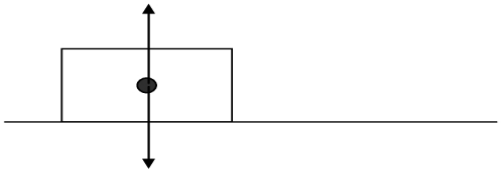
General Physics, Unit 7: One Dimensional Force Analysis

Worksheet #1, Unit 7, Determining the Net Force and using Newton's 2nd Law

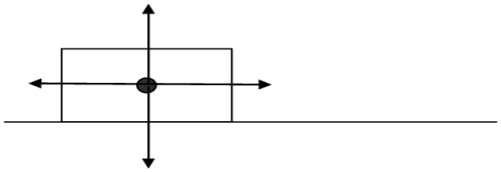
When we draw forces on objects and the forces act along an axis, the forces can be summed collinearly (forces up and right are considered positive; forces down and left are considered negative). We look at each axis separately.



When there is no motion, then we say the object is in equilibrium. All the forces must add up to equal zero. $F_{net} = ma$ but $a = 0$ so $F_{net} = 0$. All the forces are balanced.

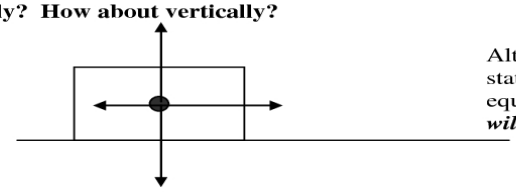
1. Let's say that the above box has a mass of 10 kg. Label the two forces acting on the box with the correct amount of force for each one.

However, there is another case of equilibrium: the object could be moving but at a constant velocity (not accelerating: i.e. not getting faster or slower). This is also equilibrium.



2. In this case, let's say you push the 10 kg box to the right with a force of 200 N. Let's say that this is the force needed to keep the box moving at constant velocity. Friction acts to oppose your push equally. Label all of your forces and put correct amounts of forces for each one.
We have equilibrium in the x direction and in the y direction.

3. What happens if the friction is smaller than your push force? Let's say that friction acts at 50 N instead of 200 N. If you still push on the box with 200 N, what is the net force now acting horizontally? How about vertically?



Although the box is balanced (equilibrium or statics) in the y direction, it is unbalanced (non-equilibrium or dynamics) in the x direction. ***How will the object move now in the x direction?***

We can now use Newton's 2nd Law to determine the acceleration. We know that $F_{net} = ma$. **Determine the net force in the x direction and then determine the horizontal acceleration**.