

7. A STACK OF PAPERS (8 points) — *Taavet Kalda and Jaan Kalda.*

There is a pack of $N \gg 1$ identical sheets of papers lying on an infinite horizontal table. The coefficient of friction between the surface of the table, and between two sheets of paper are both equal to μ . Each sheet has dimensions $L \times W$, with $L > W$. Sandra is trying to fetch the bottom-most sheet by pulling from a shorter edge of it with a constant velocity u (while all the sheets lie almost exactly on top of each other, she managed to get hold of an edge of the bottom-most sheet).

i) (2 points) Sketch a qualitative graph of how the acceleration a of the pack (excluding the bottom-most sheet) depends on time when (a) the speed u is very small.

(b) the speed u is very big.

ii) (3 points) What is the minimal speed $u_{\min}$ by which it is possible to pull the bottom-most sheet out (i.e. separating it completely from the remaining pack)?

iii) (1 point) Assuming $u > u_{\min}$, what is the speed of the remaining pack at the moment when the bottom-most sheet gets out of the pack (i.e. there is no longer overlapping areas)?

iv) (2 points) Considering still $u > u_{\min}$, what is the minimal distance l between the pack of papers and the edge of the table such that the pack would not slide over the edge of the table? (l is the maximal allowed travel distance of the pack.)