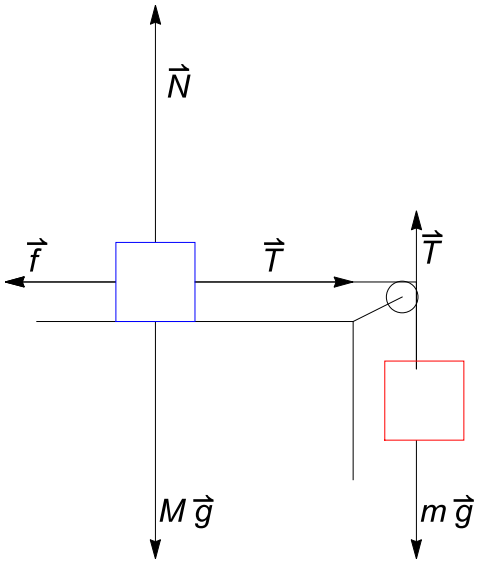
Friction + centripetal

1. A block with mass $M = 2\,kg$ rests on a horizontal table with static and kinetic friction coefficients $\mu_s = 0.7$, $\mu_k = 0.6$, respectively. A lighter block with mass $m = 1\,kg$ is hanging from a string which is attached to the 1st block.



   (a) Find the acceleration a of the system

   (b) find the tension T of the string.

   (c) find friction f (depends if the block is moving or not!!)

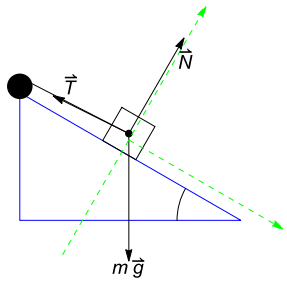
   (d) find the maximum m when the blocks are still not moving

Equilibrium on incline.

$$\boxed{f_s \leq \mu_s \cdot mg\cos\theta}$$

2. a block rests on an incline with $\mu_s = 0.3$. The angle slowly increases. At which θ will the block begin to slide?

3. Include static friction f_s (with direction!) in the diagram below, assuming that neither T nor f_s alone are sufficient for equilibrium



$$\vec{f_s} + \vec{T} + \vec{N} + m\vec{g} = 0$$

   (a) write the above for x-components, down the incline
   (b) write the above for y-components, normal to incline
   (c) find maximum possible f_s assuming $\mu_s = 0.2$, $m = 5\,kg$, $\theta = 30^o$
   (d) find the minimal possible T

4. A heavy box with $M = 100\,kg$ rests on a horizontal floor with $\mu_s = 0.4$. Find the minimal horizontal force to start the box moving.

5. A horizontal force F presses an $M = 10\,kg$ block to a vertical wall with $\mu_s = 0.5$. Find the minimal F for the block not to fall.

6. (*) same, but the force is inclined upward, making 30^o with horizontal

7. Try the following experiment. Put a coin on top of a sheet of paper on your desk. Observe what happens if you pull the paper, alternatively, slow or fast. Draw a clear force diagram and make a quantitative estimation of the maximum acceleration a, such that the coin still remains on the paper. Assume $\mu = 0.5$.

8. A Ferris Wheel has a radius $R = 25\,m$ and completes one full revolution in $1\,min$. Draw clear force diagrams and find the apparent weight of a $40\,kg$ child at the highest and the lowest points.