Lab 3 : Study of Forces

**Objective :** Quantify Newton’s Second Law (F=ma).

**Experiment 1 :** Utilize a force sensor or spring scale to determine the relationship between mass (m) and displacement (△X) (i.e, is it linear or nonlinear)

**Data:**

| Mass (g) | △x (cm) | F = ma (N) | k= F/△x  (kg x m/s^2)/m |
| --- | --- | --- | --- |
| 50 | 0.5 | 490.5 | 981 |
| 100 | 1 | 981 | 981 |
| 150 | 1.5 | 1,471.5 | 981 |
| 200 | 2 | 1,962 | 981 |

**k = 981: it is linear because the acceleration due to gravity is constant.**

**Experiment 2 :** Given F is a constant, use variable mass (△m) to define the change in acceleration (△a)

**Data:**

| Mass (g) | △a (m/s^2) | F = ma (N) |
| --- | --- | --- |
| 287 | 0.1987 | 57.0269 |
| 287 + 50 | 0.1728 | 58.2336 |
| 287 + 100 | 0.1529 | 59.1723 |
| 287 + 150 | 0.1313 | 57.3781 |
| 287 + 200 | 0.1155 | 56.2485 |

**Analysis :**

1. **When force is applied to a z spring is it proportional to the extension (△x) or the square of the extension?** When force is applied to the z spring, it is proportional to the extension, we see because with each 50g of mass added to the spring, the spring extends the same amount throughout each increment of weight added.
2. **How does the added mass to the cart affect the acceleration?** As mass continues to be added on the Fan Cart, it is clear that the acceleration of the Fan Cart decreases.
3. **What is the mean value and standard deviation for the force you estimated for the Fan Cart?**
   1. Standard Deviation: 1.126621725
   2. Mean: 57.61188

**Conclusion :** In this lab we used a fan cart to determine the force F = ma +/- 1.126621725

.

**What is the source of error for this experiment?**

Some of the sources of error we saw throughout this lab were :

* The force of friction of the track on the cart.
* Air resistance on the fan cart
* Inconsistent spring