6.6: Summary

6.6.1: Key Takeaways

When the velocity of an object does not change direction continuously (“linear motion”), we can model its motion independently over several segments in such a way that the motion is one dimensional in each segment. This allows us to choose a coordinate system in each segment where the acceleration vector is co-linear with one of the axes.

When the forces on an object changes continuously, we need to use calculus to determine the motion of the object. If the velocity vector for an object changes direction continuously, we need to model the motion in each dimension independently.

If an object undergoes uniform circular motion, the acceleration vector and the sum of the forces always point towards the center of the circle. In the radial direction, Newton’s Second Law gives

$$\sum \vec{F} = ma_R = m\frac{v^2}{R}$$

If an object’s speed is changing as it moves around a circle the acceleration vector will have a component that is towards the center of the circle (the radial component) and a component that is tangential to the circle. The tangential component is responsible for the change in speed, whereas the radial component is responsible for the change in direction of the velocity.

In a reference frame that is rotating about a circle, an inertial force, sometimes called the centrifugal force, appears to push all objects co-moving with the reference frame towards the outside of the circle.