CHAPTER OVERVIEW

17: N3) 2 Dimensional Kinematics and Projectile Motion

In this chapter we are going to extend our work on kinematics in 1-dimension to include 2-dimensional motion. It turns out that the short answer is "2D is just like two copies of 1D", and we don't need to work to hard to see that. In this course, there is really one key example of 2D motion, and that is **projectile motion**.

Projectile motion is the motion of an object that is launched into the air and moves under the influence of gravity alone. During the entire motion, the object is subject to a constant acceleration of 9.8l meters per second squared, directed downwards (which we often take to be the negative direction). The path of the object is called a trajectory, and it can be predicted using a few basic principles.

The horizontal and vertical motions of the object are independent of each other. This means that the object will continue moving forward at a constant speed unless acted upon by external forces, while at the same time, it will be pulled downwards by gravity. The initial velocity and launch angle of the object determine its trajectory. The initial velocity is the speed at which the object is launched, while the launch angle is the angle at which it is launched relative to the horizontal. Together, these two factors determine the initial velocity vector, which can be broken down into its horizontal and vertical components.

The motion of the object can be analyzed using basic kinematic equations that describe the motion of an object under constant acceleration, which we presented in the last chapter. By using these equations, you can predict the maximum height reached by the object, the time it takes to reach the maximum height, the total time of flight, the range of the object, and the final velocity of the object when it hits the ground.

It is important to note that air resistance can affect the motion of a projectile, especially at high velocities or long distances. However, in many cases, air resistance can be neglected, and the motion of the object can be described using the basic principles of projectile motion. During our work in this course, we will nearly always be ignoring air resistance, which we will generally refer to as **freely falling motion**.

Overall, understanding projectile motion is essential for a wide range of applications, from sports to engineering to astronomy. By mastering the basic principles of projectile motion, you can make accurate predictions about the motion of objects in the real world and develop more sophisticated models and simulations.
