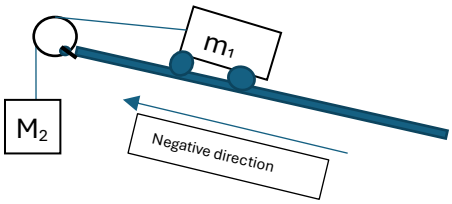
Question: How will acceleration vary when the mass (M2) changes along an inclined plane in a modified Atwood's machine?

Hypothesis: The larger the mass (M2), the higher the value of acceleration will be. The relationship will be linear, and the slope will represent the velocity as the mass (M2) changes.

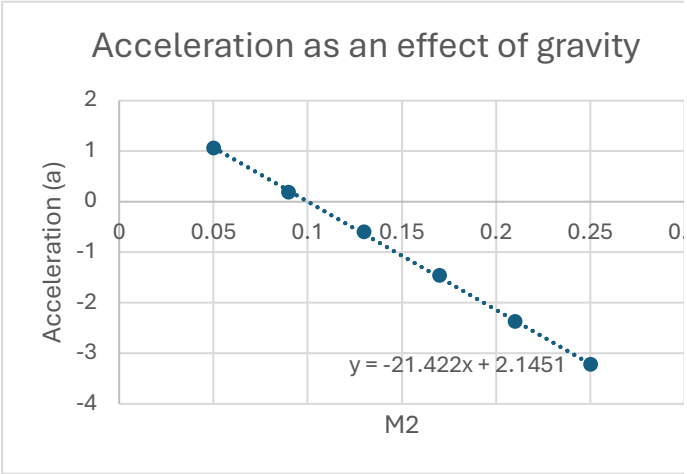
Strategy: The setup will involve M1, the cart, on an inclined plane with an angle of 13 degrees. The inclined plane will be created by lifting the track using books. The hanging mass (M2) will be attached to a pulley, and the mass will be increased by adding washers to the hanging side. The acceleration of the system will be measured at different values of M2.

Fig 1: Modified Atwood's machine



Data:

#Washers	M1 (kg)	Hanging Mass (kg)	Acceleration (m/s^2)
2	0.3	0.25	-3.225
4	0.34	0.21	-2.376
6	0.38	0.17	-1.458
8	0.42	0.13	-0.5994
10	0.46	0.09	0.1816
12	0.5	0.05	1.067



Variables:

Independent variable: mass of M2.

Dependent variable: acceleration of the system.

Analysis:

Calculated slope:

In order to detemine the velocity based on the mass during this lab, I calculated the slope by using the following equation. Slope: g(1+sin(θ))/m1+m2. Through using the given values:

- g = 9.8 m/s^2
- θ = 13
- m1 = 0.3 kg

I found the calculated slope to be: 21.8264 (m/s^2)

Percentage Error for the Slope:

- Error: -1.85%

Calculated Y-intercept:

- Theoretical value: g·sin(θ)
- 9.8·sin(13) = 2.2045 m/s^2

Percentage Error for the Y-intercept:

- Error: -2.70%.

Overall, I was able to linearize the data, and the general trend with this modified Atwood's machine was that as more mass was added to M2, or the hanging part of the mass, the acceleration increased in magnitude. Additionally, however, when the mass of the cart itself was at its highest, the acceleration was somewhat high, so preliminary conclusions could be made that when the masses are more balanced or closer together, then the acceleration is lower. Additionally, the x intercept happens when m2 balances m1gsinθ. Possible sources of error here may include slight forces applied when the cart was released.