Projectile Motion

Lab report

Purpose: Analysis projectile motion using video analysis of a thrown object.

Background: Projectile motion is defined as motion without wings, propulsion, friction (air resistance), under the influence of gravity. The formula for the motion is Range=V0^2/g sin2 theta.

Materials:

- Labtop computer with camera
- Logger pro
- Meter stick
- Ball

Procedure:

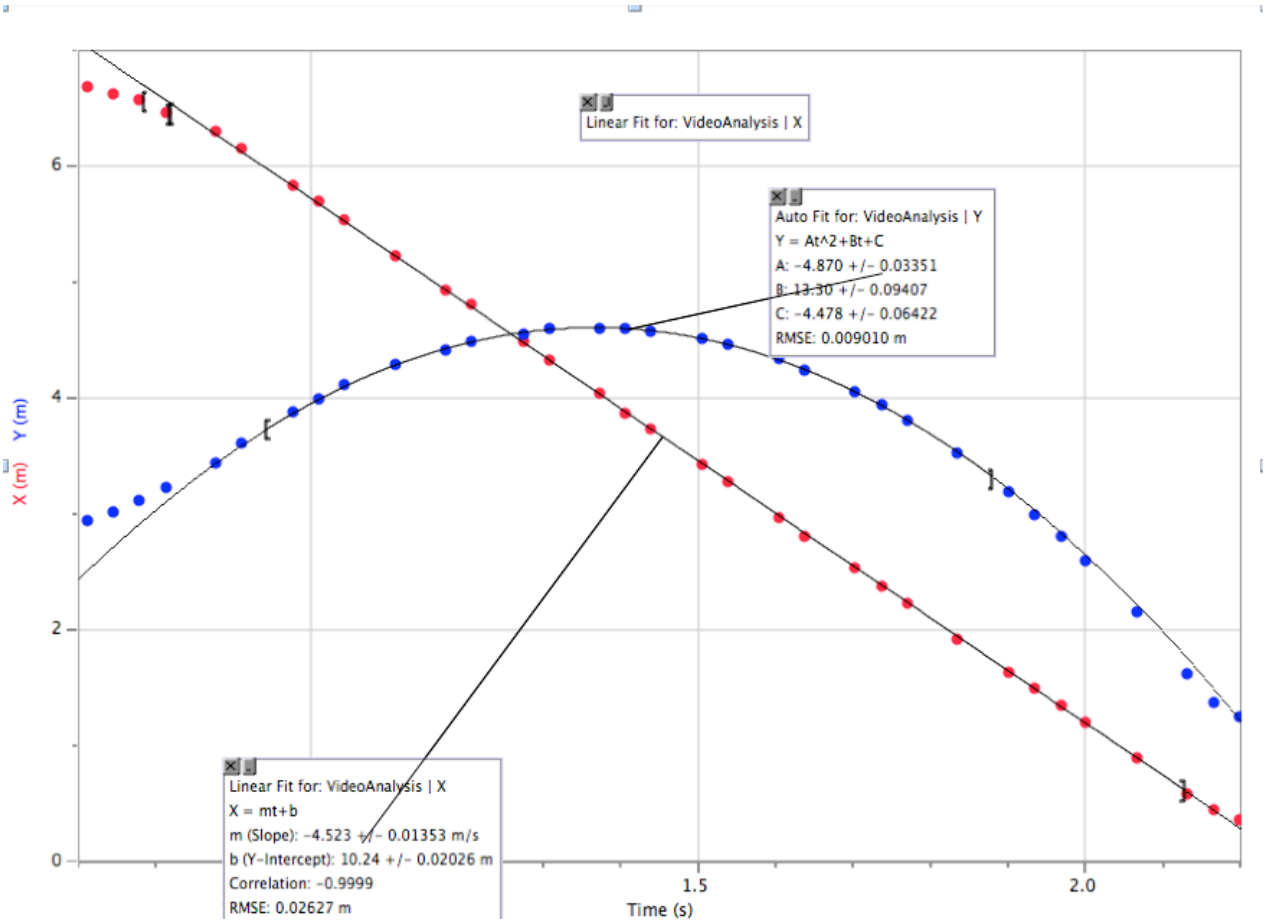
1. Retrieve a ball
2. Set up camera on labtop so that it can film the ball's motion and it's thrower
3. Start the camera and film that toss of the ball end the filming when it hits the ground
4. Analyze it's motion
5. Then plot the motion in logger pro, tracking with dots
6. Then analyze the graph that's created

Data:

Projectile motion of tennis ball

Video Analysis of Displacement and Velocity

	Time (s)	X (ft)	Y (ft)	Vx (ft/s)	Vy (ft/s)
1	0.7133	22.30	9.855	-5.788	7.622
2	0.7467	22.12	10.08	-6.434	8.949
3	0.7800	21.94	10.40	-8.098	10.658
4	0.8133	21.57	10.81	-9.407	11.528
5	0.8783	21.06	11.50	-11.276	12.677
6	0.9117	20.55	12.05	-14.336	13.667
7	0.9783	19.49	12.97	-15.167	12.884
8	1.012	19.01	13.33	-15.403	11.551
9	1.043	18.50	13.73	-15.662	9.705
10	1.110	17.44	14.32	-15.319	7.934
11	1.175	16.45	14.76	-14.680	6.584
12	1.208	16.05	14.98	-14.879	4.748
13	1.275	14.99	15.20	-15.545	3.471
14	1.308	14.44	15.34	-15.350	1.929
15	1.373	13.49	15.38	-15.305	0.395
16	1.407	12.94	15.38	-15.303	-1.442
17	1.440	12.47	15.27	-15.264	-2.922
18	1.505	11.45	15.09	-15.296	-4.095
19	1.538	10.97	14.90	-15.344	-5.799
20	1.605	9.911	14.50	-15.383	-7.412
21	1.638	9.399	14.17	-14.855	-9.222
22	1.703	8.485	13.55	-14.930	-10.412
23	1.737	7.937	13.18	-15.181	-12.561
24	1.770	7.461	12.71	-15.124	-14.455
25	1.835	6.438	11.76	-14.895	-15.752
26	1.902	5.487	10.66	-14.520	-17.224
27	1.935	5.012	10.00	-14.509	-18.915
28	1.968	4.537	9.380	-15.120	-20.708
29	2.000	4.025	8.685	-15.472	-22.733
30	2.067	3.001	7.185	-15.323	-24.107
31	2.132	1.978	5.429	-14.763	-24.349
30	2.067	3.001	7.185	-15.323	-24.107
31	2.132	1.978	5.429	-14.763	-24.349
32	2.165	1.503	4.624	-12.658	-20.705
33	2.198	1.210	4.185	-10.493	-16.602
34	2.265				



Observations:

When the ball was thrown it's acceleration upward slowed down to a stop and as it fell back down the velocity seemed to increase (decrease) as it neared closer to the ground. So I propose that it's initial velocity was less in magnitude then the final velocity because the ball traveled further in a downward motion. The ball only bounced once. To capture this motion it took several takes, patience is a virtue in this lab.

Analysis:

As you can see in the table motion didn't come into effect until 0.7133 sec. and about 3 meters above the ground. The Y's displacement and velocity showed noticeable changes. When the ball was thrown upward it decelerated at a positive rate (because up is positive) due to the force of gravity which is 9.8m/s2. It's initial upward movement was acceleration (from 2.32 m. to 4.26 m above ground) due to the intial force of the thrower but after 0.9117 sec. it started to decelerate and at 1.373 sec. the ball reached its peak, 0 acceleration and 0 velocity. And at 4.8 m. the ball then starts to accelerate at a negative rate (because down is negative) increasing it's speed as it falls and decreasing the Y's displacement until the ball hits the ground with a final velocity that's the highest of any interval. In the graph this is all explaining the blue line (Y) with the line starting at 3 m. going up to 4.8 m. then curving back down.

But for the X component of the graph, horizontal motion, there aren't drastic changes because rates of X are constant. For instance its displacement decreases at a constant negative rate (since its motion goes from left to right) due to the straight line the graph makes. Besides the final and initial velocities the X velocity remains constant at about 4.8 m/s.

Conclusion:

So Y components are affected by gravity while X components aren't, which is why X components remain constant. Throughout the lab I noticed that you had to be familiarized with logger pro and other technologies. If I had a chance to redo this lab I would better prepare myself with the equipment that's used such as how to capture the video and where to you retrieve it. It took a lot of extra time trying to figure out how everything worked but it made you pay attention to detail and observe things that most people won't bother (like a ball's velocity in flight).

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