F=MA LAB

Purpose:
To find the difference between cart acceleration and velocity between 6 different trials. Each varying either incline, weight or fan speed.

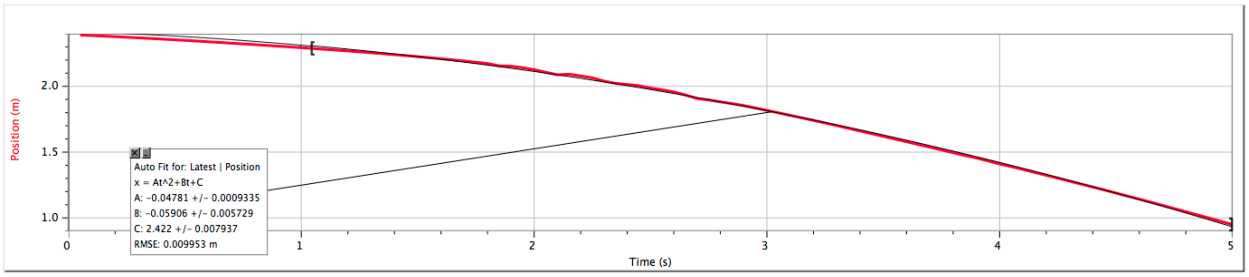
Background:
Fan powered carts were launched down a ramp with varying weights on top, to see the effects of mass on acceleration.

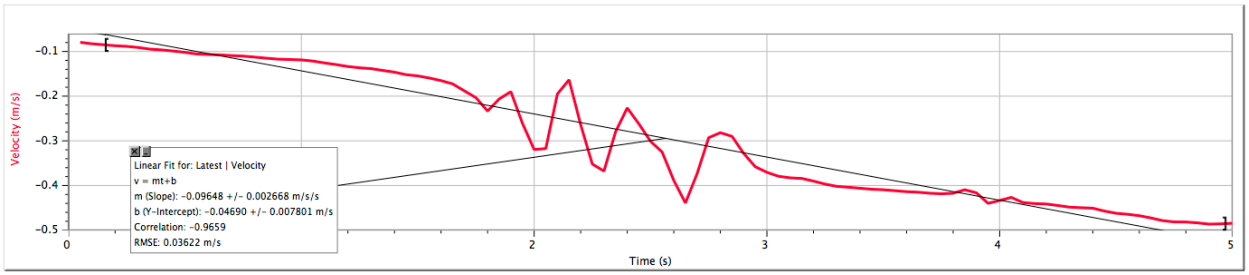
Materials:
1 Sonic ranger
1 Computer
Logger pro
1 Fan cart
1 Weight
1 Ramp
1 Sail

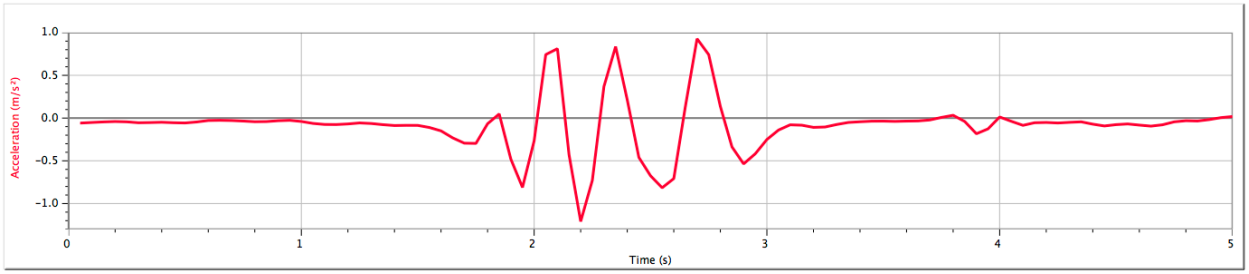
Procedure:
1. Set cart on flat ramp
2. Start sonic ranger through logger pro
3. Toggle low fan speed
4. Record
5. Repeat steps 2 and 4 while substituting 3 for 6, 7 and 8
6. High fan speed
7. Low fan speed with weight
8. High fan speed with weight
9. Set ramp on slight incline
10. Start sonic ranger through logger pro
11. Release cart with fan off and no weight
12. Record
13. Set ramp on greater incline
14. Repeat steps 10-12
15. Write report

Data:

Low speed, no weight:

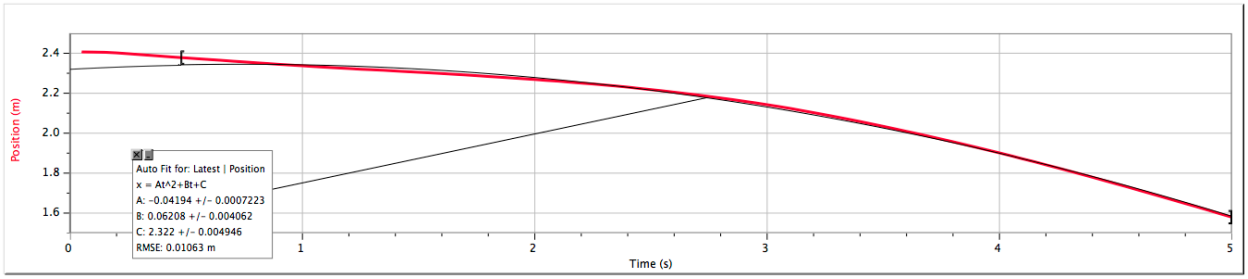


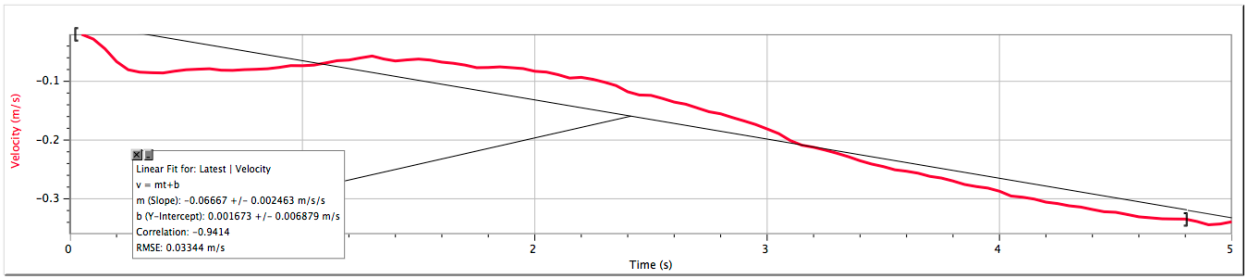


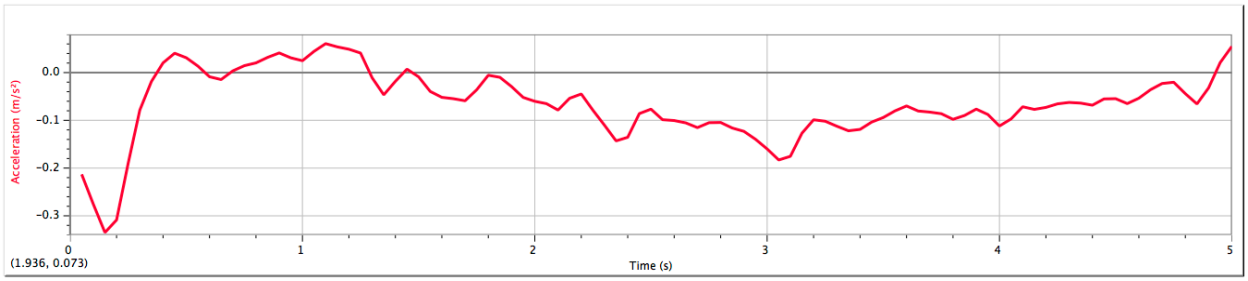


	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	2.390	-0.080	-0.058
2	0.10	2.386	-0.083	-0.051
3	0.15	2.382	-0.085	-0.045
4	0.20	2.378	-0.087	-0.040
5	0.25	2.373	-0.089	-0.044
6	0.30	2.369	-0.091	-0.055
7	0.35	2.364	-0.095	-0.052
8	0.40	2.359	-0.096	-0.049
9	0.45	2.354	-0.099	-0.054
10	0.50	2.349	-0.102	-0.057
11	0.55	2.344	-0.106	-0.046
12	0.60	2.339	-0.107	-0.028
13	0.65	2.333	-0.108	-0.026
14	0.70	2.328	-0.109	-0.029
15	0.75	2.323	-0.110	-0.035
16	0.80	2.317	-0.113	-0.043
17	0.85	2.311	-0.115	-0.041
18	0.90	2.306	-0.117	-0.031
19	0.95	2.299	-0.118	-0.026
20	1.00	2.294	-0.119	-0.040
21	1.05	2.288	-0.121	-0.063
22	1.10	2.282	-0.126	-0.075
23	1.15	2.275	-0.129	-0.076
24	1.20	2.269	-0.134	-0.069
25	1.25	2.262	-0.137	-0.057
26	1.30	2.255	-0.138	-0.063
27	1.35	2.248	-0.143	-0.077
28	1.40	2.241	-0.146	-0.087
29	1.45	2.233	-0.152	-0.085
30	1.50	2.225	-0.155	-0.086
31	1.55	2.218	-0.159	-0.110
32	1.60	2.209	-0.165	-0.150
33	1.65	2.202	-0.173	-0.231
34	1.70	2.192	-0.188	-0.294
35	1.75	2.183	-0.203	-0.296
36	1.80	2.173	-0.233	-0.067
37	1.85	2.156	-0.206	0.048
38	1.90	2.153	-0.190	-0.480
39	1.95	2.142	-0.261	-0.811
40	2.00	2.127	-0.319	-0.267
41	2.05	2.107	-0.317	0.743
42	2.10	2.088	-0.195	0.812
43	2.15	2.092	-0.163	-0.429
44	2.20	2.079	-0.264	-1.209
45	2.25	2.065	-0.352	-0.729
46	2.30	2.040	-0.368	0.370
47	2.35	2.023	-0.280	0.836

Low speed, with weight:

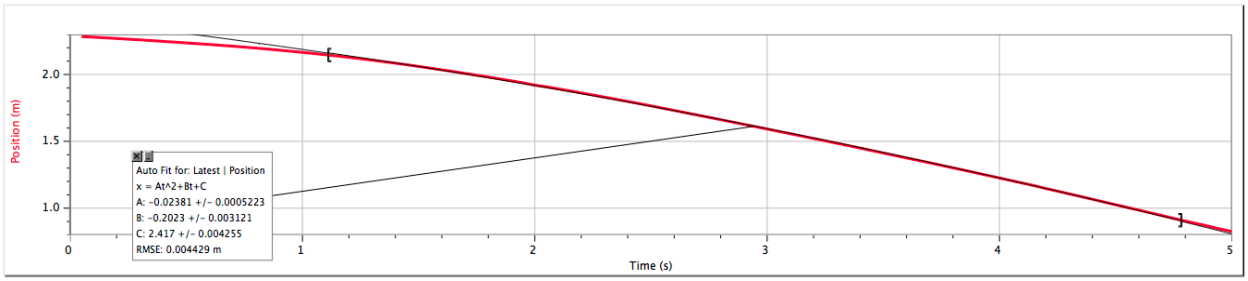


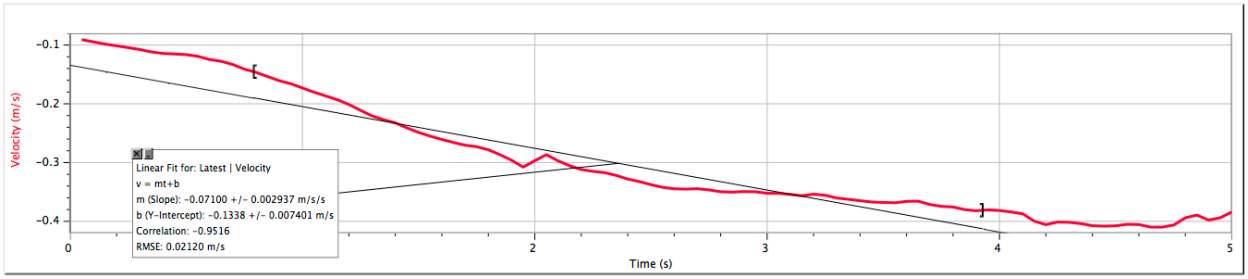


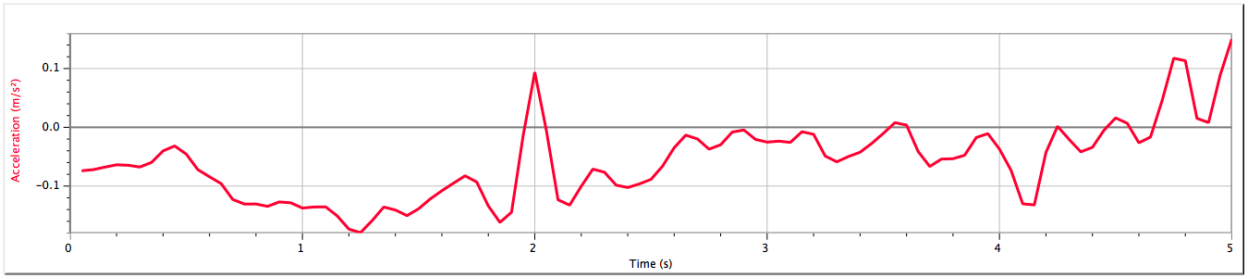


	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	2.407	-0.020	-0.213
2	0.10	2.406	-0.028	-0.276
3	0.15	2.405	-0.045	-0.335
4	0.20	2.402	-0.066	-0.309
5	0.25	2.398	-0.080	-0.190
6	0.30	2.393	-0.084	-0.079
7	0.35	2.389	-0.085	-0.019
8	0.40	2.385	-0.086	0.020
9	0.45	2.380	-0.083	0.041
10	0.50	2.377	-0.080	0.031
11	0.55	2.372	-0.079	0.014
12	0.60	2.369	-0.079	-0.009
13	0.65	2.365	-0.081	-0.015
14	0.70	2.360	-0.081	0.003
15	0.75	2.357	-0.080	0.014
16	0.80	2.352	-0.080	0.020
17	0.85	2.349	-0.079	0.032
18	0.90	2.344	-0.076	0.041
19	0.95	2.341	-0.073	0.031
20	1.00	2.337	-0.073	0.025
21	1.05	2.333	-0.072	0.045
22	1.10	2.330	-0.069	0.061
23	1.15	2.327	-0.065	0.054
24	1.20	2.324	-0.064	0.049
25	1.25	2.320	-0.060	0.041
26	1.30	2.318	-0.057	-0.011
27	1.35	2.315	-0.062	-0.047
28	1.40	2.311	-0.065	-0.018
29	1.45	2.308	-0.064	0.007
30	1.50	2.305	-0.062	-0.009
31	1.55	2.302	-0.064	-0.039
32	1.60	2.299	-0.067	-0.052
33	1.65	2.295	-0.069	-0.055
34	1.70	2.292	-0.072	-0.059
35	1.75	2.288	-0.077	-0.036
36	1.80	2.284	-0.077	-0.006
37	1.85	2.280	-0.075	-0.010
38	1.90	2.276	-0.077	-0.029
39	1.95	2.273	-0.078	-0.052
40	2.00	2.269	-0.083	-0.060
41	2.05	2.264	-0.084	-0.065
42	2.10	2.261	-0.089	-0.079
43	2.15	2.255	-0.095	-0.054
44	2.20	2.251	-0.093	-0.045
45	2.25	2.246	-0.097	-0.079
46	2.30	2.241	-0.102	-0.110
47	2.35	2.236	-0.107	-0.143

High speed, no weight:

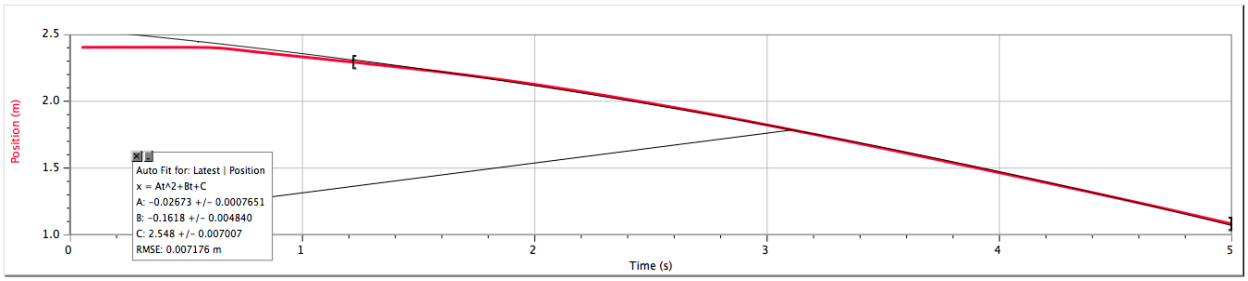


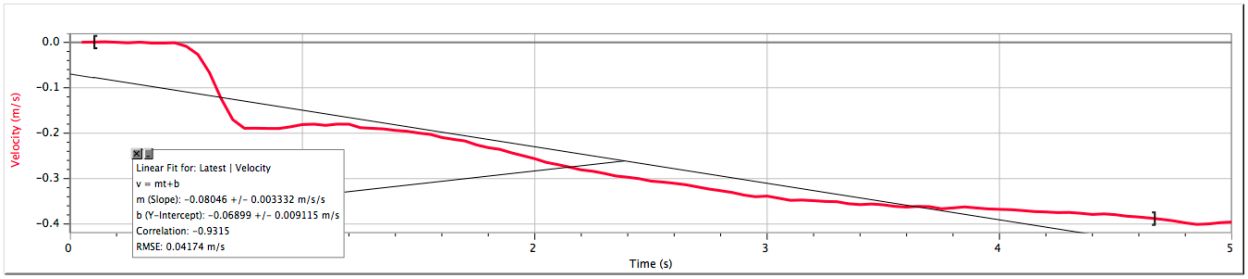


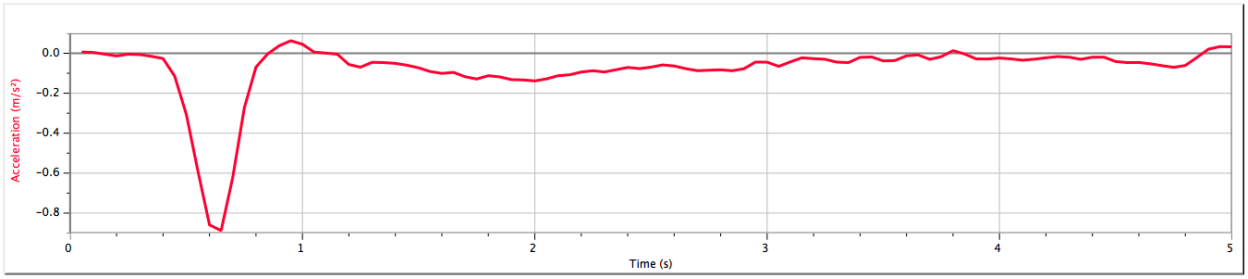


	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	2.284	-0.091	-0.074
2	0.10	2.279	-0.095	-0.072
3	0.15	2.275	-0.098	-0.068
4	0.20	2.270	-0.101	-0.064
5	0.25	2.264	-0.104	-0.065
6	0.30	2.259	-0.108	-0.068
7	0.35	2.254	-0.112	-0.060
8	0.40	2.248	-0.114	-0.040
9	0.45	2.242	-0.115	-0.032
10	0.50	2.236	-0.116	-0.046
11	0.55	2.231	-0.119	-0.072
12	0.60	2.225	-0.125	-0.084
13	0.65	2.218	-0.128	-0.096
14	0.70	2.212	-0.133	-0.123
15	0.75	2.205	-0.141	-0.131
16	0.80	2.198	-0.146	-0.131
17	0.85	2.190	-0.154	-0.134
18	0.90	2.182	-0.161	-0.127
19	0.95	2.174	-0.166	-0.128
20	1.00	2.166	-0.173	-0.137
21	1.05	2.157	-0.180	-0.136
22	1.10	2.148	-0.187	-0.135
23	1.15	2.138	-0.193	-0.151
24	1.20	2.129	-0.201	-0.173
25	1.25	2.118	-0.211	-0.179
26	1.30	2.107	-0.221	-0.159
27	1.35	2.096	-0.227	-0.136
28	1.40	2.085	-0.232	-0.141
29	1.45	2.073	-0.241	-0.150
30	1.50	2.060	-0.249	-0.139
31	1.55	2.048	-0.255	-0.122
32	1.60	2.035	-0.261	-0.108
33	1.65	2.022	-0.266	-0.095
34	1.70	2.008	-0.270	-0.083
35	1.75	1.995	-0.273	-0.093
36	1.80	1.981	-0.278	-0.134
37	1.85	1.967	-0.287	-0.162
38	1.90	1.953	-0.296	-0.144
39	1.95	1.938	-0.308	-0.014
40	2.00	1.921	-0.297	0.094
41	2.05	1.908	-0.287	-0.006
42	2.10	1.893	-0.297	-0.123
43	2.15	1.878	-0.305	-0.132
44	2.20	1.862	-0.312	-0.100
45	2.25	1.847	-0.315	-0.071
46	2.30	1.831	-0.317	-0.076
47	2.35	1.815	-0.322	-0.098

High speed, with weight:

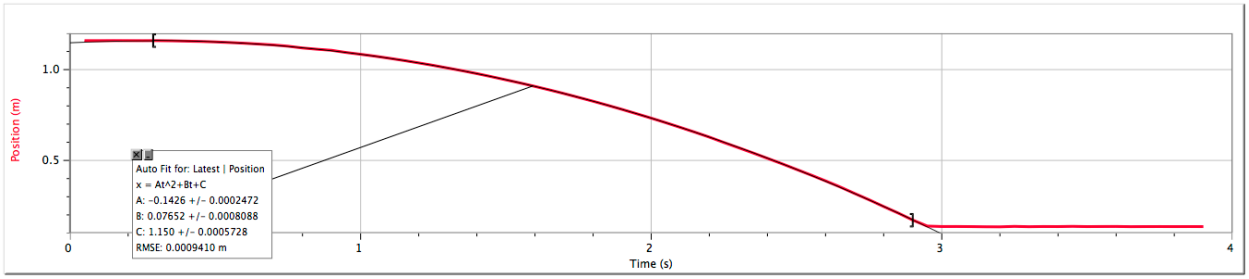


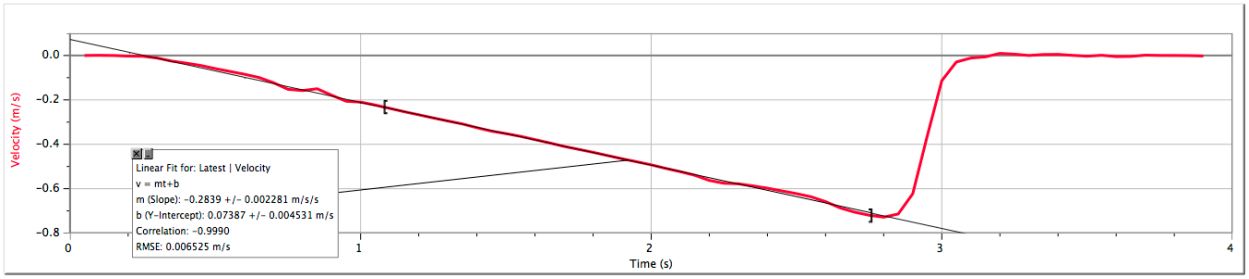


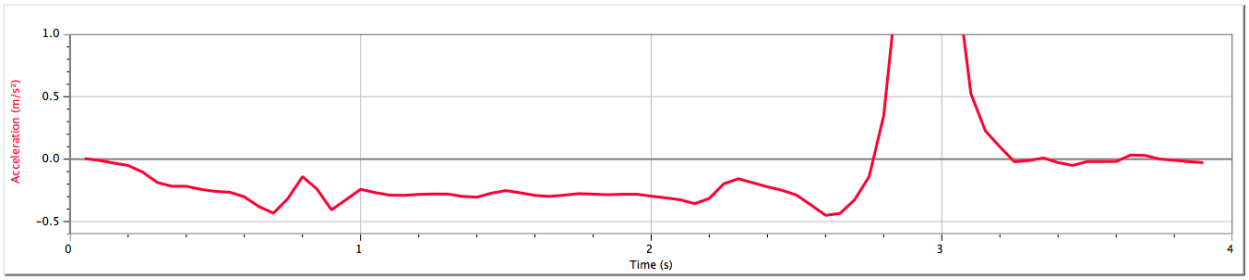


	Latest				
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)	T
1	0.05	2.403	0.000	0.006	
2	0.10	2.403	0.001	0.004	
3	0.15	2.403	0.001	-0.004	
4	0.20	2.404	0.000	-0.013	
5	0.25	2.403	-0.001	-0.005	
6	0.30	2.403	0.000	-0.007	
7	0.35	2.404	-0.002	-0.015	
8	0.40	2.403	-0.002	-0.026	
9	0.45	2.403	-0.001	-0.114	
10	0.50	2.403	-0.009	-0.305	
11	0.55	2.403	-0.027	-0.589	
12	0.60	2.402	-0.067	-0.859	
13	0.65	2.397	-0.124	-0.888	
14	0.70	2.389	-0.170	-0.621	
15	0.75	2.379	-0.189	-0.273	
16	0.80	2.369	-0.189	-0.069	
17	0.85	2.360	-0.190	-0.003	
18	0.90	2.350	-0.190	0.038	
19	0.95	2.341	-0.186	0.063	
20	1.00	2.332	-0.181	0.045	
21	1.05	2.323	-0.180	0.006	
22	1.10	2.314	-0.183	0.001	
23	1.15	2.304	-0.180	-0.005	
24	1.20	2.296	-0.180	-0.056	
25	1.25	2.287	-0.188	-0.070	
26	1.30	2.277	-0.189	-0.045	
27	1.35	2.268	-0.191	-0.047	
28	1.40	2.258	-0.194	-0.051	
29	1.45	2.248	-0.196	-0.060	
30	1.50	2.238	-0.200	-0.073	
31	1.55	2.228	-0.203	-0.091	
32	1.60	2.218	-0.209	-0.101	
33	1.65	2.207	-0.214	-0.096	
34	1.70	2.197	-0.217	-0.117	
35	1.75	2.186	-0.226	-0.129	
36	1.80	2.174	-0.232	-0.112	
37	1.85	2.163	-0.236	-0.118	
38	1.90	2.151	-0.243	-0.132	
39	1.95	2.138	-0.250	-0.133	
40	2.00	2.126	-0.256	-0.138	
41	2.05	2.113	-0.264	-0.128	
42	2.10	2.099	-0.269	-0.112	
43	2.15	2.086	-0.275	-0.108	
44	2.20	2.072	-0.281	-0.094	
45	2.25	2.057	-0.284	-0.087	
46	2.30	2.043	-0.289	-0.094	
47	2.35	2.029	-0.294	-0.082	

Low incline 6cm:

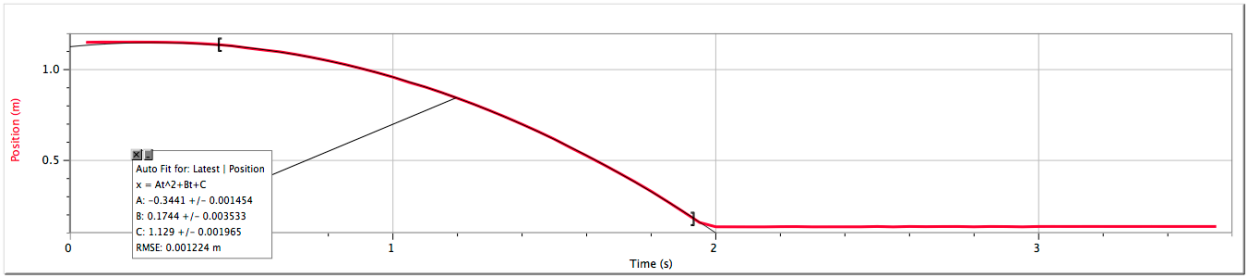


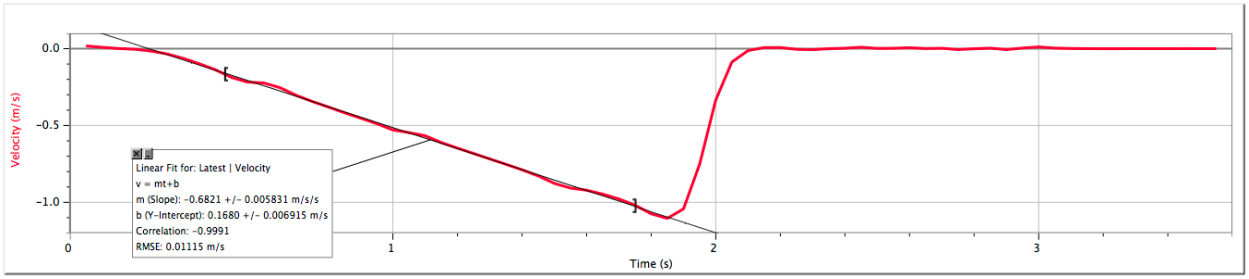


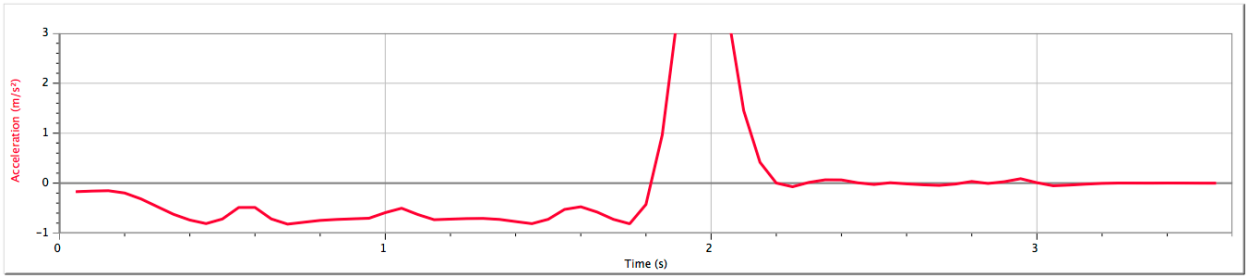


	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.160	0.000	0.004
2	0.10	1.159	0.001	-0.010
3	0.15	1.160	0.000	-0.031
4	0.20	1.160	-0.003	-0.051
5	0.25	1.159	-0.003	-0.104
6	0.30	1.160	-0.011	-0.186
7	0.35	1.159	-0.025	-0.217
8	0.40	1.157	-0.035	-0.217
9	0.45	1.155	-0.045	-0.242
10	0.50	1.152	-0.059	-0.258
11	0.55	1.149	-0.072	-0.265
12	0.60	1.145	-0.084	-0.302
13	0.65	1.141	-0.099	-0.380
14	0.70	1.136	-0.123	-0.432
15	0.75	1.129	-0.152	-0.315
16	0.80	1.119	-0.158	-0.140
17	0.85	1.112	-0.150	-0.240
18	0.90	1.106	-0.179	-0.407
19	0.95	1.094	-0.206	-0.324
20	1.00	1.084	-0.210	-0.242
21	1.05	1.074	-0.223	-0.268
22	1.10	1.062	-0.238	-0.289
23	1.15	1.050	-0.253	-0.290
24	1.20	1.037	-0.267	-0.282
25	1.25	1.023	-0.281	-0.279
26	1.30	1.009	-0.295	-0.280
27	1.35	0.994	-0.308	-0.298
28	1.40	0.978	-0.325	-0.305
29	1.45	0.961	-0.341	-0.273
30	1.50	0.944	-0.352	-0.252
31	1.55	0.926	-0.364	-0.270
32	1.60	0.907	-0.379	-0.291
33	1.65	0.888	-0.394	-0.298
34	1.70	0.868	-0.410	-0.289
35	1.75	0.847	-0.423	-0.276
36	1.80	0.826	-0.436	-0.280
37	1.85	0.804	-0.451	-0.285
38	1.90	0.781	-0.465	-0.281
39	1.95	0.757	-0.479	-0.281
40	2.00	0.733	-0.493	-0.296
41	2.05	0.708	-0.509	-0.310
42	2.10	0.682	-0.523	-0.325
43	2.15	0.656	-0.540	-0.357
44	2.20	0.628	-0.563	-0.314
45	2.25	0.599	-0.576	-0.197
46	2.30	0.570	-0.578	-0.157
47	2.35	0.541	-0.587	-0.190

High incline 11cm:







	Latest			
	Time (s)	Position (m)	Velocity (m/s)	acc (m/s²)
1	0.05	1.150	0.018	-0.171
2	0.10	1.152	0.009	-0.159
3	0.15	1.151	0.001	-0.152
4	0.20	1.151	-0.004	-0.198
5	0.25	1.151	-0.015	-0.316
6	0.30	1.150	-0.034	-0.470
7	0.35	1.148	-0.063	-0.624
8	0.40	1.144	-0.098	-0.739
9	0.45	1.139	-0.137	-0.810
10	0.50	1.131	-0.187	-0.719
11	0.55	1.119	-0.218	-0.488
12	0.60	1.108	-0.223	-0.487
13	0.65	1.098	-0.254	-0.716
14	0.70	1.084	-0.303	-0.821
15	0.75	1.067	-0.343	-0.783
16	0.80	1.049	-0.380	-0.747
17	0.85	1.029	-0.417	-0.728
18	0.90	1.007	-0.452	-0.715
19	0.95	0.984	-0.488	-0.703
20	1.00	0.959	-0.529	-0.591
21	1.05	0.930	-0.546	-0.503
22	1.10	0.904	-0.567	-0.629
23	1.15	0.874	-0.611	-0.733
24	1.20	0.843	-0.647	-0.721
25	1.25	0.810	-0.682	-0.710
26	1.30	0.775	-0.717	-0.707
27	1.35	0.738	-0.752	-0.726
28	1.40	0.699	-0.788	-0.770
29	1.45	0.659	-0.828	-0.811
30	1.50	0.617	-0.877	-0.724
31	1.55	0.571	-0.907	-0.527
32	1.60	0.525	-0.921	-0.474
33	1.65	0.479	-0.947	-0.579
34	1.70	0.431	-0.978	-0.725
35	1.75	0.382	-1.019	-0.814
36	1.80	0.330	-1.075	-0.427
37	1.85	0.274	-1.104	0.963
38	1.90	0.217	-1.043	3.515
39	1.95	0.158	-0.752	5.832
40	2.00	0.134	-0.333	5.660
41	2.05	0.134	-0.087	3.453
42	2.10	0.134	-0.013	1.451
43	2.15	0.134	0.007	0.417
44	2.20	0.135	0.007	0.002
45	2.25	0.136	-0.004	-0.073
46	2.30	0.134	-0.007	0.014
47	2.35	0.134	0.000	0.066

Observations:

I found that there was a notable difference in acceleration due to mass for the fan carts and the lab also proved to me the obvious that objects naturally accelerate quicker down a steeper slope.

Analysis:

The data we gathered I believe is fairly accurate due to the sensitivity of the sonic rangers, however the low speed no weight graph was extremely flawed due to interference between the cart and the ranger.

If the lab was preformed again he main thing I would change was the control, making sure the rangers path to the cart was always clear and gathering more accurate data about cart weight, ramp slope and such other variables between trials.

Conclusion:

This lab succeeded in graphically showing the differences and relationships between cart acceleration, mass and velocity, across various slopes.

1. How was the acceleration of the inclined cart related to g? How should it be related?
   -The cart accelerated in relation to g and the friction acting against it on the ramp, it accelerated in accordance to g because no force was applied to start the cart rolling.

3. If you allowed the ramp to bounce, what would the v/t graph look like and why?
   -It would not change unless the ramp did actually bounce during a trial at which point the cart would likely get throw off the tracks thus preventing data collection.
   -
4. If the fan cart had another identical cart hooked to it, what would this do to the three curves: x/t v/t a/t?

-It would make the a/t graph be slower but end at a higher value, thus also putting the v/t data set into a higher numerical range.