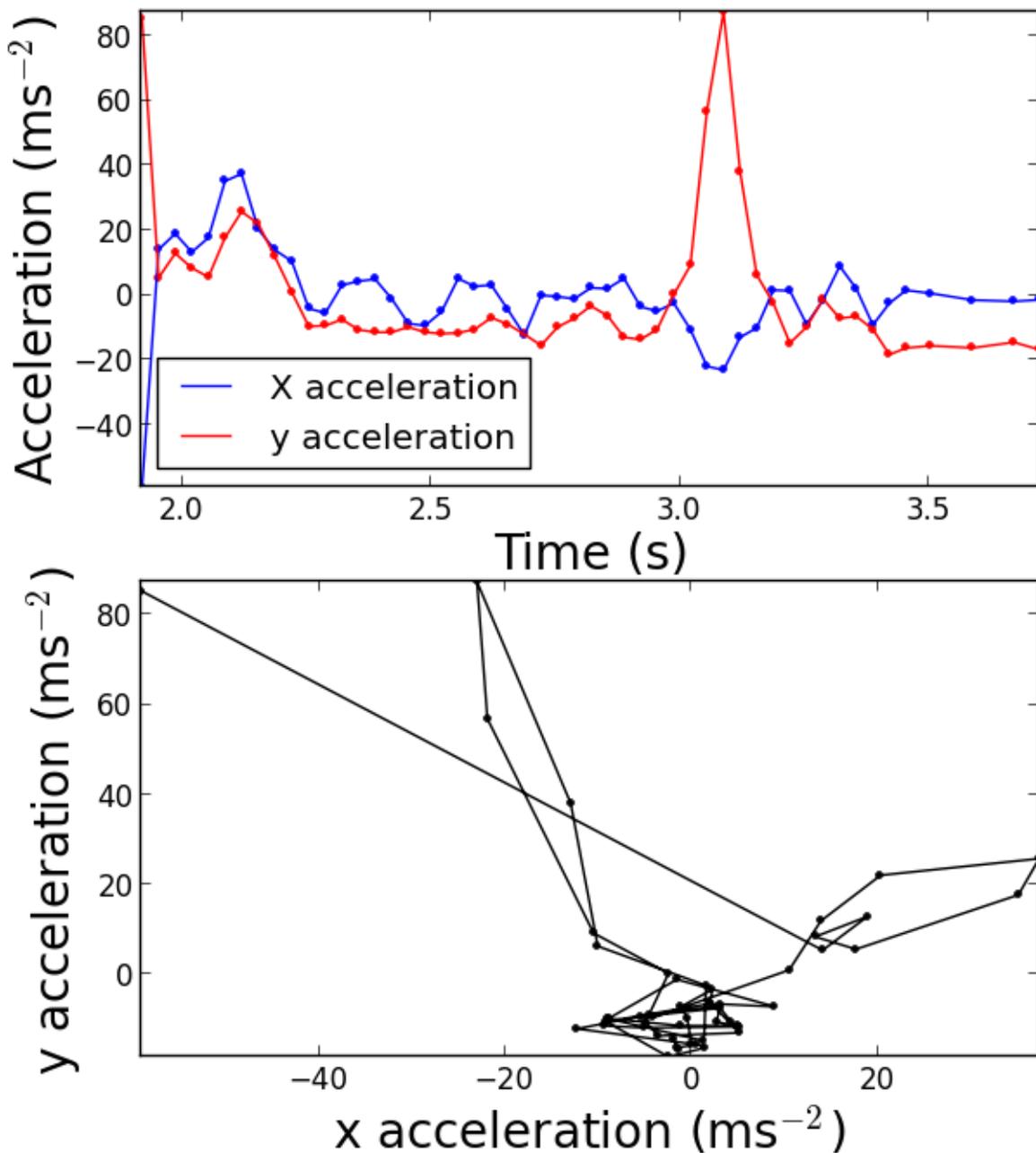Figure 1: Acceleration in the x- and y-directions is plotted against time, and against one another. These data are derived using the formula $a = (v-u)/t$ applied to the x- and y- velocity data and the time between consecutive frames in the original videos. Acceleration is related to force by Newton's second law of motion, and thus to impulse and work, which describe the time profile of an applied force and the energy expended by a force, respectively.
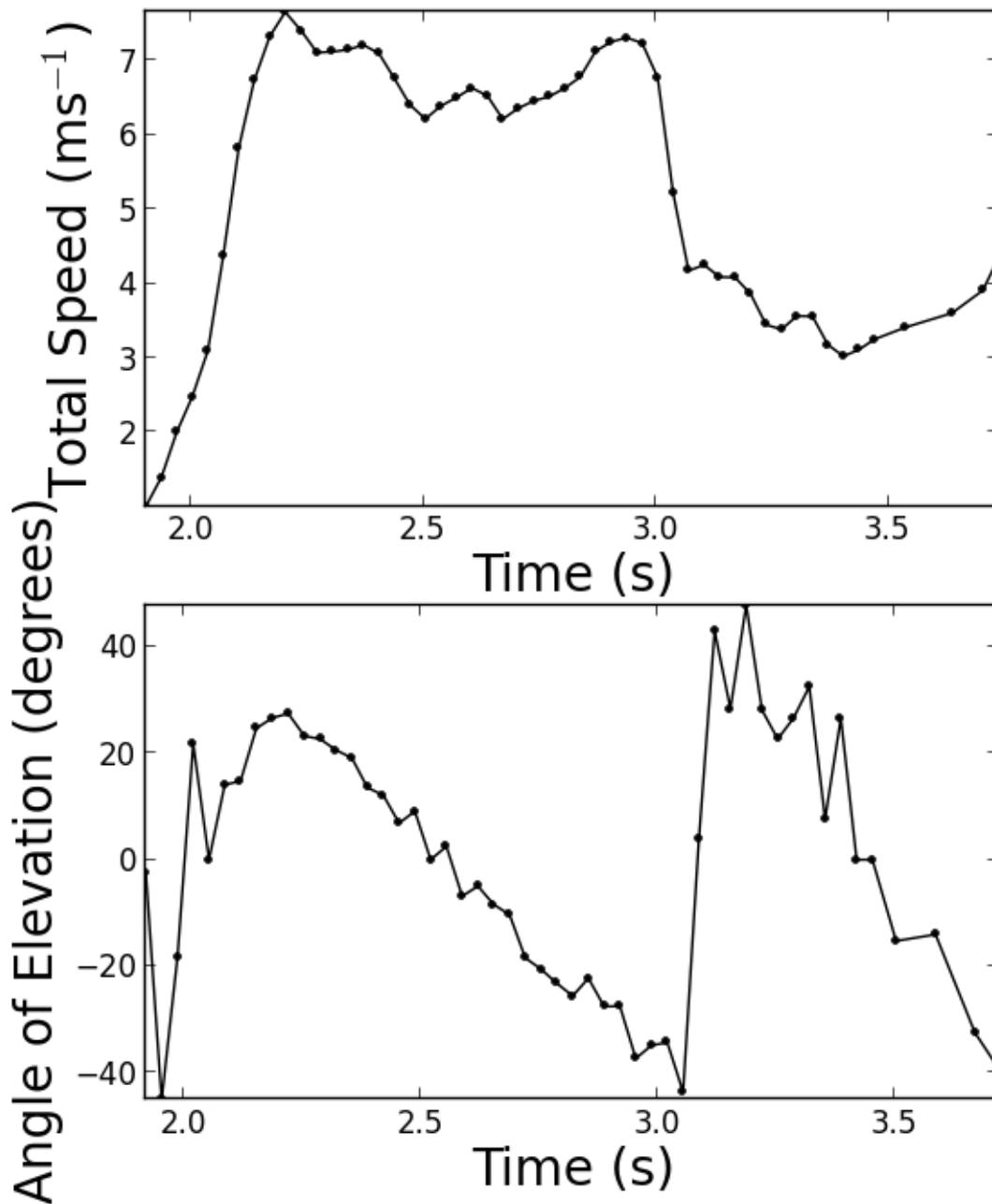
Figure 2: The total speed of an object is calculated by applying Pythagoras' theorem applied the x- and y-components of the velocity. Note that while the horizontal and vertical components of the motion are related to the forces that act in these directions, the total speed is more closely related to the total kinetic energy of the moving object. The angle of elevation is the angle between the path of the object and the (horizontal) ground. A positive angle of elevation indicates that an object is rising, while a negative angle of elevation indicates that an object is falling. Note that it is highly sensitive to small variations in position, as evidenced by the data at about 3 seconds.
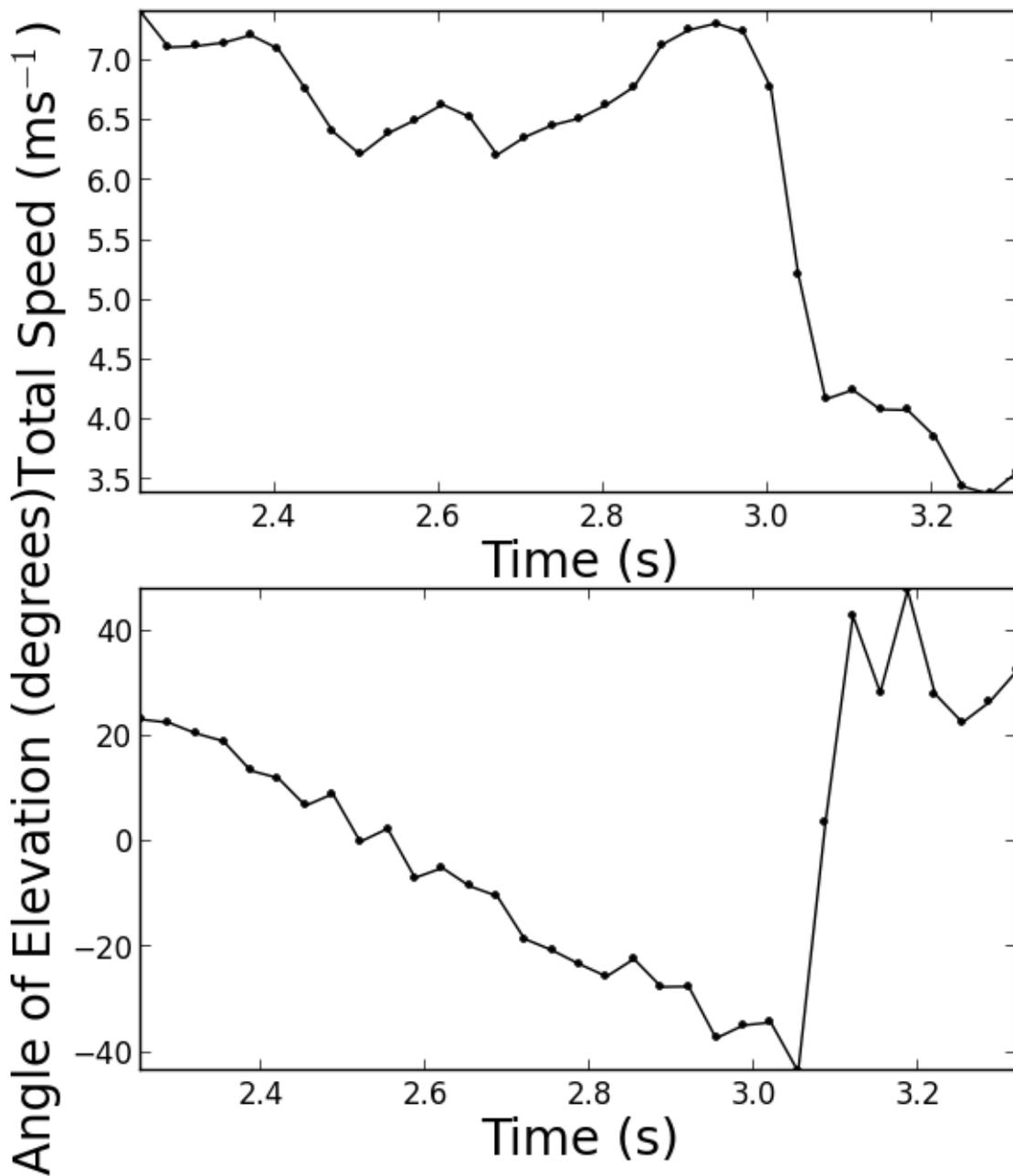
Figure 3: The same data as in Figure 2, including the flight of the projectile while it is subject to no forces (almost) other than gravity. These are the data pertinent to studies of projectile motion. Our program deduces the relevant portion of data from the maximum height (y), the beginning of projectile motion from when acceleration becomes negative and the end from when the object bounces (the object begins to rise). This is the task that is most easily accomplished by a program of the kind that we have written and not a less-sophisticated tool.