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Phys 2426: E&M and Light

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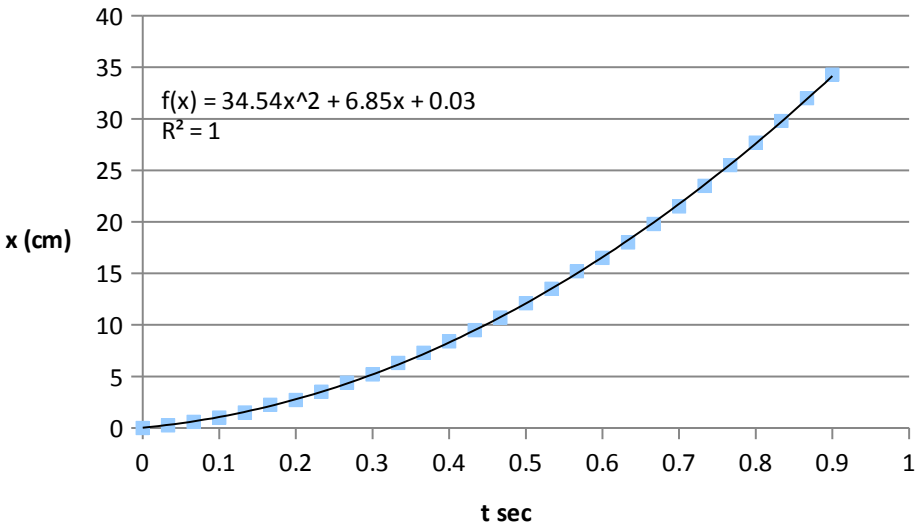
Lab Report for Inclined Plane Lab.

1. Hypothesis: A ball rolling down an inclined plane has position function $x = g \sin(\text{theta}) t^2 / 2$.
2. Experimental Design: We rolled balls down two rulers set side-by-side. We had to make sure the rules were not right next to each other, because the ball would fall off. For efficiency, we had a ball collection device at the end to make it easy to retrieve balls. We held a camera above the rulers to take a video of the ball rolling down the plane.

Picture here.

3. Procedure: we took a video of the ball rolling down the incline, transferred the video to a computer, and analyzed the video frame-by-frame in QuickTime. Moving the video from one second to another gave us the information that the camera had a data rate of 30 frames per second. At each frame, we measured the ball's position, and recorded it in Excel. We also measured the ruler's height on the underside, at 80 cm from the lower end. This height was 8 cm, yielding sin(theta) = 1/10.
4. Data Analysis: We subtracted out the ball's initial position, plotted the position as a function of time, and fitted a quadratic equation to the data. Following is a graph of the data:



This fitted line suggests that the acceleration is 69.08 cm/s^2. Theory says that the acceleration is 98.1 cm/s^2. The error is 29.6%.

5. Conclusion: this experiment does not support or undermine the hypothesis. Because the ball is resting on two edges, there may be other forces or torques that the theory does not take into account. In addition, the formula in the hypothesis did not take angular kinetic energy into account. This could account for the error. To fix this, it might be better to have a gently curved ramp to roll balls down, so that the ball only touches the ramp in one spot, as well as use a more accurate formula for the hypothesis.