Projectile Motion Preliminary Lab

Physics

In your final lab report for this activity, your job will be to use an initial set of measurements to predict the motion of a ball shot from a projectile launcher. For today, you will need to work in groups to collect initial data and make some calculations about a different object – one that you select and will toss at various speeds and angles.

You will be using the Big 4 to analyze the motion of the object. Since the ball is moving in two dimensions (horizontally and vertically), the measurements and calculations you make will need to correspond to x- and y-variables that describe positions, velocities, acceleration, and time.

1. Use the video capture function in the Logger Pro application to collect data and plot that data for an object that you toss. The object should have both vertical and horizontal motion. Make sure to correctly graph the motion and set your initial time, x-, and y-coordinates to 0. **In your notes, show how you can use the Big 4 equations to derive formulas that will allow you to complete a variable inventory for both the x- and y-components of the motion of the object (there are several equations you can use to do this – you should be able to develop multiple equations using your data). Make sure to include a diagram showing your frame of reference for both the x- and y-axes.**

2. As part of this lab, you will need to be able to predict the location of a ball at various points in its trajectory. Since the ball will be launched at an angle, you will need to include trigonometric formulas where necessary in your equations. With your group, discuss how you could calculate the height of any object at any distance along its path, and how you could calculate the distance the ball has traveled by knowing its height. Use the information from part 1, along with the trigonometric formulas, to derive formulas for these calculations. (It might help you to think of the final position variables – x and y – as functions of time; i.e., x_t and y_t.) **In your notes, detail the derivations of these formulas – there may be several – and show them in their final form. You will need to highlight all measured and calculated values, including numbers that will be unknown until you conduct your final tests (such as the angle of launch).**

3. Make a rough prediction of the location of an objection at some point along its path (assume a velocity and angle typical of what you found in part 1 above). Test your prediction by using another video capture. **In your notes, record your resulting data, and evaluate the accuracy of your prediction (show all your calculations in detail).**