right before plummeting into the bottomless crevice with the sand, he is able to stop himself and grab onto a stone column. In reality, how fast would Dastan have been moving, and could he have stopped on that narrow column? (HINT – think 1-D Navier-Stokes, here!)

1) What is this problem actually asking for? (Be specific, and answer in terms of things you can actually solve for!)

2) Draw a sketch depicting the conditions of interest, including variables that need to be considered when simplifying this problem.

3) a) What physical laws apply to this problem?
   b) Indicate equations, correlations, and/or formulae that can model these laws.
   c) What are the potential limitations of these equations?

4) What assumptions should be made?
        a) List ALL the assumptions that you need to in order to solve the problem.
        b) Justify your assumptions (references, reasoning, judgment, common sense, etc.
        where possible, use numbers and *quick* calculations)

5) What are the physical properties you used in this problem?

6) Calculate the quantity that you listed in part 1 (be sure to include intermediate values).

7) Verify your answer... Does it look reasonable? Anything odd about the calculation?

a) In reality, the stone blocks are falling all around Dastan as he slides down the slanted stone wall. How would these impacts affect the process you used to calculate the result?
b) Aside from the asymmetry effects of part a, is this method (simplifying of Navier-Stokes) reasonable? What about the sand makes this solution method questionable?
d) Based on your answer to part 1, generate an expression for the volumetric flow rate as a function of the sand properties and the sand flow thickness (i.e. between Dastan and the stone slab). Based on the estimated amount of sand initially resting at room's floor, is this flow rate reasonable?