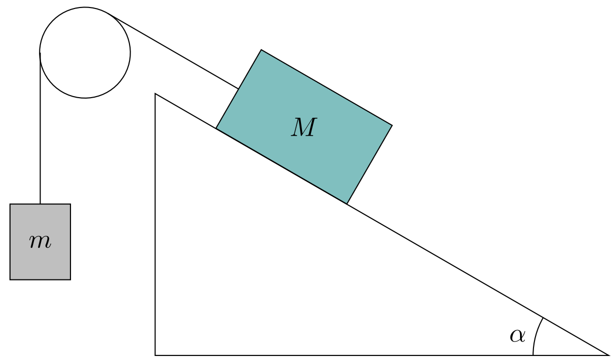
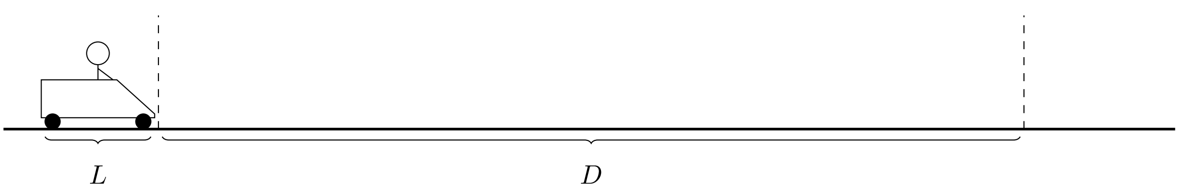
Slope and pulley

A block of mass M is initially still on a frictionless slope set at an angle α. It is attached via a rope hung across a frictionless pulley to a hanging block of mass m. Depending on the angle of the slope and the masses of the blocks, they might stay still, or end up moving in either direction.



Drag race

A car of length L participates in a race with a strange requirement: the car must be stopped immediately after crossing the finish line a distance D away, and the race is only finished once the whole car crosses the finish line. The car can accelerate with an acceleration $a_{x,+} > 0$ and brake with an acceleration $a_{x,-} < 0$.



Newton's Laws	Notable forces	Kinematics
1. $\vec{F}_{\text{net}} = 0 \iff \vec{a} = 0$ **2.** $\vec{F}_{\text{net}} = m\vec{a}$ **3.** $\vec{F}_{\text{by A on B}} = -\vec{F}_{\text{by B on A}}$	$\lvert F_g\rvert = mg$, $g = 10$ m/s^2 $\lvert F_{\text{friction}}\rvert = \mu \lvert F_{\text{normal}}\rvert$	$v_x = \frac{dx}{dt}$, $a_x = \frac{dv_x}{dt}$ For a_x constant: $v_{f,x} - v_{i,x} = a_x \Delta t$ $x_f - x_i = v_{i,x}\Delta t + \frac{1}{2}a_x(\Delta t)^2$ $x_f - x_i = \left(\frac{v_{i,x}+v_{f,x}}{2}\right)\Delta t$ $(v_{f,x})^2 - (v_{i,x})^2 = 2a_x(x_f - x_i)$