1D Motion Lab Report

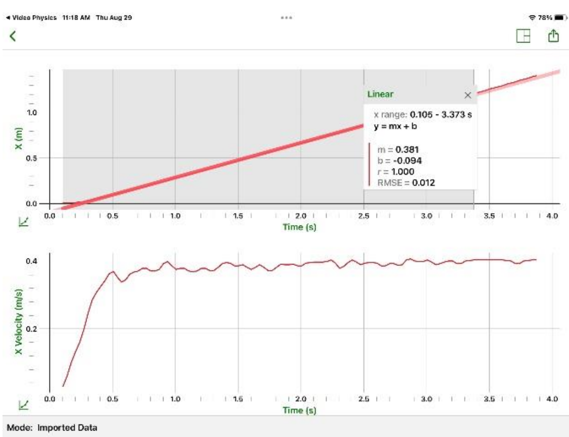
Alec Gray, Grace Gordan, Jonah Spector

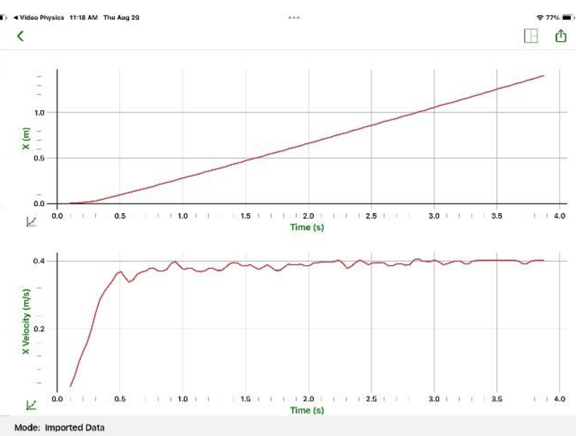
1 BUGGY EXPERIMENT

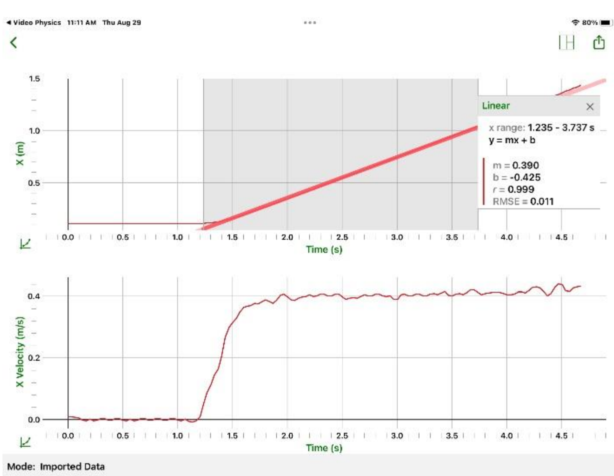
Note that the front wheel starts at 0cm. The equation for calculating the velocity of the buggy is simply: $v_{avg} = \Delta x / \Delta t$. The length of the ruler is 1.21m and the time it takes the buggy to go the length of the ruler was recorded with a stopwatch.

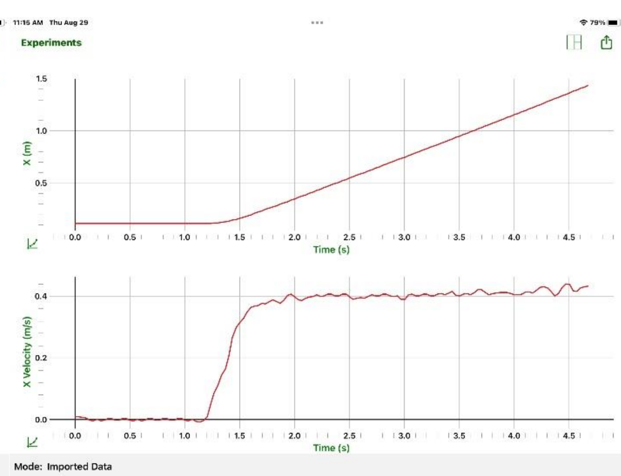
- Buggy 1: V_{b1} = 1.21m/3.815s = 0.32 m/s
- Buggy 1 (Video Data): 0.39 m/s
- Buggy 2: V_{b2} = 1.21m/3.37s = 0.36 m/s
- Buggy 2 (Video Data): 0.38 m/s

We also ended up needing to record from much farther back than expected due to the camera on the iPad having a relatively small field of view. Constant velocity is a reasonable explanation for this experiment, because the buggy was not affected by gravity like the cart was. Our measurements were reasonable and consistent between the two videos. We can tell from the two graphs shown (buggy 1 above, buggy 2 below):









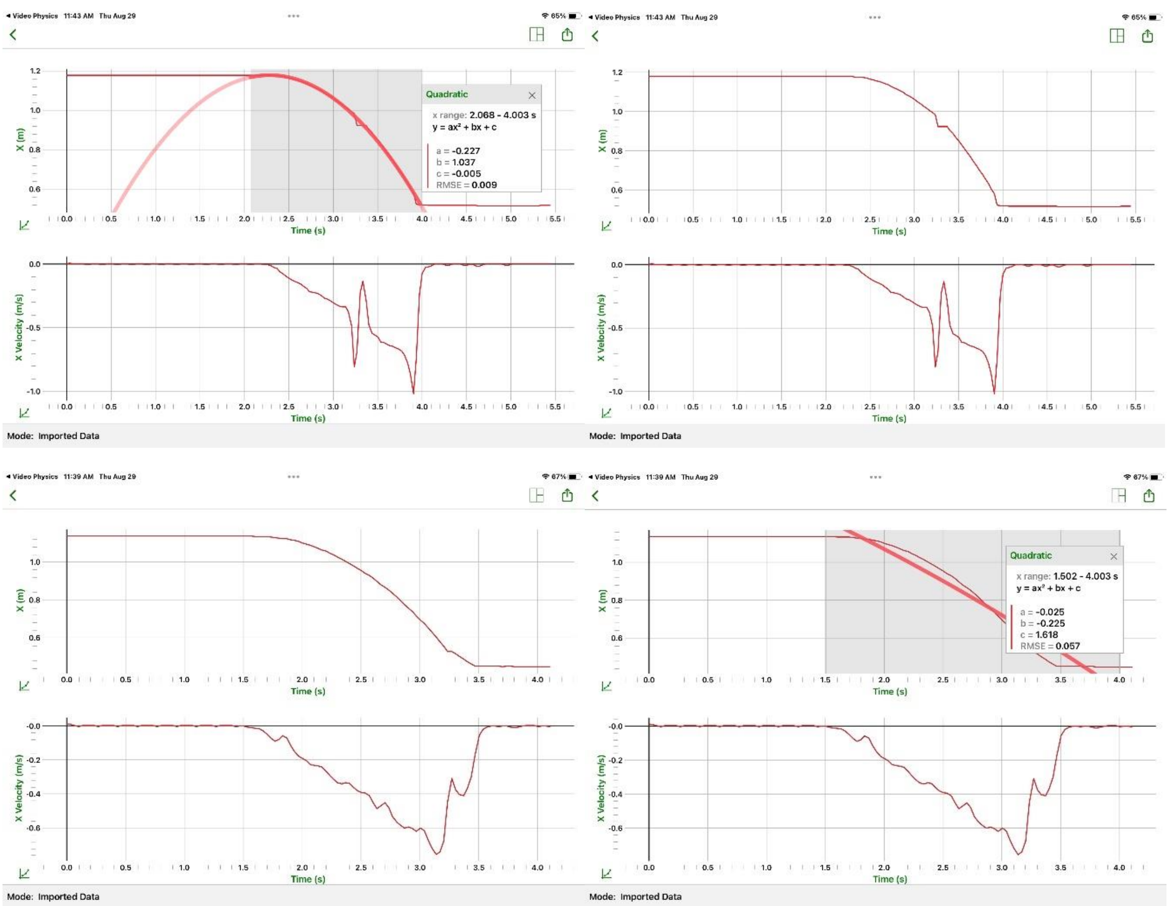
2 CART EXPERIMENT

The equation to calculate the acceleration uses the kinematic equation: $v_f^2 = v_i^2 + 2a\Delta x$.

Rearranged, and given that $v_i = 0$, $a = \frac{v_f^2}{2\Delta x} = \frac{\left(\frac{\Delta x}{t}\right)^2}{2\Delta x} = \frac{\Delta x}{2t^2}$. The length of the ruler is 1.21m and the time it takes the cart to go the length of the ruler was recorded with a stopwatch.

- Cart 1: a_{c1}= 1.21m/2*(1.85s)^2 = 0.325 m/s^2
- Cart 1 (Video Data): 0.227m/s^2
- Cart 2: a_{c1}=1.21m/2*(2.17s)^2 = 0.28 m/s^2
- Cart 2 (Video Data): -0.025m/s^2 (issue explained below)

Cart 1 above, cart 2 below:



Constant velocity wouldn't be a reasonable explanation, because the slope of the velocity graph is not 0, but constant acceleration would be, since the position is quadratic and the velocity linear. The quadratic regression, which models $x = \frac{1}{2}at^2$, gives the acceleration. For the second cart, the range given for the regression accidentally included some of the time where the cart hit the end of the ruler.

The acceleration is not equal to g because the ramp blocks the normal path of a falling object; friction and the slope, which causes to cart to move horizontally with some velocity gained from the acceleration (force) of gravity, prevent the acceleration relative to the slope from being g.

3 PERSON:

Test 1: 2.11s

Test 1 (Video Data): 1.87 m/s^2, Quadratic: 0.94 m/s^2

Test 2: 2.42s

Test 2: (Video Data): -

Unfortunately, we ran out of time to create a graph from the video and calculations for a person. However, we made sure to film at the right distance to avoid having inaccurate data.