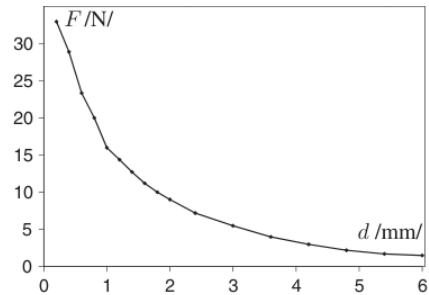
## 8. Experiment (12 pts)

**1)** We incline the plate until sheet starts sliding: the static coefficient is found as $\mu_{static} = h/\sqrt{l^2 - h^2}$, where $h$ is height of the plate endpoint, and $l$ — the plate length. Now we push the sheet laying on the plate slightly, and find the inclination angle, for which the sheet will slide down with a constant velocity; we use again the formula $\mu_{kinetic} = h/\sqrt{l^2 - h^2}$. The reasonable numerical values are $\mu_{static} \approx 0.37$ and $\mu_{kinetic} \approx 0.29$.

**2)** We put several paper stripes on the plate, and the magnet on the top of them. We make a loop of cord, put it around the magnet, and pull it using the dynamometer sideward (sliding the whole system of paper and magnet). The attraction force $F \approx N$ (where $N$ is the reaction force) is found as the ratio of the reading of the dynamometer $F_d$ and the appropriate friction coefficient (depends, which reading is taken: either the maximal one, or the one corresponding to sliding), $F \approx F_d/\mu$. The distance $d$ is measured in the number of paper stripes (one stripe had a thickness of $\approx 0.2\,\mathrm{mm}$). For large distances (approximately $d > 4\,\mathrm{mm}$), the weight of the paper $F_p$ stripes and magnet is no longer negligible, the accuracy of the results can be enhanced by subtracting this weight from $N$: $F = F_d/\mu - F_p$.

**3)** We use a similar set-up, except that smaller number of paper stripes is used (totaling up to around 2 mm), and a steep slope of the plate. We let the brick slide down the slope and hit on the magnet. We keep the falling height and plate slope constant, and measure the sliding path, which is covered by the papers and the magnet after having been hit by the brick. This path is inversely proportional to the attraction force $N$. If this path turns out to be too short for an accurate measurement (for very small distances between the magnet and the plate), several brick hits can be used. In that case, the single-hit path can be found as the measured path, divided by the number of hits. The constant of proportionality can be found by comparing the results of this and previous question, for those distances, which are covered by both measuring techniques. Reasonable measurement results are given in the attached graph.




**4)** The same technique as in the case of previous question is applied, except that a larger number of hits has to be used ($\approx 10 - -20$). Reasonable result for $d = 0.2\,\mathrm{mm}$ (one paper stripe) is $F \approx 270\,\mathrm{N}$. Note that the result is much larger than the double result in the case of a single magnet; this is due to closing the ferromagnetic loop of magnetic field lines.