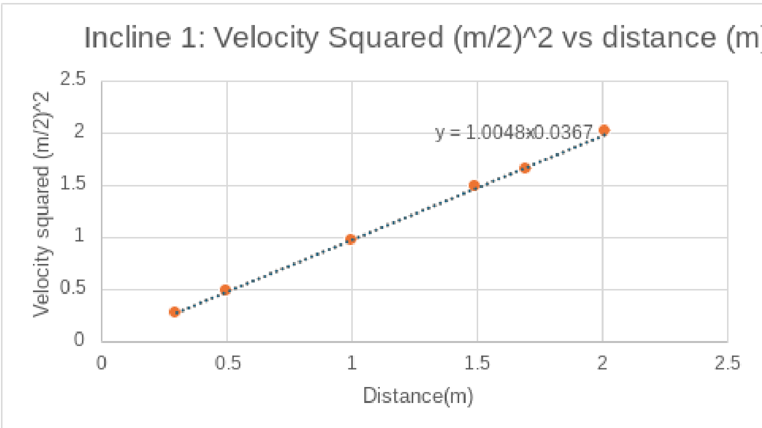
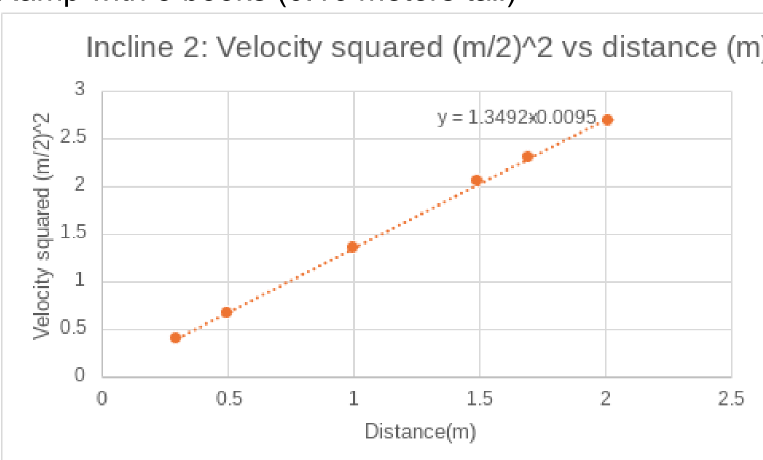
Analysis: To graph velocity and distance data, they must be linearized. To do so, we used the no-time equation, $v^2 = v_0^2 + 2a\Delta x$, and modified it in terms of y= mx+b. Here is how the equation was converted into y = mx+b form. The term, v_0^2, was equal to 0 because the cart started from rest. The resulting equation in slope-intercept form was as follows $v^2 = 2a\Delta x$. The next step was to plot the data for both ramps simply. Distance was used for the x-axis as it is the horizontal of the ramp. Therefore, v^2 is left to be the y-axis. The graphs were found to be as follows:

Ramp with 2 books (0.12 meters tall)



Ramp with 3 books (0.16 meters tall)



Next, it is time to find the experimental accelerations. To do so, we used the slope of the line of best provided by each of the graphs. The slope of the two graphs is equal to 2a (the m value of our linearized equation). Here was the work conducted to find the experimental accelerations.

For the ramp with 2 books:
Slope = 1.0048
Plug into slope = 2a
1.0048 = 2a
Solve for a
1.0048/2

a = 0.50 m/s^2 (rounded to the nearest hundredth place)

For the ramp with 3 books:
Slope = 1.3492
Plug into slope = 2a.
1.3492 = 2a
Solve for a
1.3492/2
a = 0.67 m/s^2 (rounded to the nearest hundredth place)

Conclusion:
The experimental acceleration of the ramp with 2 books was 0.50 m/s^2 while the experimental acceleration with 3 books was 0.67 m/s^2. To check the validity of our lab results, first find the expected value of acceleration by using the formula, a = gsin(θ) and inputting the corresponding values. In this scenario, the sin of θ is equal to the proportion of sin (opposite/hypotenuse) from the dimensions of the ramp and gravity is positive 9.8.

For the ramp with 2 books: a = 9.8(0.12/2.07)
a = 0.57 m/s^2 (rounded to the nearest hundredth place)

For the ramp with three books:
a = 9.8(0.16/2.07)
a = 0.76 m/s^2 (rounded to the nearest hundredth place).

Use the expected and experiment values of acceleration to calculate the percent error (given by the formula, experimental - expected/expected). The ramp with 2 books' percent error was 12.3%. Similarly, the ramp with 3 books percent error was 11.8%.

There were a number of possible sources of errors in the lab. Firstly, the error in pushing the cart affected the velocity data on both ramps. The pusher may accidentally push the cart, giving an initial velocity (which we assumed to be zero as the cart was to roll "naturally" from its place), resulting in an experimental acceleration lower than it was supposed to be. Furthermore, we neglected the effect of friction. If the lab accounted for friction, the experimental acceleration would've been even smaller than what was calculated under no friction. This thereby illustrates that the experimental acceleration was misrepresented to be greater than it was. Another source of error in this lab was that there may have been an error in the measurement of the hypotenuse (length) of the ramp as the measurement was assumed to be the same for both heights (2 books and 3 books). However, changes in the height of the ramp would've changed the length (hypotenuse), thereby misrepresenting the acceleration; if the ramp was higher than it was measured, the length was greater than it should've been, and the acceleration was less than it should've been and vice versa. Finally, the experimental and expected accelerations were both rounded to the nearest hundredth place, which misrepresents the actual value of the experimental value; depending on if the value was rounded up, the experimental value would be bigger than actually is and vice versa.