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1 • Plan Statement

We will record the car traveling straight along a meterstick and record how long it takes to travel certain distances, then approximate a position function using that data, then differentiate that function to determine whether the car acceleration is constant or not.

2 • Procedure

1. Obtain car, meterstick, and slow-motion camera.
2. Pull car back a certain distance.
3. Start recording car with camera.
4. Release car, and record car with camera until car stops.
5. Examine recording to determine how long it took car to reach distances of 0.05 m increments.
6. Repeat with different pullback distances.

3 • Data

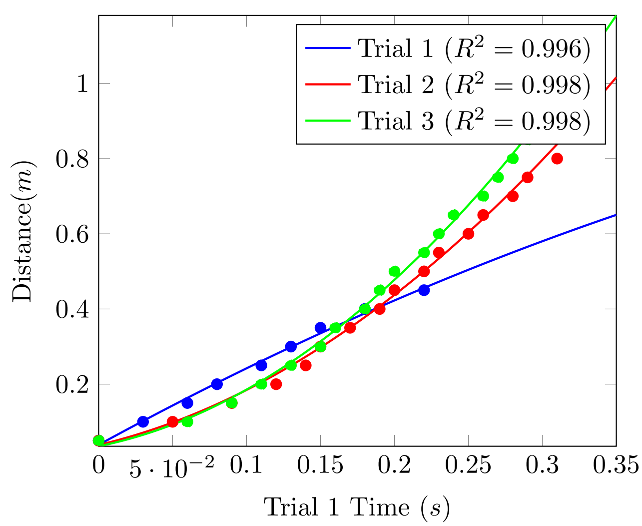

Figure 1: The position functions of each trial, along with the associated R^2 values.

Distance (m)	Trial 1 Time (s)	Trial 2 Time (s)	Trial 3 Time (s)
0.05	0.00	0.00	0.00
0.10	0.03	0.05	0.06
0.15	0.06	0.09	0.09
0.20	0.08	0.12	0.11
0.25	0.11	0.14	0.13
0.30	0.13	0.15	0.15
0.35	0.15	0.17	0.16
0.40	0.18	0.19	0.18
0.45	0.22	0.20	0.19
0.50		0.22	0.20
0.55		0.23	0.22
0.60		0.25	0.23
0.65		0.26	0.24
0.70		0.28	0.26
0.75		0.29	0.27
0.80		0.31	0.28
0.85			0.29

4 • Analysis

All three trials were modeled with second-degree polynomial position functions as follows:

$$x_1(t) = 0.0387 + 2.15x - 1.15x^2$$

$$x_2(t) = 0.0383 + 0.932x + 5.32x^2$$

$$x_3(t) = 0.035 + 0.799x + 7.07x^2$$

These functions are very accurate models of the data, as indicated by the very high R^2 values of each of these functions when compared with the discreet data they respectively model.

The acceleration functions derived from these functions are as follows:

$$a_1(t) = -2.30$$

$$a_2(t) = 10.64$$

$$a_3(t) = 14.14$$

Since these are all constant functions, we have demonstrated that the manufacturer's claim of the car experiencing near constant acceleration is supported.