

There's an important distinction to make between cause and effect when analyzing the motion of objects.

There are two very separate questions that we can ask.

The first is, how does a particular object move?

This is a purely descriptive geometrical question that we're asking.

What does the geometry of the motion look like?

If we were to draw its trajectory as a function of time, what's the shape of that trajectory?

The study of the geometry of motion of a trajectory is referred to as kinematics.

The second question we can ask is, why does an object move the way it does?

Why does the kinematic description of the trajectory look the way it does?

This concerns what the causes are of the motion and of the changes in that motion.

The study of the cause behind the changes of motion is called dynamics.

Newton's Second Law of Motion connects these two questions.

When we write F equals ma , this is more than just a mathematical identity.

Physically, we're connecting two very different questions.

And we can symbolize that by dividing the equation into its two sides.

The right-hand side, the ma side, is essentially asking the question of how, how does the object move?

What does that motion look like?

It's a description, a geometric description of the object's motion.

The left-hand side of the equation, where the forces are, answers the question of why, why does the object move the way it does?

What causes the motion to change?

These are very different conceptually.

And the remarkable thing about Newton's Second Law, in fact, one of Newton's signature accomplishments was to realize that these two questions can be connected in this way through Newton's Second Law of Motion.

Since these are very different issues, we'll examine them separately in our course.

We'll begin this week by looking at kinematics in one and two dimensions, basically learning how to describe the geometric motion of an object and its trajectory.

We'll follow that by discussing the dynamics of the motion, examining why an object's motion changes when forces are applied through a discussion of Newton's laws and their applications.