what does -32 lbf/300 lbm mean? lbf/lbm has units of force/mass, so it is an acceleration. But how to convert to something useful like ft/s^2? Multiply by 1 in the funny form of g_c = 1 = 32.174 lbm ft / lbf s^2, of course!

acceleration = (-32 lbf/300 lbm) (32.174 lbm ft / lbf s^2) = -3.43 ft/s^2

or, since g_{earth} = 32.174 ft/s^2,

acceleration = (-3.43 ft/s^2)/(32.174 ft/s^2 g_{earth}) = -0.107 g_{earth}.

The negative sign indicates the acceleration is in the –x direction, i.e. down the slope of course.

A good function test is that the acceleration has to be less than 1 g_{earth}, which is what you would get if you dropped the block vertically in a frictionless environment. Obviously, a block sliding down a slope (not vertical) with friction and with an external force acting up the slope must have a smaller acceleration.

Example 4. Wheels and friction

A car of known weight W is equipped with rubber tires with coefficient of static friction μ_s. Unlike the earlier example, there is no cable but the wheels are locked and thus the tires exert a friction force parallel to and in the plane of the ramp surface. As with the previous example, the car is on a ramp of angle θ with respect to horizontal. The center of gravity of the vehicle is a distance "c" above the ramp, a distance "a" behind the front wheels, and a distance "b" in front of the rear wheels.

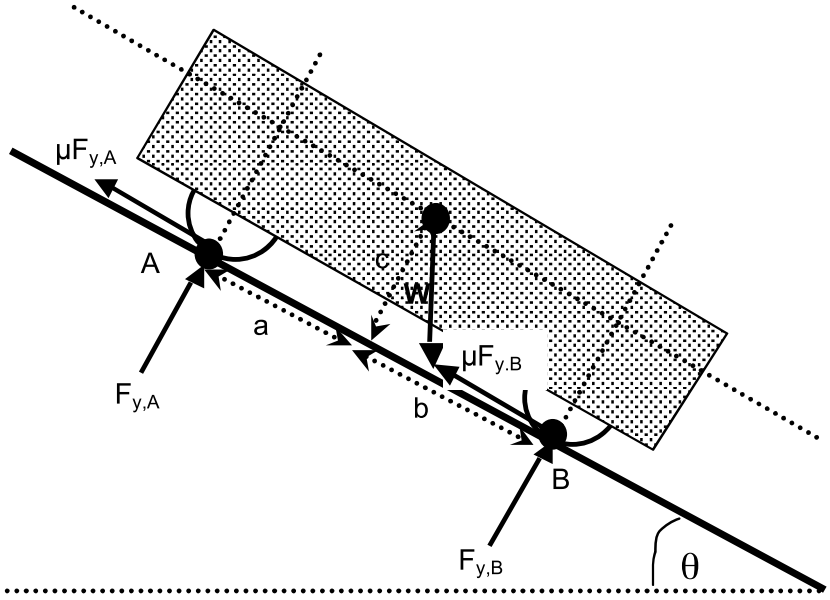

Figure 9. Free body diagram for car-on-ramp with friction example

(a) What is the minimum μ_s required to keep the car from sliding down the ramp?