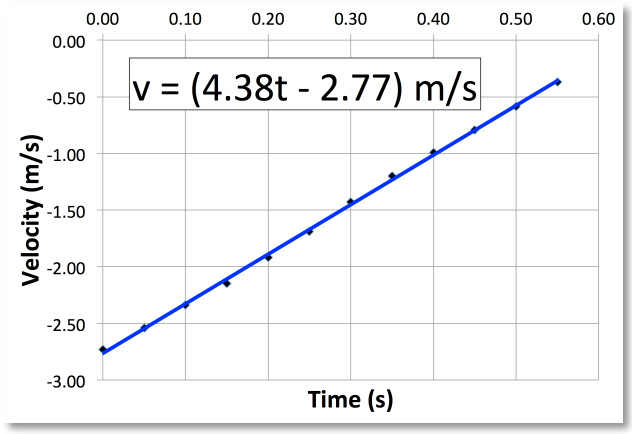
Flipping Physics Lecture Notes:
Using Newton's Second Law to find the Force of Friction



We haven't defined the Force of Friction[♥] yet, however, we can still solve for its magnitude.

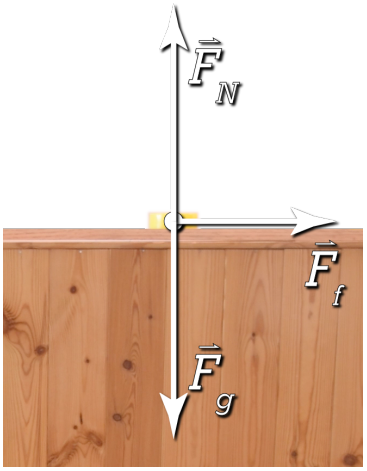
Example Problem: You slide a 56 gram street hockey puck on a wooden board. The graph of its velocity as a function of time is shown. What is the magnitude of the force of friction between the puck and the wooden board?

The best-fit line or trendline of the velocity as a function of time graph is $v = \left(4.38t - 2.77\right)\frac{m}{s}$

This line equation is in the slope intercept form or y = mx +b, which means the slope of the line or m = 4.38 and the y-intercept or b = -2.77. Remember the slope of a velocity versus time graph is acceleration:

$$slope = m = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{\Delta v}{\Delta t} = a = 4.38\frac{m}{s^2}$$

The y-intercept is the initial velocity: $v_i = -2.77\frac{m}{s}$



Draw the free body diagram to solve for the force of friction.

Sum the forces in the x-direction:

$$\sum F_x = F_f = ma_x = \left(56\right)\left(4.38\right) = 245.28N \times \frac{1lb}{4.448N} = 55.144lb$$

Something must be wrong because the force of friction acting on an object with such a small mass shouldn't be that large! We didn't convert the puck mass to kg, which we need to do because Newtons are in $\frac{kg \cdot m}{s^2}$.

$$m = 56g \times \frac{1kg}{1000g} = 0.056kg$$

$$\sum F_x = F_f = ma_x = \left(0.056\right)\left(4.38\right) = 0.24528 \approx \boxed{0.25N}$$

[♥] Technically it is the force of *kinetic* friction. We will define static and kinetic friction in a later lesson.