Janis Crawford
Honors Physics

Force and Newton's Laws

Purpose: To study Newton's Laws.
Background: F=ma. An objects mass determines how much it will resist a change in velocity. A net force causes acceleration. All forces are vectors: their direction matters.
Materials:

- Logger Pro
- Cart
- Weight
- Fan
- Floor
- Computer
- Motion radar
- Ramp or some kind of incline
- Ruler
- Batteries

Procedure:

1. Hook motion radar up to logger pro on the computer.
2. Set up cart with fan on with floor with motion radar facing the direction the cart is going to come about a meter away.

3. Turn the fan on.
4. Start the motion radar and let the cart go at the same time.
5. Analyze the graph (velocity, position and acceleration)
6. Repeat this procedure for the four different situations (fan high with weight, fan low with weight, fan high without weight and fan low without weight).
7. Set up motion radar attached to computer facing the ramp (high and low) that the cart is going to go down.
8. Start motion radar and let go of cart at the same time.
9. Analyze the graph (velocity, position and acceleration)

(GRAPHS AND DATA ARE AT THE BOTTOM)

Observations:
When the fan was turned on and you let go of the cart the cart accelerated forward. When the cart was on the ramp and you let go of the cart the cart accelerated forward. When the ramp is at a lower incline the cart does not move as fast as when the ramp is at a high incline. Our cart weighed 584 grams and the weight we put on the cart for two situations weighed 198 grams. Our low incline was 6 cm and our high incline was 11 cm.
Analysis:
Our cart broke so we had to put it back together the best we could, but out data might not be as exact as it could be because of that. Our fan did not work very well and sometimes when we had it set on the high speed it did not seem like it was going as fast as it should have been. When we went to weigh our cart we had to take it all apart and weigh each

piece individually, but sometimes part of the cart was hanging off the side of the scale so our weight might not be exactly correct.

Conclusion:

In this lab we studied Newton's laws by recording the force on a cart compared to its velocity, position and acceleration. We did this by using a fan to accelerate a cart with and without and weight on it at different speeds. We also studied Newton's laws by sending a cart down a ramp at different inclines.

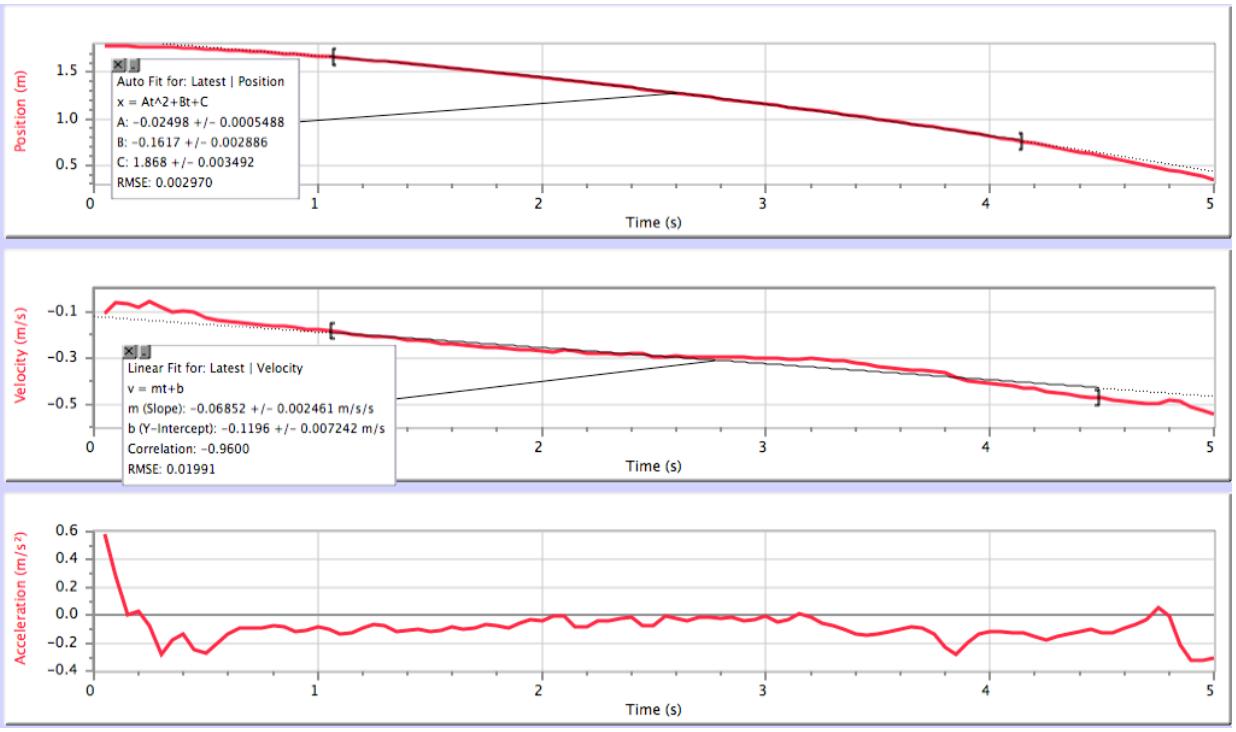
Questions:

1. The acceleration of our high incline cart was 1.07 and the acceleration of our low incline cart was 0.59. G is 9.8 so the acceleration of both of the carts was less than g, which it should be.
2. The force from the fan on low speed with a 198 gram weight was 782 N, the force from the fan on high speed with a 198 gram weight was 78.2 N, the force from the fan when the fan was on low speed without a weight was 116.9 N and the force from the fan when the fan was on high speed without a weight was 58.4 N
3. If you allowed the ramp to bounce the v/t graph would go up and down because the cart would have to go up and down so it would slow down and speed up.
4. The x/t curve would not have as high of a slope, the v/t curve would not have as high of a slope and the a/t curve would be lower.

Graph and data for when the fan was on slow with a 198 gram weight:

	Latest		
	Time (s)	Position (m)	Velocity (m/s)
1	0.05	1.792	-0.106
2	0.10	1.784	-0.064
3	0.15	1.788	-0.068
4	0.20	1.778	-0.082
5	0.25	1.777	-0.056
6	0.30	1.776	-0.083
7	0.35	1.769	-0.102
8	0.40	1.764	-0.097
9	0.45	1.760	-0.105
10	0.50	1.754	-0.126
11	0.55	1.747	-0.137
12	0.60	1.740	-0.145
13	0.65	1.732	-0.149
14	0.70	1.725	-0.152
15	0.75	1.717	-0.158
16	0.80	1.709	-0.162
17	0.85	1.701	-0.163
18	0.90	1.693	-0.170
19	0.95	1.684	-0.178
20	1.00	1.675	-0.182
21	1.05	1.666	-0.184
22	1.10	1.657	-0.191
23	1.15	1.647	-0.199
24	1.20	1.637	-0.205
25	1.25	1.626	-0.208
26	1.30	1.616	-0.209

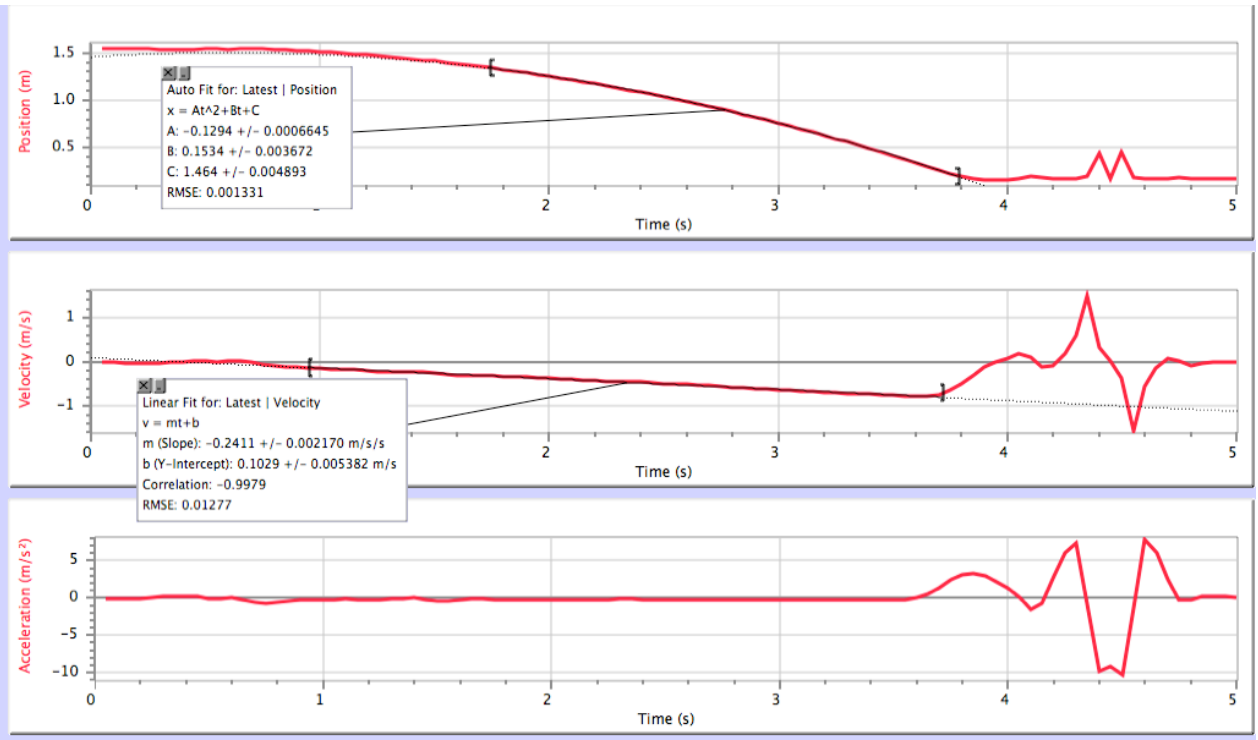
Position m



Graph and data above for when fan on high speed with 198 gram weight.

	Latest		
	Time (s)	Position (m)	Velocity (m/s)
1	0.05	1.548	-0.011
2	0.10	1.547	-0.011
3	0.15	1.548	-0.025
4	0.20	1.545	-0.034
5	0.25	1.544	-0.034
6	0.30	1.541	-0.030
7	0.35	1.541	-0.014
8	0.40	1.540	0.001
9	0.45	1.540	0.025
10	0.50	1.544	0.025
11	0.55	1.544	-0.004
12	0.60	1.540	0.020
13	0.65	1.547	0.026
14	0.70	1.545	-0.016
15	0.75	1.545	-0.051
16	0.80	1.541	-0.101
17	0.85	1.534	-0.124
18	0.90	1.528	-0.129
19	0.95	1.521	-0.136
20	1.00	1.514	-0.146
21	1.05	1.507	-0.163
22	1.10	1.498	-0.174
23	1.15	1.489	-0.173
24	1.20	1.482	-0.194
25	1.25	1.469	-0.217
26	1.30	1.459	-0.223

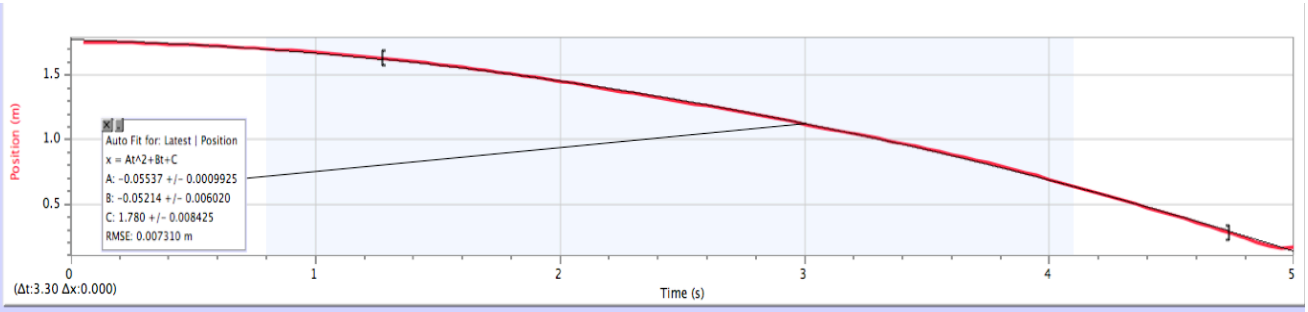
Position m

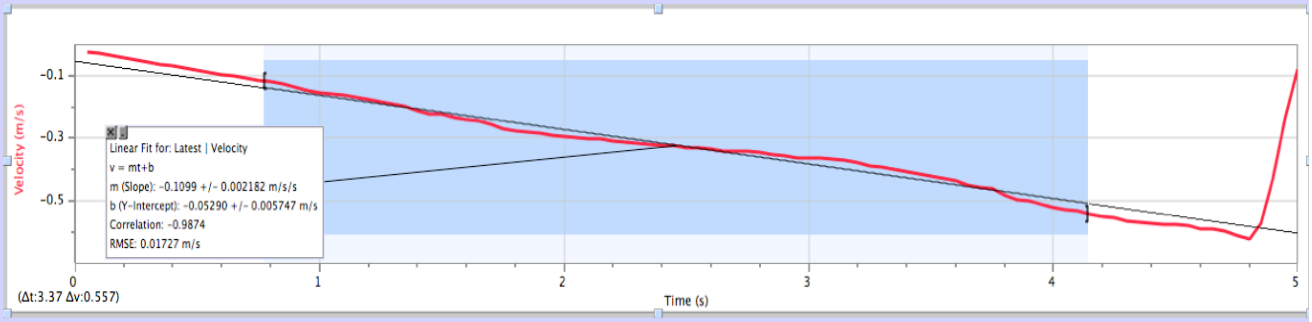


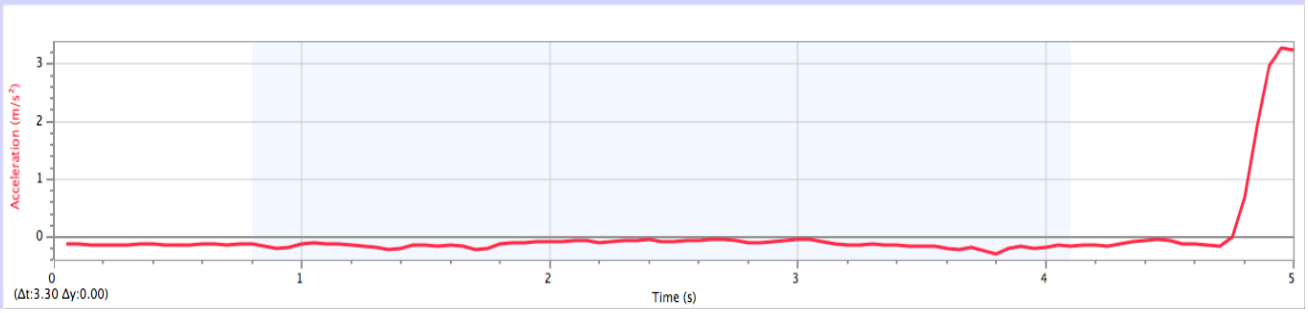
Graph and data below for when fan is on low speed without a weight.

	Latest		
	Time (s)	Position (m)	Velocity (m/s)
1	0.05	1.759	-0.026
2	0.10	1.758	-0.031
3	0.15	1.756	-0.038
4	0.20	1.754	-0.045
5	0.25	1.752	-0.051
6	0.30	1.749	-0.058
7	0.35	1.746	-0.065
8	0.40	1.742	-0.069
9	0.45	1.739	-0.076
10	0.50	1.735	-0.084
11	0.55	1.730	-0.091
12	0.60	1.726	-0.097
13	0.65	1.721	-0.102
14	0.70	1.716	-0.109
15	0.75	1.710	-0.116
16	0.80	1.704	-0.120
17	0.85	1.698	-0.126
18	0.90	1.692	-0.135
19	0.95	1.684	-0.148
20	1.00	1.676	-0.154
21	1.05	1.669	-0.157
22	1.10	1.661	-0.163
23	1.15	1.653	-0.169
24	1.20	1.644	-0.175
25	1.25	1.635	-0.183
26	1.30	1.626	-0.190
27	1.35	1.616	-0.199
28	1.40	1.606	-0.214
29	1.45	1.594	-0.222
30	1.50	1.583	-0.225
31	1.55	1.572	-0.233
32	1.60	1.560	-0.242
33	1.65	1.548	-0.246
34	1.70	1.536	-0.257
35	1.75	1.522	-0.271
36	1.80	1.508	-0.278
37	1.85	1.494	-0.279

Position m





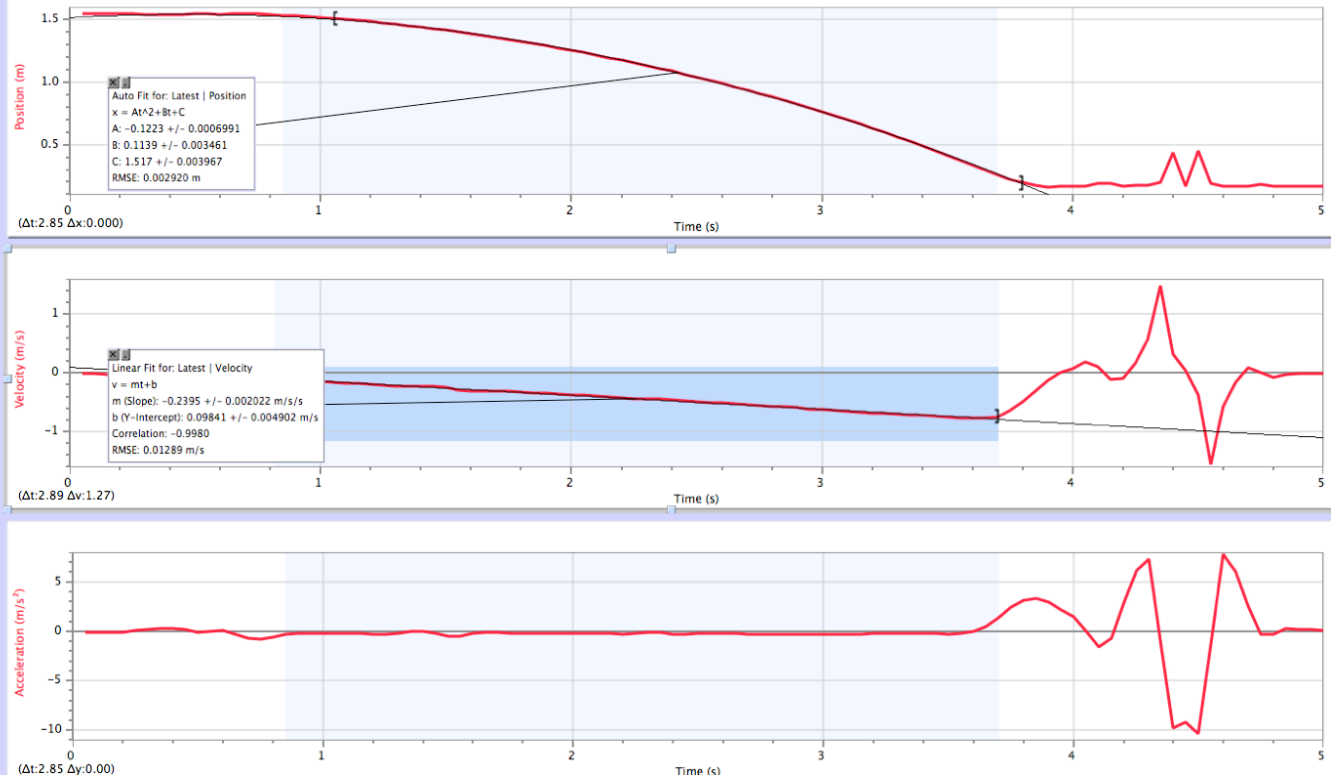


Data below is when fan was on high speed without a weight.

Latest

Time (s)	Position (m)	Velocity (m/s)
0.05	1.548	-0.011
0.10	1.547	-0.011
0.15	1.548	-0.025
0.20	1.545	-0.034
0.25	1.544	-0.034
0.30	1.541	-0.030
0.35	1.541	-0.014
0.40	1.540	0.001
0.45	1.540	0.025
0.50	1.544	0.025
0.55	1.544	-0.004
0.60	1.540	0.020
0.65	1.547	0.026
0.70	1.545	-0.016
0.75	1.545	-0.051
0.80	1.541	-0.101
0.85	1.534	-0.124
0.90	1.528	-0.129
0.95	1.521	-0.136
1.00	1.514	-0.146
1.05	1.507	-0.163
1.10	1.498	-0.174
1.15	1.489	-0.173
1.20	1.482	-0.194
1.25	1.469	-0.217
1.30	1.459	-0.223
1.35	1.447	-0.233
1.40	1.435	-0.228
1.45	1.424	-0.221
1.50	1.415	-0.246
1.55	1.400	-0.287
1.60	1.385	-0.304
1.65	1.369	-0.302
1.70	1.355	-0.304
1.75	1.339	-0.317
1.80	1.323	-0.333
1.85	1.306	-0.342

Position m

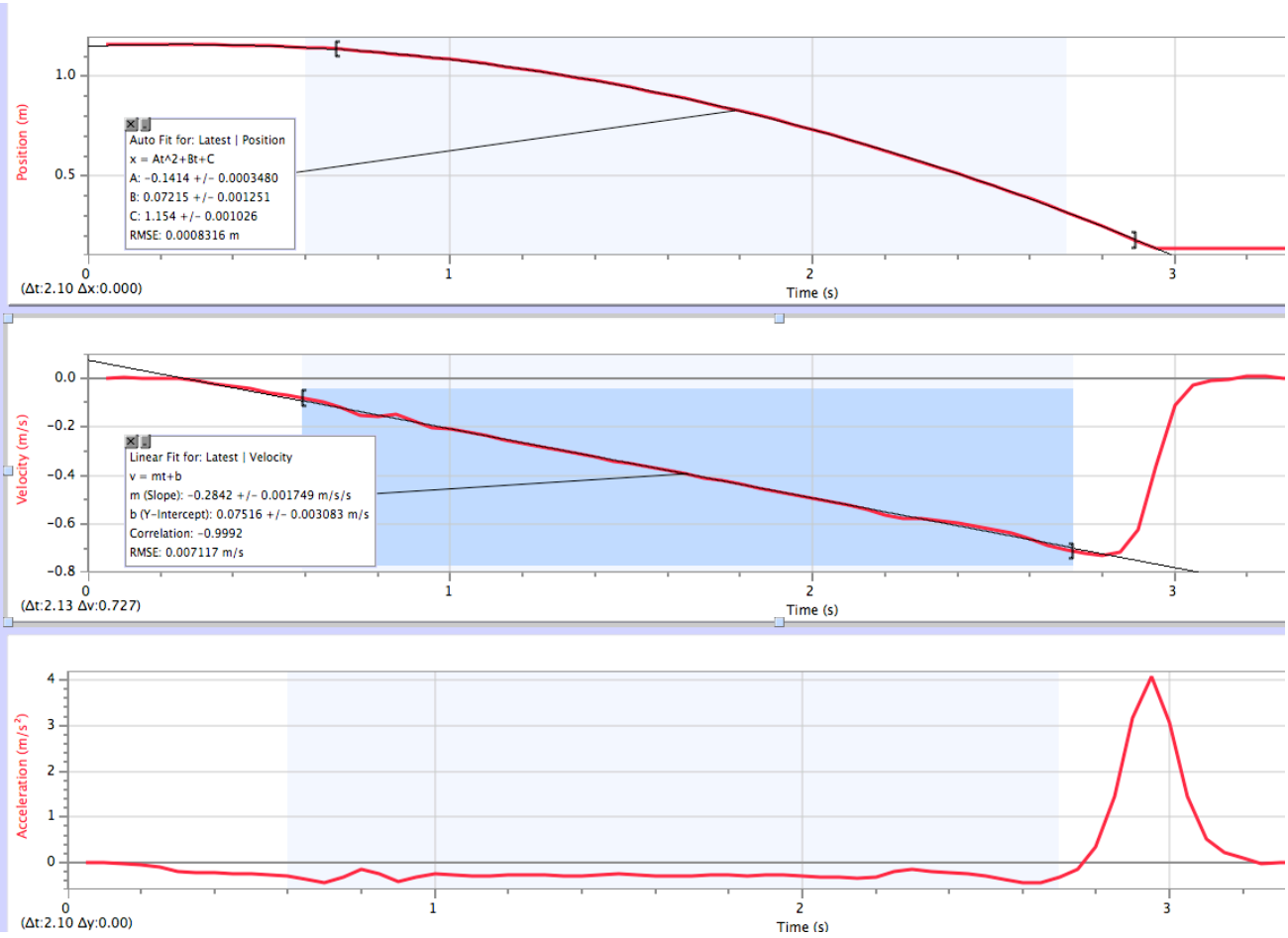


Graph and data below of cart when at a low incline.

Latest

Time (s)	Position (m)	Velocity (m/s)
0.05	1.160	0.000
0.10	1.159	0.001
0.15	1.160	0.000
0.20	1.160	-0.003
0.25	1.159	-0.003
0.30	1.160	-0.011
0.35	1.159	-0.025
0.40	1.157	-0.035
0.45	1.155	-0.045
0.50	1.152	-0.059
0.55	1.149	-0.072
0.60	1.145	-0.084
0.65	1.141	-0.099
0.70	1.136	-0.123
0.75	1.129	-0.152
0.80	1.119	-0.158
0.85	1.112	-0.150
0.90	1.106	-0.179
0.95	1.094	-0.206
1.00	1.084	-0.210
1.05	1.074	-0.223
1.10	1.062	-0.238
1.15	1.050	-0.253
1.20	1.037	-0.267
1.25	1.023	-0.281
1.30	1.009	-0.295
1.35	0.994	-0.308
1.40	0.978	-0.325
1.45	0.961	-0.341
1.50	0.944	-0.352
1.55	0.926	-0.364
1.60	0.907	-0.379
1.65	0.888	-0.394
1.70	0.868	-0.410
1.75	0.847	-0.423
1.80	0.826	-0.436
1.85	0.804	-0.451

Position m



Graph and data below for when cart is at a high incline.

Latest		
Time (s)	Position (m)	Velocity (m/s)
0.05	1.150	0.018
0.10	1.152	0.009
0.15	1.151	0.001
0.20	1.151	-0.004
0.25	1.151	-0.015
0.30	1.150	-0.034
0.35	1.148	-0.063
0.40	1.144	-0.098
0.45	1.139	-0.137
0.50	1.131	-0.187
0.55	1.119	-0.218
0.60	1.108	-0.223
0.65	1.098	-0.254
0.70	1.084	-0.303
0.75	1.067	-0.343
0.80	1.049	-0.380
0.85	1.029	-0.417
0.90	1.007	-0.452
0.95	0.984	-0.488
1.00	0.959	-0.529
1.05	0.930	-0.546
1.10	0.904	-0.567
1.15	0.874	-0.611
1.20	0.843	-0.647
1.25	0.810	-0.682
1.30	0.775	-0.717
1.35	0.738	-0.752
1.40	0.699	-0.788
1.45	0.659	-0.828
1.50	0.617	-0.877
1.55	0.571	-0.907
1.60	0.525	-0.921
1.65	0.479	-0.947
1.70	0.431	-0.978
1.75	0.382	-1.019
1.80	0.330	-1.075
1.85	0.274	-1.104

Position m