***Title**:* application of Newton's law

Purpose: to inspect and verify Newton's law by doing lab.

***Background**:* Projectiles are defined as object moving:

1. under the force of gravity

2. no propulsion

3. no wings

4. in ideal situations, we ignore air resistance and friction

***Materials**:*

- logger pro
- ruler
- mass cube
- modle car
- modle car with fan
- computer

***Procedure**:*
lab 1:survey the angle of the incline, put the logger pro at the end of the incline, put the model car on the highest point of the incline, survey thelength from it to the end. release the car and start the logger pro at the same time.

lab 2:add more books under the incline, then survey the angle again. and repeat the lab 1 step.

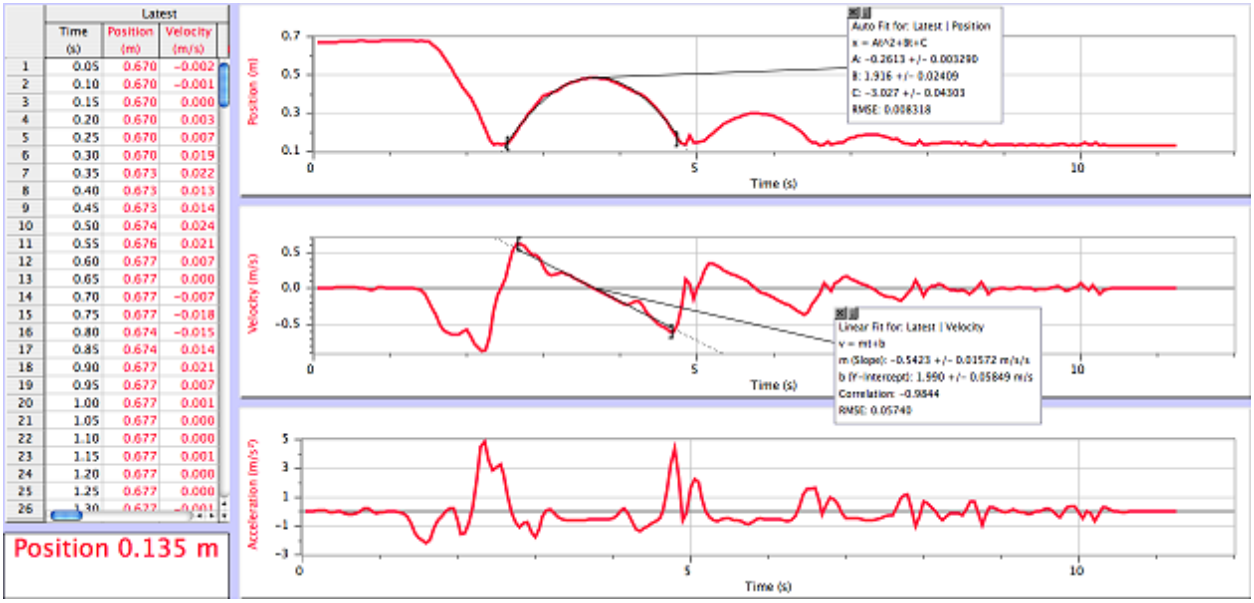
lab 3:change to the model car with fan. survey the length between car ang logger pro, start the logger pro and turn on the power of car to the low speed.

lab 4:repeat the lab 1 step, but change the speed of the car to high speed.

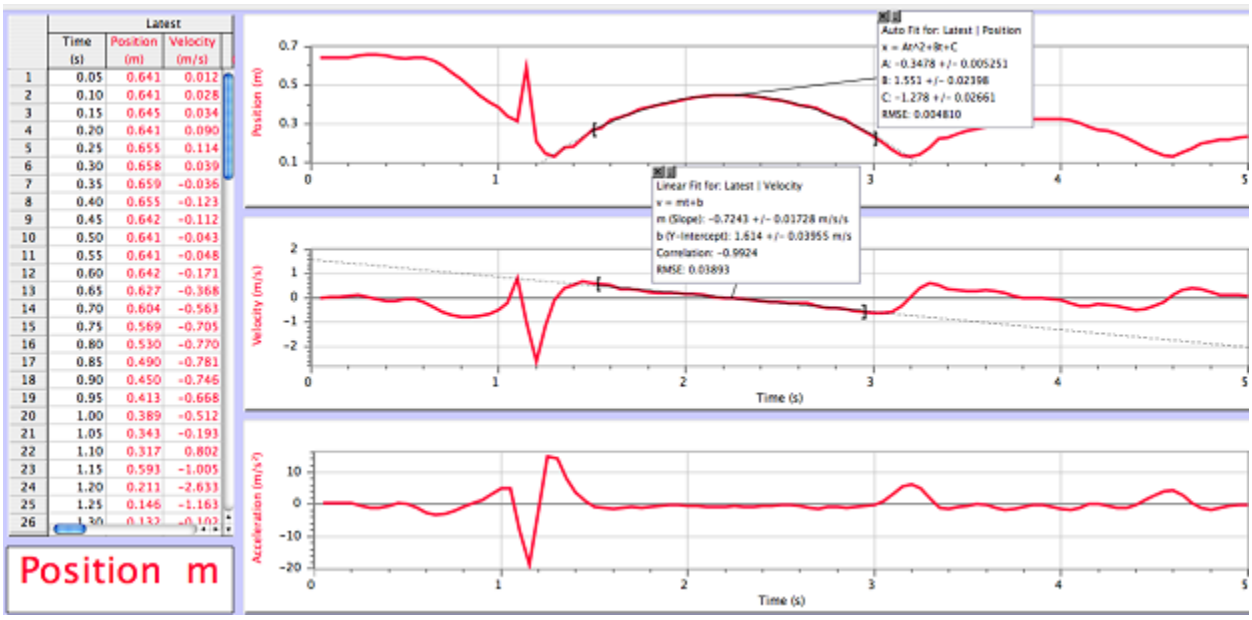
lab 5:add a 240 g metal cube on the car and repeat the step of lab 3.

lab 6:repeat the step of lab 5, but change the speed to high level.

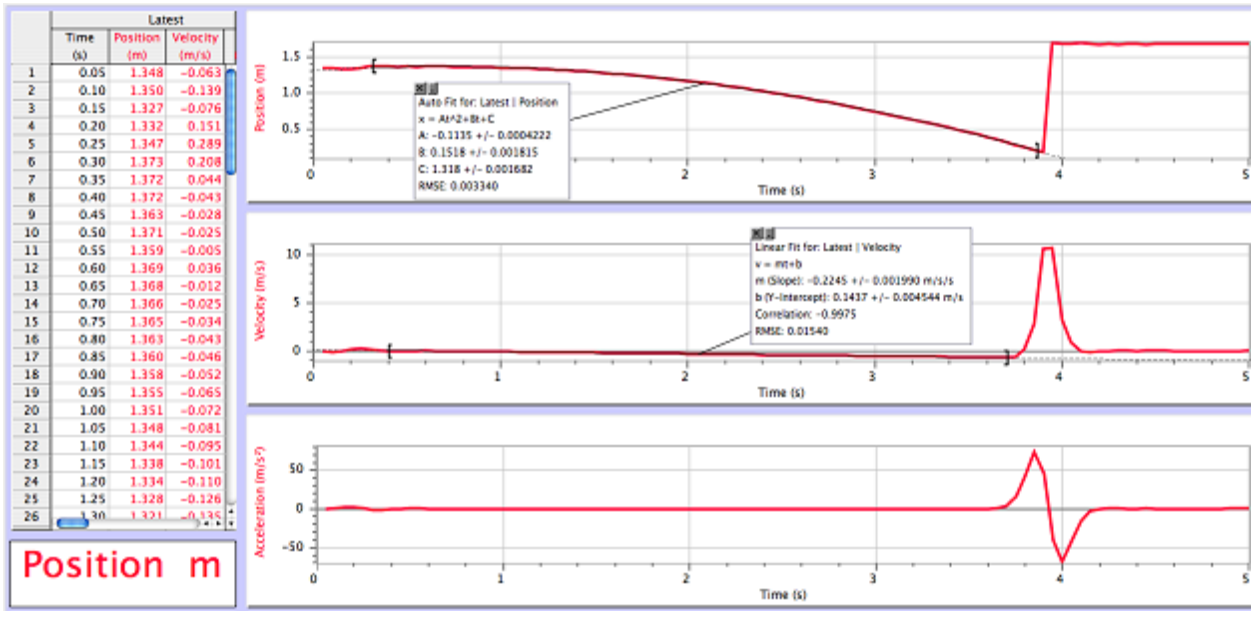
Data:
lab1 normal model car with *an angle of 5 degree*.



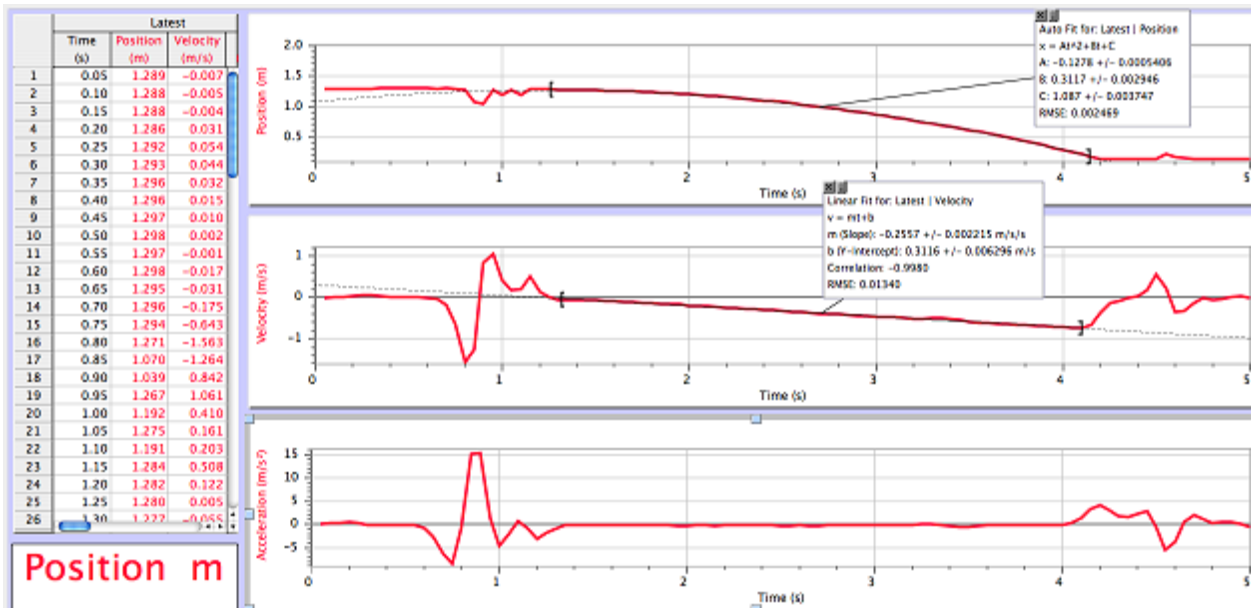
lab2 normal model car with *an angle of 7 degree.*



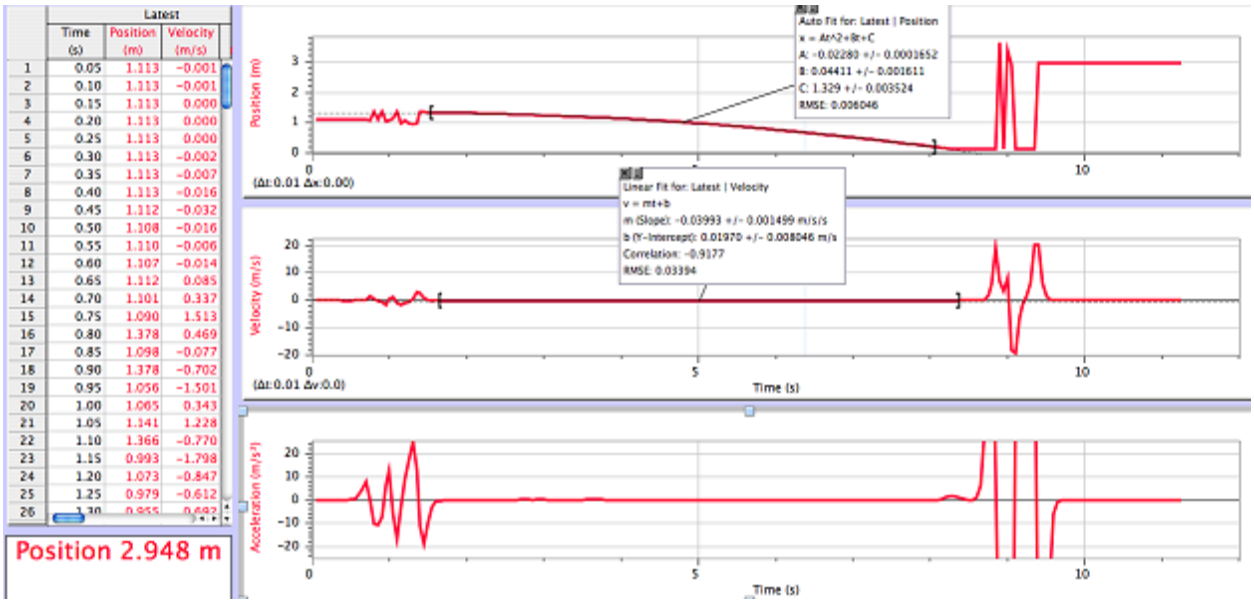
lab3 model car with fan at *low speed*.



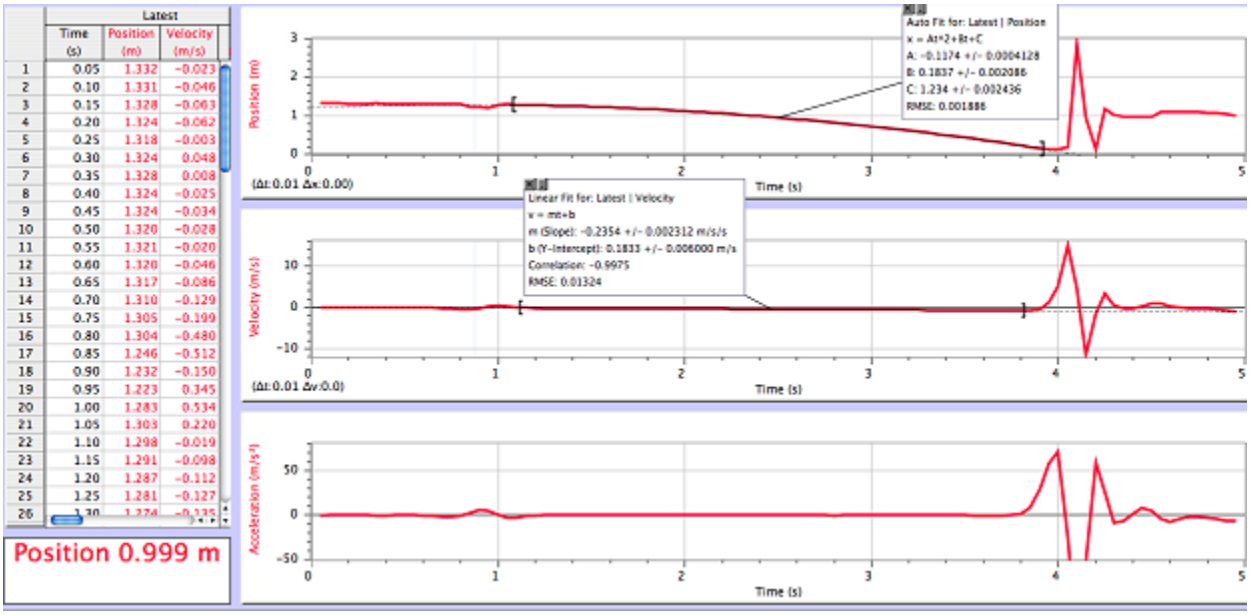
lab4 model car with fan at *high speed*



lab5 model car with fun and a *heavy cube* at *low speed*



lab6 model car with fan and *heavy cube* at *high speed*



Observation:

lab1:the car moving down to the end of the incline, its speed is increasing.then it hit the board, and bound back. the car keep doing this motion till it stop.

lab2:the car's speed of moving increasing faster then it in lab 1, because the angle is greater. it rebound the board at the end of the incline again and again after it touched the board, till it stop.

lab3:the fan car move at a low speed(which is not very slow.).and the speed seems didn't change. and it wouldn't stop till we turn it's battery off. the car can move without we push it, because it have an engine inside of it, which can give it power to move. the fan whirl slow at this time.

lab4:the fan car move at a higher speed then last time. the fan of the car whirling faster then last time.

lab5:the fan car move very slowly with a 240g metal cube on it, even the fan on it whirl as fast as in lab 3.

lab6:the fan on the car whirled crazy fast, it made flatus, which is really cold. but the car just move a little bit faster then it in lab 5, but much slower then in other labs.

***Analysis**:*

lab 1 and 2:the position graghs of both lab 1 and 2 are a bunch of parabola. the valocity gragh of it is the drevitive of the position. and the accleloration gragh is the second drevitive of the first one.and when the position is zero in the gragh, wecan know the car bound on the board at the end of the incline, because the velocity change side obviously at this point.

the car have two force act on it, gravity and friction. and because it is start on an incline, the angle of the hill also make an effact of the car's motion. the net force can be divide to two force in these labs. one is Mg, which is horizatal to the incline, the other one is parallal to the incline. and the net force of them are still horizatal to the earth. so the net force should be Mg divid by cos θ, θ equel to the angle of the hill. so the greater the cosθ is, the bigger the net force will be. and cosθ is increase with the degree of the

angle between 0 degree and 90 degree. and because the angle of a hill will naver greater then 90 degree, bigger the angle of the hill is, greater the net force of the car could be, in the same condition.

lab 3 and 4:both lab 3 and 4's position gragh showes a smooth curve at the middle,and because the logger pro had been put at the end of the way, the position is decreasing in the gragh. same as the last two gragh, volosity is the drivitive of position, and acceloration is the second drivitive of it.

from the gragh, we can know that in lab 4, the car move faster then in lab 3, because forget about the time before the motion start, the time quantum of lab 4, which the car move, is shorter then it in lab 3. also, we can see that the drevitive of the velocity in lab 4 is greater then in lab3, because the line of it is obviously more acclivitous then the lab 3 one. it is because we used a higher speed in lab 4 then lab3.

in these two lab, speed is the independent variable. it change the accleloration of the car, which will cause the changing of the net force act on the car. the greater speed will decrease friction force of the car. so the car can move faster in lab 4.

lab 5 and 6:the gragh of both lab 5 and 6 is not a huge differences with the lab 3 and 4 gragh during the motion period on the from of the curve. but the car use more time then the last to lab to reach zero of the position. be cause we add an 240 gram cube on the car which caused this difference.

according to the Newton second law, F=ma, and F=mg, so when the mass of object increase, and because the acceloration is constent when the spped didn't change, the force act on the car will increase, and this change will make the affect on increasing of the time the car moving.(t=s/v).

same as the lab 3 and 4, higher speed will make the car move faster.

***Conclusions**:*

these 6 lab is kind of seccess. ignore the few second at the begin and end of those labs, the gragh and data we got is really similar to the theoretical gragh and data. but if we use a smoother place insted of the normal ground the our class room might get a better curve, because we still can see some little wave motion in the gragh. and we should use a fan car with enough betering, to make sure that it will have enough eletron for the car to move with a heavy metal cube.