Mr. Murray's Physics
Forces, Equilibrium, Normal Force, Friction – the Basics

1. Forces -
   A. Objects move the direction of forces.
   B. Force causes acceleration. If there is a net force on an object, the object either starts moving (if at rest) or accelerates in the direction of the net force (if already moving).
   C. Forces are vectors – you can do "Adding Vectors" with forces – just like before. This is nothing new.
2. Equilibrium -
   A. Three conditions of equilibrium: $F_{net} = 0$ N; $a = 0$ m/s^2; $\Delta v = 0$ m/s.
   B. At equilibrium an object might be at rest or might be in motion at constant speed.
   C. If you are asked to find an equilibrium force – it is the force that makes Fnet = 0 N. If you have a net force already, the equilibrium force is equal and opposite (cancels out the net force).
3. Mass vs. Weight -
   A. Mass is in kg and weight is in N.
   B. Use Fw = mg ($g = 10$ m/s^2) to switch between them.
4. Normal Force -
   A. Think of it as the supporting force. If you are asked to find the normal force on a surface ask yourself "how much is that surface supporting?"
   B. A force pulling up on an object reduces the weight the surface must support, so the normal force is reduced by that amount.
5. Friction –
   A. Friction depends on how rough the surface is (μ) and how hard it is being pressed against the surface (Fn)
   B. Since $F_f = \mu Fn$, you always have to find Fn to find friction.
   C. Use Fs when an object is not moving, to find out if an object will move, etc.
   D. Use Fk when an object is moving, to find a (from F = ma), once an object is moving, etc.
   E. Fs and Fk NEVER occur at the same time, even if you have them draw at the same time. Also, friction NEVER starts an object moving.
   F. If $Fs > F_{applied}$ the object will not move. Do not think that since Fs is greater, the object will move the direction of Fs (see letter "E" above).
6. Angles -
   A. Just as before – resolve all non-vertical or non-horizontal forces into components.
   B. Draw two diagrams: one for the x-direction and y-direction.
   C. Find Normal force in y-direction.
   D. Use Fs to decide if the object will move.
   E. Use Fk to find "a" with Fnet = ma.

