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Projectile Motion

Purpose: Analyze projectile motion using video analysis.

Background: Projectile motion is described as motion without propulsion, friction (air resistance), wings under the influence of gravity. The formula for this is:

$R= (Vo^2/g) X (\sin(2\theta))$

Materials:

- Meter stick
- Laptop with camera and the program logger pro
- A partner
- A cone
- A ball
- An open space

Procedure:

1.Get your laptop set up so that is it facing the open space. You should be able to see a good amount of space going from left to right and up and down.

2.Put the cone in the open space so that it appears on the left hand side of the screen.

3.Place the meter stick so that is up right in the middle of the cone.

4.Get your partner to stand on the left hand side of the screen with the ball. So that they and the cone make a line perpendicular to the camera's angle.

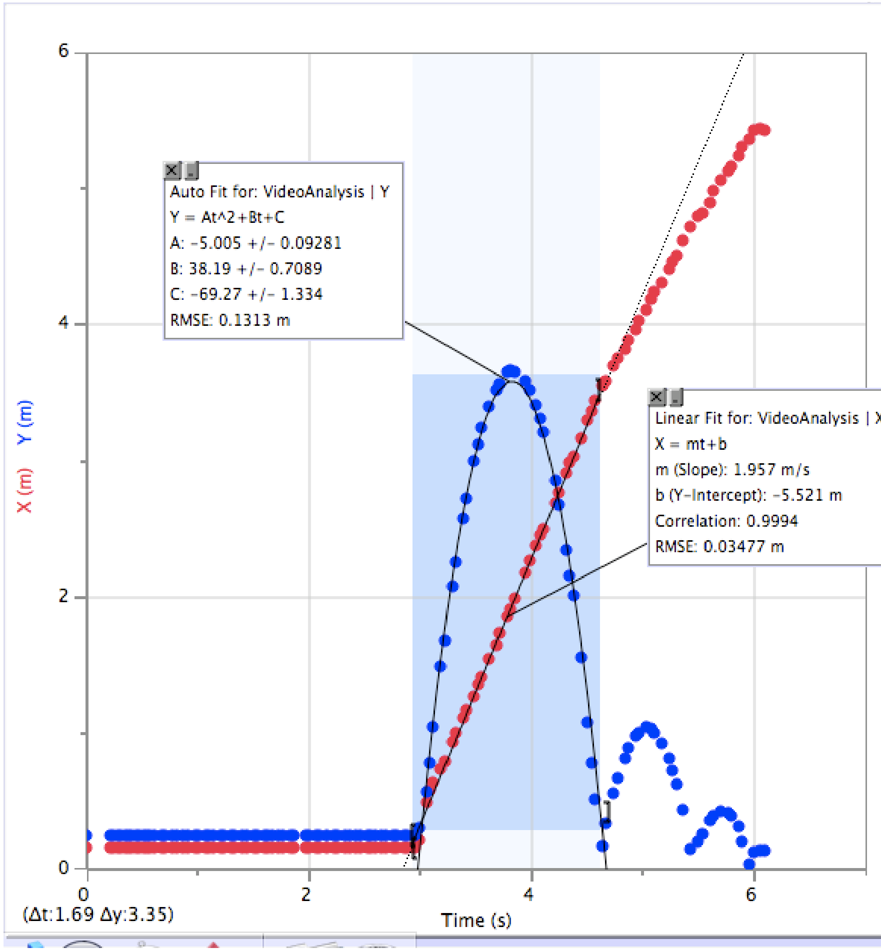
5.Tell your partner to throw the ball so that it will stay in the screen so you can see it arc and hit the ground. This is just practice so your partner knows how to throw the ball. You can do this as many times until you think it is a good throw.

6.Now tell your part to throw it again and but his time record it on the computer in logger pro.

7. Plot out the points that the ball traveled in logger pro and use the meter stick in the movie to get your scale.

8.You can now see two graphs a velocity graph and a position graph. You now need to analyze the graphs. Go to analyze and fit to curve and select the quadratic equation. The curve you are fitting is the initial throw not any of the bounces.

Data:



	Time (s)	X (m)	Y (m)	Vx (m/s)	Vy (m/s)
58	2.788	0.1605	0.2549	0.000	0.000
59	2.855	0.1605	0.2549	0.035	0.028
60	2.888	0.1605	0.2549	0.292	0.264
61	2.955	0.1605	0.2549	1.113	1.091
62	2.987	0.2224	0.3044	2.715	3.035
63	3.053	0.4950	0.5770	3.110	4.731
64	3.087	0.5817	0.7877	2.418	6.523
65	3.118	0.6437	1.048	1.824	6.814
66	3.185	0.7428	1.494	1.674	6.410
67	3.218	0.7924	1.680	1.911	6.011
68	3.283	0.9411	2.076	1.995	5.733
69	3.317	1.003	2.262	1.818	5.153
70	3.383	1.115	2.584	1.765	4.700
71	3.415	1.176	2.721	1.719	4.312
72	3.482	1.276	3.006	1.836	3.950
73	3.515	1.362	3.117	1.946	3.440
74	3.548	1.412	3.241	1.881	2.794
75	3.613	1.548	3.402	1.846	2.194
76	3.680	1.647	3.526	1.889	1.704
77	3.713	1.734	3.563	2.023	1.297
78	3.778	1.858	3.650	1.965	0.848
79	3.812	1.920	3.662	2.017	0.036
80	3.845	1.994	3.650	2.002	-0.566
81	3.943	2.180	3.588	2.034	-1.018
82	3.977	2.267	3.526	2.000	-1.617
83	4.042	2.378	3.414	1.914	-2.186
84	4.075	2.453	3.315	1.863	-2.958
85	4.108	2.502	3.216	1.854	-3.542
86	4.208	2.688	2.857	1.987	-4.113
87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Observations: I kicked the ball instead of throwing it. Also the path of the ball was not directly perpendicular to the laptop and we delayed the throw after we stated the camera.

Analysis: The data that we have doesn't exactly start at zero. It is a little bit above zero. This is probable due to how well we aliened ourselves to the computer. The ball didn't travel in a perfectly perpendicular path too so it looks as though it bounces on air in our graph and finally hits the ground at the end. Also our line that was fit on our graph is a little off. So our equations may be a little off too. Another thing that my cause our data to be a little off is how well the camera could capture the ball. Our graph has some uneven spaces between each dot probably due to an error in the camera.

Conclusion: We did what we set out to do. We analyzed projectile motion using video analysis. If I was to do this experiment again, I would do it next to a wall with measurements written on the wall. The wall will also help guide the thrower as to which direction the ball should be thrown. Also I would get a better camera so the dots on the graph are more evenly spread and accurate, because the computer camera isn't that good and doesn't shoot may fames per second to be accurate enough.