Lab #3 Discussion

In this lab, you recorded the hang time for a bouncing golf ball as well as the height of its apex.

Since the vertical displacement for the bounce was equal to zero, we knew that the time required for the ball to rise to its apex would be half of the total time it spent in the air (hang time). In Method #1, you were able to calculate an experimental value for the acceleration due to gravity using the kinematics equation $s = v_o t + \frac{1}{2}at^2$ and the known values for v_o, s, and t.

In Method 2, you entered the height (h) and hang time (t) data from all of the groups in EXCEL. Then we programmed the column for time down ($\frac{1}{2}t$) and time down squared $(\frac{1}{2}t)^2$. Next we graphed scatter plots of *height vs time down* and *height vs time down squared* noticing the one of the graphs was parabolic and the other was linear. Using our kinematics equation for uniformly accelerated motion, $s = v_o t + \frac{1}{2}at^2$ where $v_o = 0$, we then determined an experimental value for acceleration of gravity as being twice the slope of *height vs time down squared*.

The conclusions for this lab also emphasized the graph shapes for position vs time, velocity vs time, and acceleration vs time for the golf ball during its bounce.

Practice Exercises

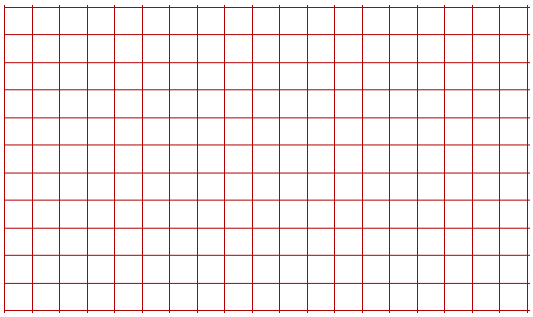
1. If the ball spent a total of 1.8 seconds in the air and rebounded to a height of 130 cm above the bottom of the colored banner, what was the group's experimental acceleration due to gravity?

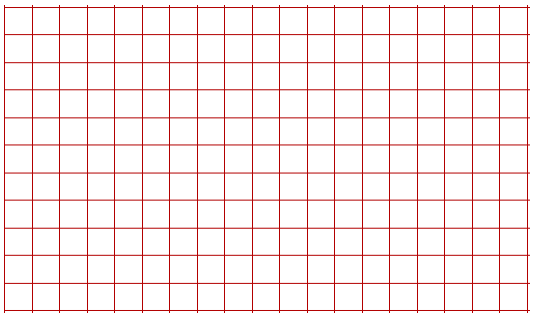
2. What was their percent error for this trial? (Use 9.8 m/sec^2 as the accepted value.)

3. If the ball was dropped from rest from the top of the building, h = 5.14 meters, what was the coefficient of restitution for this trial? The coefficient of restitution is calculated as the ratio of the golf ball's speed of separation to the speed of approach for its first collision with the concrete. This coefficient is a measure of how much energy was lost during the collision. If e = 1 then the collision is perfectly elastic (no KE is lost) while if e = 0 the collision is perfectly inelastic (a large percentage of KE was lost) – anywhere in-between the collision is considered to be partially elastic.

4. Explain what types of energy the ball lost during its collision with the concrete.

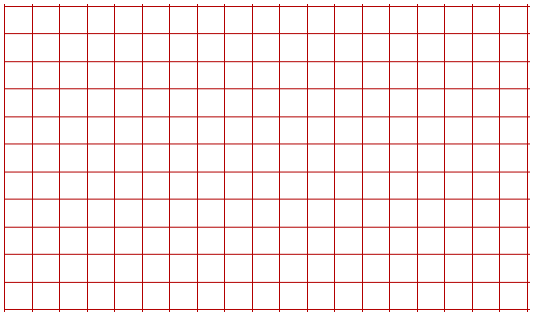
5. Sketch a position-time graph of the golf ball during its bounce and the corresponding velocity-time graph during its bounce.





6. Why in Method #2 did we need to graph height vs time down squared to obtain an experimental value for the ball's acceleration?

7. Sketch the acceleration-time graph for any object while in freefall.



8. Which method (#1 or #2) gave us a more "accurate" value for the acceleration due to gravity in our experiment?