Forces and Inclines *with Friction*

Prof. Jordan C. Hanson

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1 Review of Friction Force

The friction force is $f = \mu N$. That is, the force is directly proportional to the *normal force*, and the constant of proportionality is μ. If the object is not moving, then μ is the static coefficient of friction. If the object is *sliding*, then μ is the kinetic coefficient of friction. If $N = mg$, then $f = \mu mg$ and the direction of f will be in the direction opposing motion.

2 Inclined Surfaces with Static Friction

Place a mass on the ruler and incline the ruler at some small angle. Draw a free body diagram below summarizing the weight, friction, and normal forces on the mass. Use the free body diagram to show that $\mu = \tan(\theta)$, if μ is the static coefficient of friction.

3 Measurement of μ

For several masses, measure μ by measuring the largest possible θ such that the mass does not slide down the ruler. Create a plot of μ versus mass. Does μ depend on mass?