

Title: Projectile Motion

Purpose: Analyze projectile motion using video analysis

Background: projectile motion is defined as motion without wings, propulsion, friction (air resistance), under the influence of gravity. The formula for this motion is $\text{range} = \frac{V_0^2 \sin 2\theta}{g}$

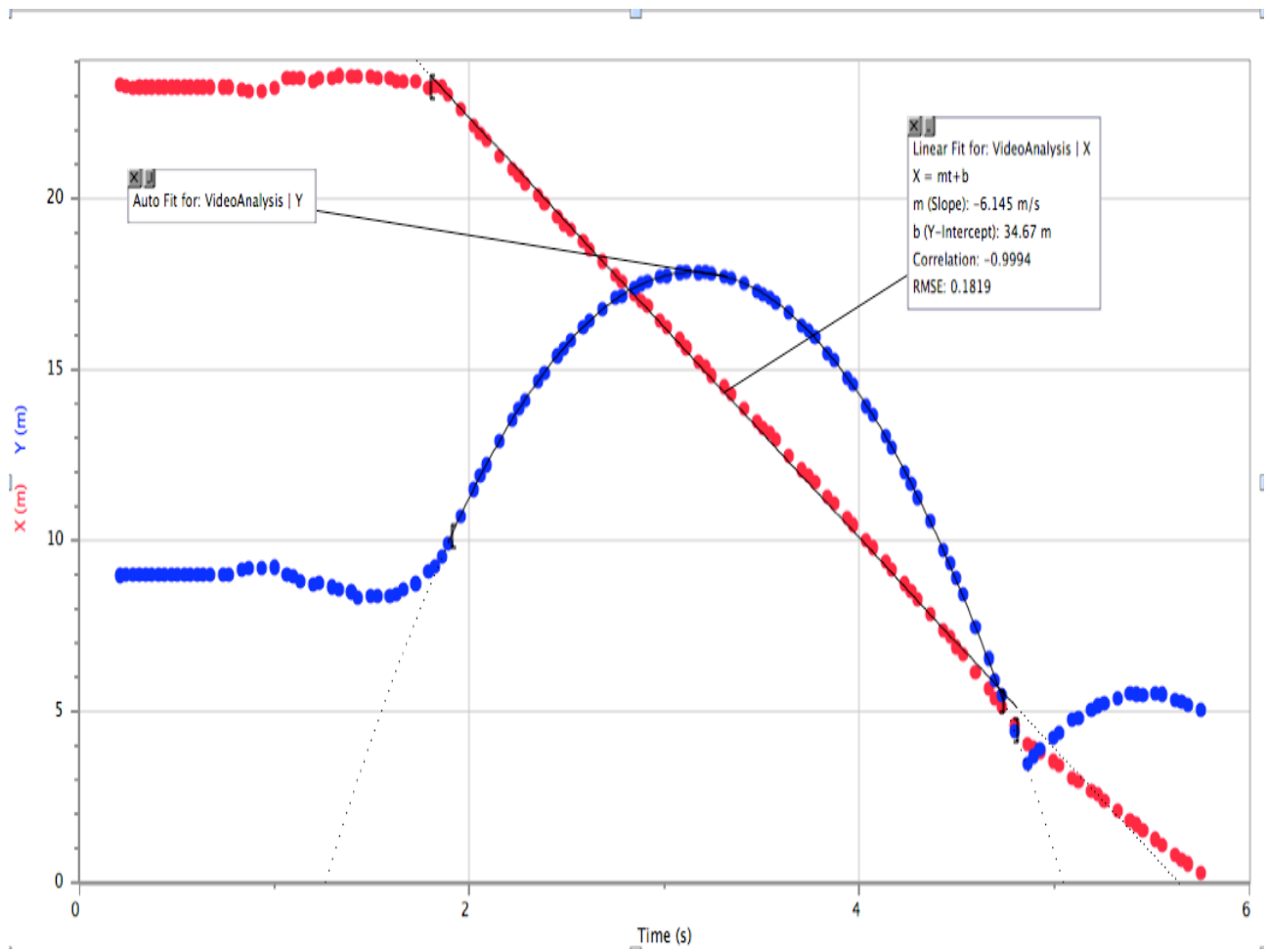
Materials: laptop computer with camera, logger pro, meter stick
Basket ball, Cones

Procedure:

1. Setup cones with meter stick
2. Setup laptop facing the throw
3. Throw the ball while starting video capture
4. Do dot thing
5. Analyze the graph: x velocity and y velocity gravity from $s = \frac{1}{2}at^2$

Data:

VideoAnalysis				
Time (s)	X (m)	Y (m)	Vx (m/s)	Vy (m/s)
0.4717	23.26	9.015	0.000	0.000
0.5050	23.26	9.015	0.000	0.000
0.5383	23.26	9.015	0.000	0.000
0.5717	23.26	9.015	0.000	0.000
0.6050	23.26	9.015	0.000	0.000
0.6367	23.26	9.015	0.000	0.000
0.6700	23.26	9.015	-0.057	0.076
0.7367	23.26	9.015	-0.227	0.316
0.7683	23.26	9.015	-0.726	1.013
0.8350	23.17	9.135	-0.817	1.308
0.8683	23.14	9.195	-0.056	0.602
0.9350	23.14	9.195	0.984	-0.090
1.000	23.23	9.225	2.223	-1.208
1.065	23.53	9.015	2.185	-2.225
1.098	23.50	8.955	0.555	-2.442
1.132	23.53	8.835	-0.191	-2.000
1.198	23.44	8.715	-0.062	-1.068
1.232	23.50	8.775	0.592	-0.961
1.297	23.53	8.655	0.678	-1.557
1.330	23.59	8.595	0.322	-1.710
1.395	23.56	8.505	-0.102	-2.045
1.428	23.56	8.325	-0.168	-1.104
1.495	23.56	8.385	-0.502	0.014
1.528	23.50	8.385	-0.651	0.258
1.593	23.50	8.385	-0.828	0.965
1.627	23.41	8.445	-0.962	2.589
1.660	23.41	8.595	-0.419	3.223
1.725	23.44	8.745	-1.036	4.014



Observations: it was hard to catch the ball, if you don't keep the arc of the ball in the picture frame it throws off the whole lab. So make sure it stays within the frames. You must log into admin before capturing the video otherwise the computer will not work.

Analysis: We had very clean data and the video capture was consistent since there was no wind. We determined the slope of the x velocity was -6 m/s and did a curve fit on the y velocity finding the gravity to be -4.9 , which tells us that gravity was -9.8 m/s^2 . The reason for having the orange cones was because there were difficulties seeing the meter stick and the ball.

Conclusion: we successfully captured the motion of a parabolic projectile, and determined that g was -9.8 . In the future we may repeat this experiment with a better camera, with faster video. The frame rate was too fast for the computer to capture in real time. One might also repeat the lab with a brighter colored ball.