The one exception to our rule regarding dynamic equilibrium is the special case of uniform circular motion. Since moving along a circular path implies that the direction of the velocity vector must continually change, this means that there must be some unbalanced acceleration acting on the object. This acceleration is called the 'centripetal' acceleration because the acceleration must act perpendicular to the velocity vector and towards the center of the circular path in order for circular motion to be possible.

In our analysis of all simple rotating systems we must identify the net force that is directed towards the center of the circle. No matter what provides that net force, it is equivalent to the magnitude of the centripetal force.

Now we study the origin of the frictional forces acting on a system and relate them to the magnitude of a coefficient of friction between an object and the surface upon which it rests. We find that it always requires more force to cause an object to start moving than is required to keep it moving so we conclude that the coefficient of static friction exceeds the coefficient of kinetic friction.

To solve problems involving friction, we must determine the magnitude of the normal force that describes the contact between an object of interest and a surface. The magnitude of the frictional force is then used in Newton's formulation to determine the acceleration of the object.

Next we ponder a way to evaluate the state of a system that does not depend on such detailed vector analysis. We need a way to get at the essential aspects of a system even when we do not know everything about it.