Guiding Question: (from your investigation handout)

Claim: Your answer to the guiding question

Evidence:

Analysis

Make a data table, graph and/or figure to show a relationship, a change over time, or a difference between groups

Interpretation

- **This graph suggests…**
- **This graph shows…**

Explain what the analysis (graph, figure) means

Justification of the Evidence

- These are the science concepts that are important for understanding our evidence…
- Our evidence is based on the following assumptions…

Discuss 1-2 science concepts that your data helps explain. Identify and explain the equation that supports the relationship between the variables.

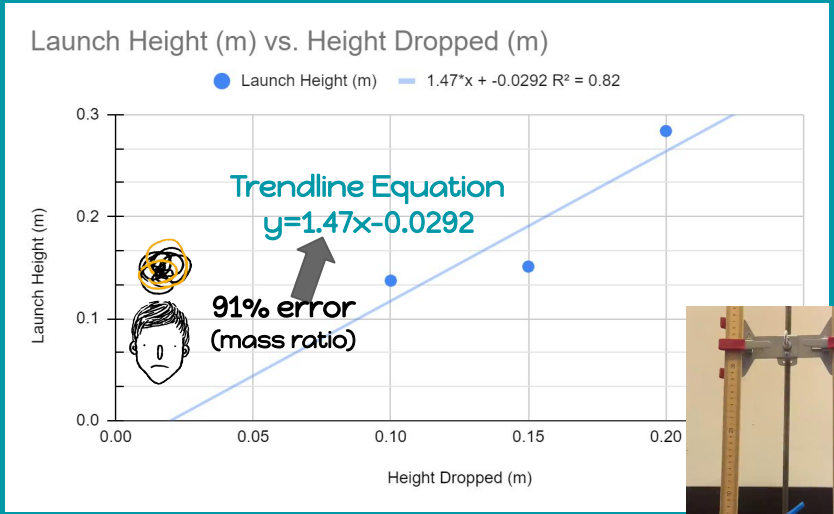
YOUR NAME(s) HERE

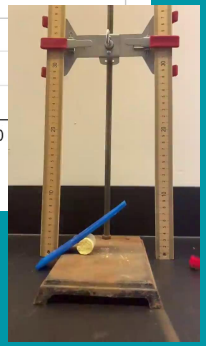
Guiding Question: How can you make an action figure jump higher?

Claim: If an object is dropped from a higher height, the object on the other end of the teeter board will be launched higher as well.

Evidence:

Strong correlation:
$R^2 = 0.82$





Average launch height of 5 trials at 3 different heights

Justification:

- Energy should be transferred from the object in the air to the object on the seesaw.
- Energy is neither created nor destroyed
- Potential energy = mgh
- The launch height of the action figure (red meeple in video) is based on the masses of the objects and the drop height.
  - The masses were constant throughout
  - The object should launch higher than the initial height
  - Ratio of masses: 16.5
- Relationship between variables

$$PE_{object\ 1} = PE_{object\ 2}$$

$$m_1 \cdot g \cdot h_1 = m_2 \cdot g \cdot h_2$$

$$h_2 = \frac{m_1}{m_2} \cdot h_1$$

m: mass of object
g: acceleration due to gravity
h: height of object

h_1: represents height of object dropped and x in trendline

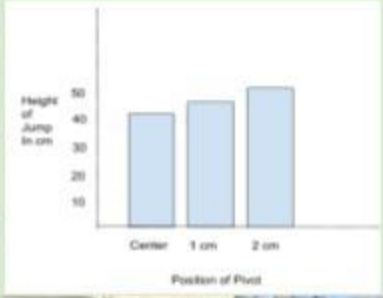
Amanda Bovard

Laura Wommack

Guiding Question: How does the length of the lever arm affect the launch height?

Claim: An object seated on the longer lever arm of a class 1 lever will be imparted with more energy and be launched to a higher height.

Evidence:



	Trial 1	Trial 2	Trial 3	Average
Pivot at center	40 cm	42 cm	41 cm	41 cm
Pivot 1 cm away	45 cm	46 cm	44 cm	45 cm
Pivot 2 cm away	52 cm	50 cm	51 cm	51 cm

Conclusion: The data collected was inclusive because not many trials were run and the data collection was difficult due to not having a partner to read height. It did seem to correlate to the the initial claim.

Justification:

- A class 1 lever is a lever in which the fulcrum is located between the force and the load.
- If the fulcrum of a class 1 lever is closer to the load, less force is needed to move the load; if it is further from the load, more force is needed.
- The mechanical advantage of a lever is the ratio of the output force to the input force; as the input force increases, the output force decreases.

Guiding Question: How does Surface Area of a Parachute Affect the Force Due to Air Resistance as an Object falls to the Ground.

Claim: The more circular a parachute is shaped, the longer the falling time of an object.

Evidence:

Trial	Control Group Circular	Exp. Group 1 Octogonal	Exp. Group 2 Square	Exp. Group 3 Triangle
1	1.13	1.11	1.76	1.01
2	1.26	1.24	1.88	1.35
3	1.08	1.13	1.52	1.1
4	1.02	1.11	1.46	1.25
5	1.07	1.18	1.49	1.11
6	1.02	1.16	1.58	1.21
7	1.07	1.13	1.32	1.08
8	1.14	1.28	1.09	1.08
Variance	0.005	0.003	0.052	0.011
Standard Deviation	0.073	0.059	0.229	0.104
Range	0.240	0.170	0.790	0.340
Interquartile Range	0.075	0.070	0.200	0.140
Mean	**1.099**	**1.168**	**1.513**	**1.149**
Median	1.075	1.145	1.505	1.105
Mode(s)	1.020	1.110	#N/A	1.080



⟸ Mean Air Time (s)

Each parachute shape was calculated to have the similar surface area of a circle with a 28cm diameter A ≅ 615cm^2

Dimensions:
Triangle = equilateral with approximately 38cm sides

$A = \frac{\sqrt{3}}{4}a^2$

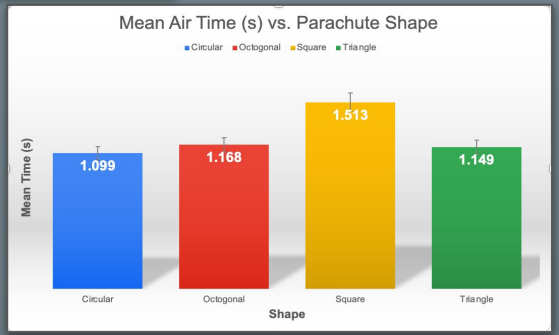
Square = Approximately 25cm x 25cm

$A = bh$

Octagon = equilateral with approximately 11.3cm sides

$A = 2a^2(1+\sqrt{2})$

Drop Height = 3m
Cargo Mass = 20g
String Length = 30cm x 4



Each parachute was dropped from a fixed height of 3m and the airtime, in seconds, was recorded with a basic stopwatch from the time the parachute was released to the time it reached the ground. Eight trials of each parachute shape were conducted.

Justification:

Based on the evidence of the investigation, the hypothesis *is not* supported but the null hypothesis *is* supported

The squared shaped parachute achieved the longest falling time of all shapes which is contrary to the claim

The Circular, Octogonal and Triangular shaped parachutes statistically performed similar in comparison with little discernible variance considering reasonable systematic and random error

A review of variance however, reveals that the trials of the square parachutes had the greatest variance of 0.052

Trial 8 of square, air time = 1.09s, falls outside 1 standard deviation and although biased very close to 2 standard deviations, is not far enough away from the dataset's mean to be considered an outlier

A parachute's effectiveness may be measured based on how much opposing force can be applied to an attached object as it free falls due the effect of earth's gravity. Airtime is a quantitative indicator of the opposing force that a parachute generates. The longer the airtime, the greater the effective opposing force. Therefore, based on results of this investigation, square shaped parachutes generate the most opposing force

Paul J. Cuaresma

Guiding Question: (from your investigation handout)

Claim:

Evidence:

Justification:

YOUR NAME HERE