“When are we ever going to use this?”

https://clipartimage.com

What is the opposite of boring?

- Interesting
- Compelling
- Engaging
- Thought-provoking

https://clipartimage.com

Students want:

Real-life problems

Hands-on problems

Practical applications

To do something valuable

Fig. 1 The McDonald's Prompt served as the genesis for the Notice and Wonder routine.

Marcus went for his daily run. Then he met Samuel at McDonald's for lunch to have hamburgers and milkshakes.

Samuel's Lunch

NUTRITION CALCULATOR

750	23g	112g	24g
Calories	Total Fat	Total Carbs	Protein

Marcus's Lunch

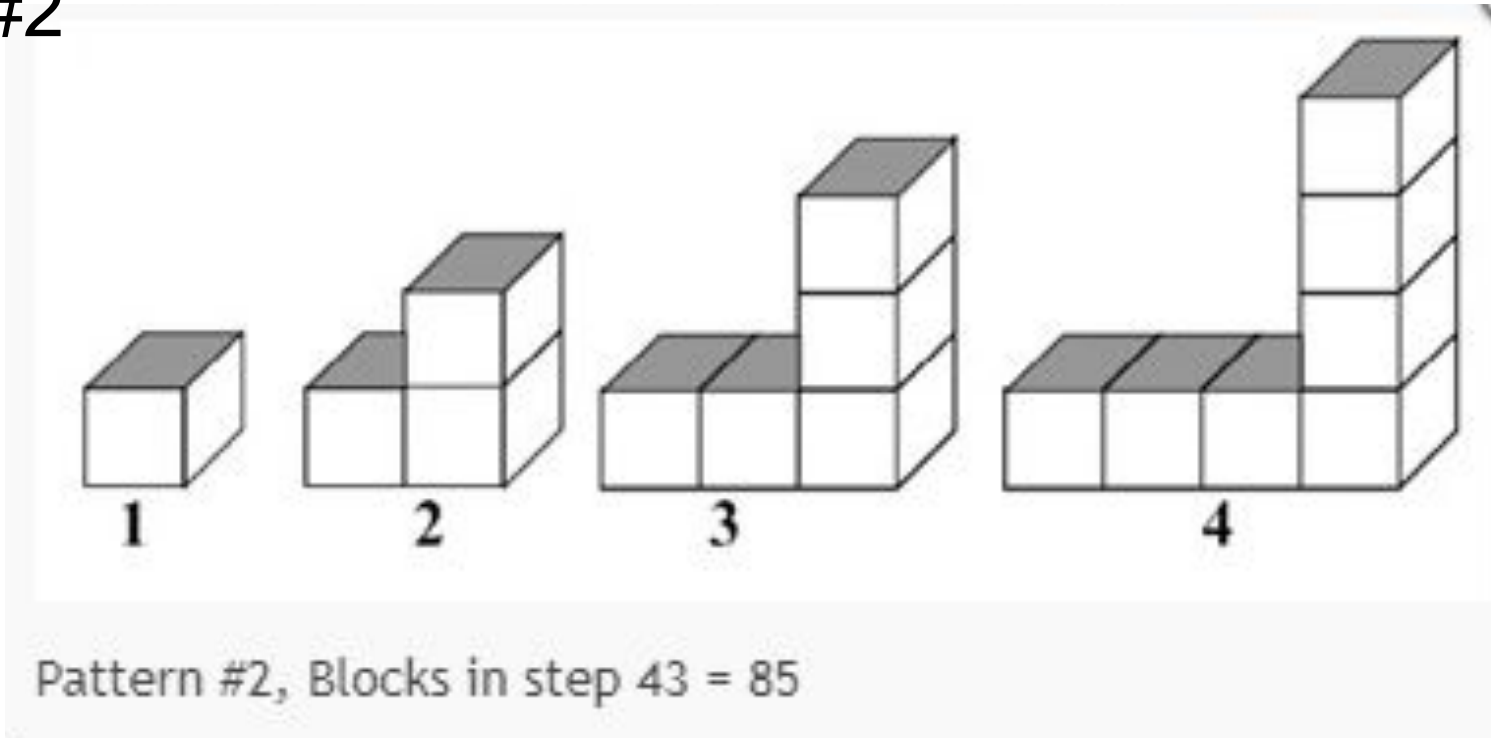
NUTRITION CALCULATOR

1250	39g	174g	49g
Calories	Total Fat	Total Carbs	Protein

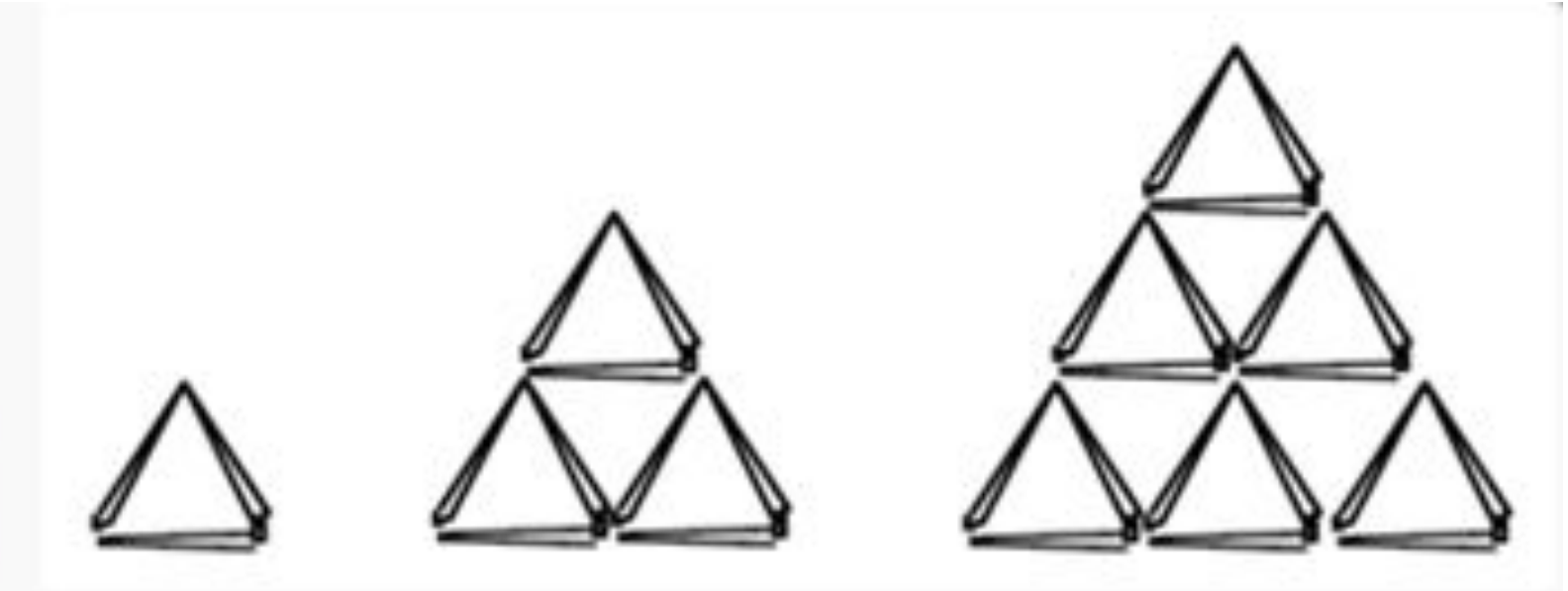
NCTM *Mathematics Teaching in the Middle School, May 2019*

McDonald's nutrition calculator.

Visualpatterns.org #2



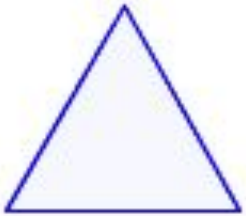
Visualpatterns.org
#6



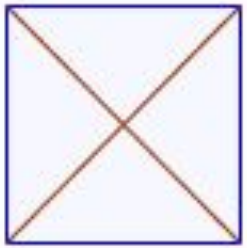
Pattern #6, Toothpicks in step 43 = 2838

Visualpatterns.org
#65

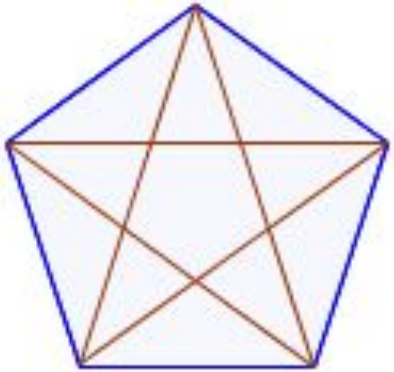
Visualpatterns.org #132



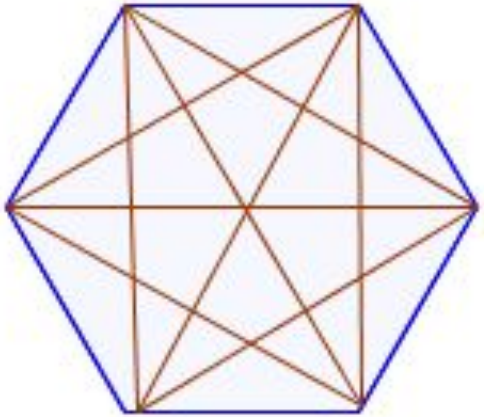
Step1
0 diagonals



Step2
2 diagonals



Step 3
5 diagonals



Step 4
9 diagonals

Describe the relationship between the area and mass of a piece of cardboard.

1. Find area of a piece of cardboard.
2. Find mass of cardboard.
3. Graph.
4. Repeat for each piece.
5. Draw line.
6. What is y-intercept?
7. What is the meaning of the y-intercept?
8. What is the slope?
9. Predict the mass for a given area.
10. Draw and cut a piece with that area.
11. Find the actual mass. Does it meet your prediction?
12. Compare the piece you made to a piece your neighbor made. Do the shapes match? What do the shapes have in common?

Increase the challenge:

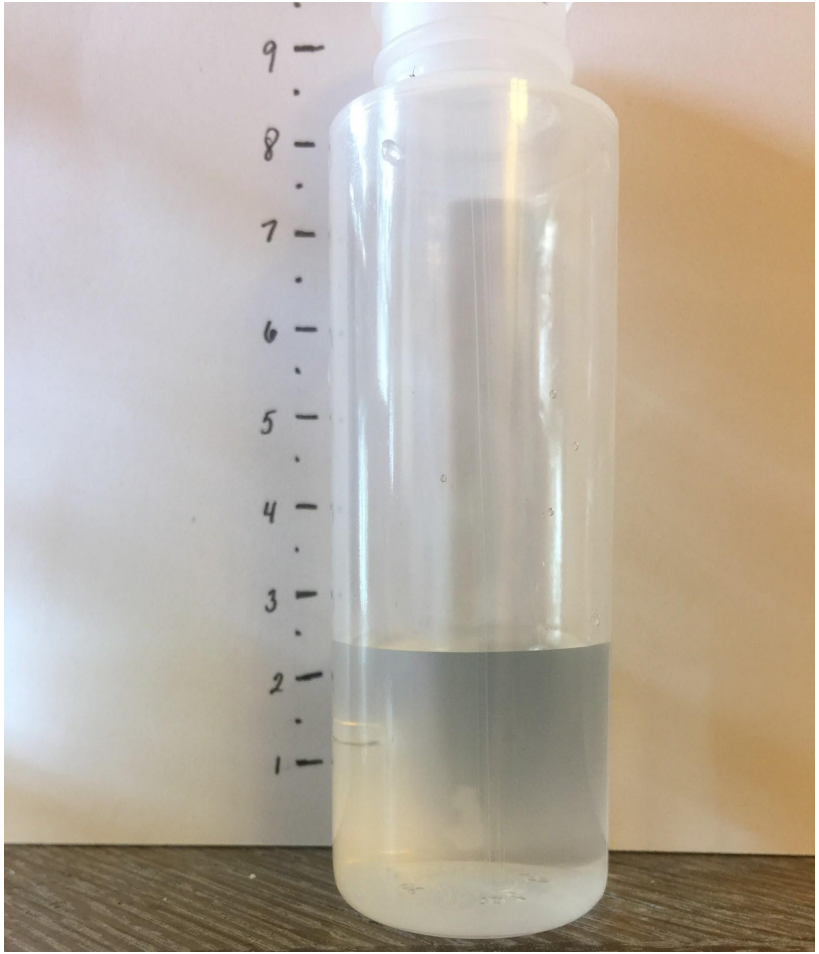
- Different shapes.
- Use data to predict mass of an entire box. (Requires finding surface area.)
- Graph on a spreadsheet.
- Use spreadsheet to write a formula that accurately predicts mass when given area.
- Start with a piece of cardboard. Graph mass. Then cut in half and graph mass. Repeat.

Topics:

- Plotting points
- Area
- Rates
- Measuring
- Data collection
- Accuracy
- Predicting (Interpolation)
- Determining equations
- Meaning of slope

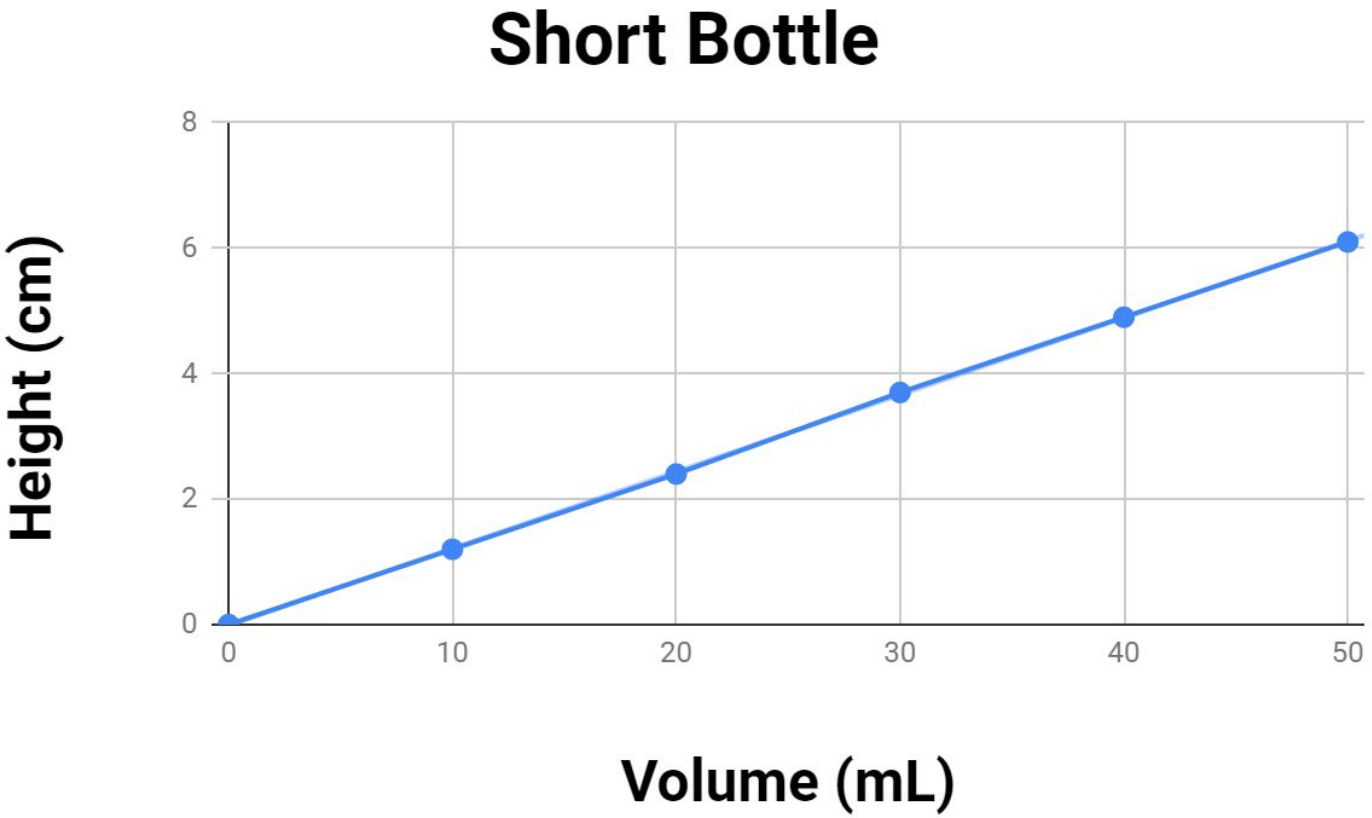
If using a spreadsheet:

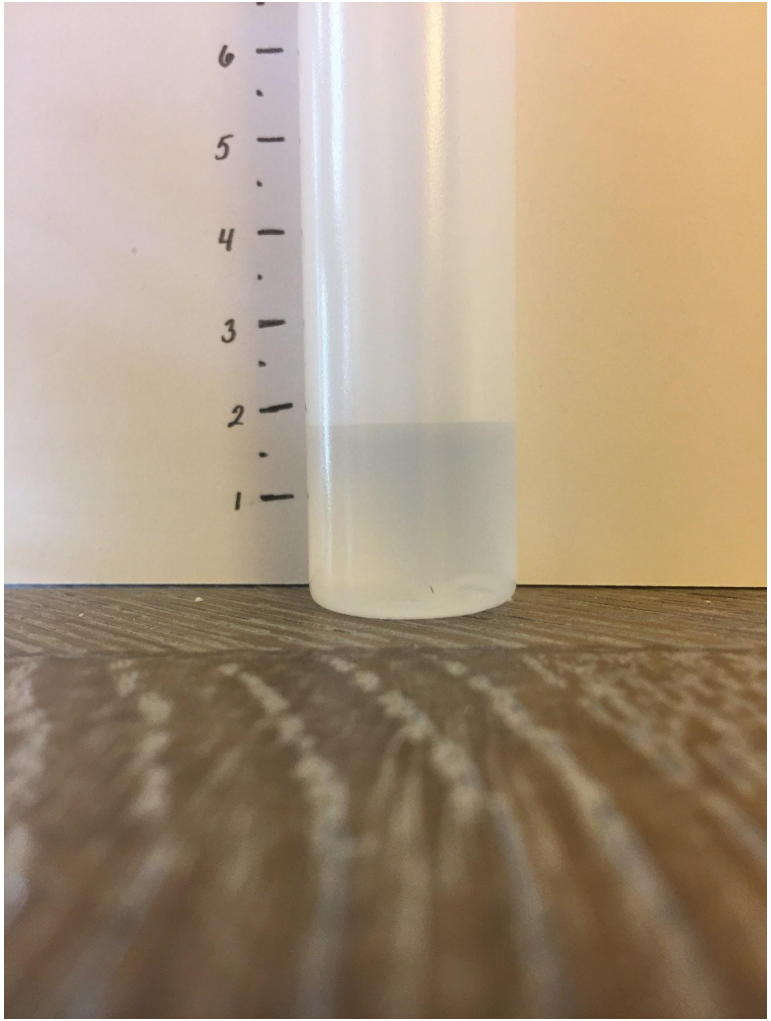
- Scatterplot of class data
- Generating a graph
- Line of best fit
- Correlation
- Using a formula


9
8
7
6
5
4
3
2
1


10
9
8
7
6
5
4
3
2
1

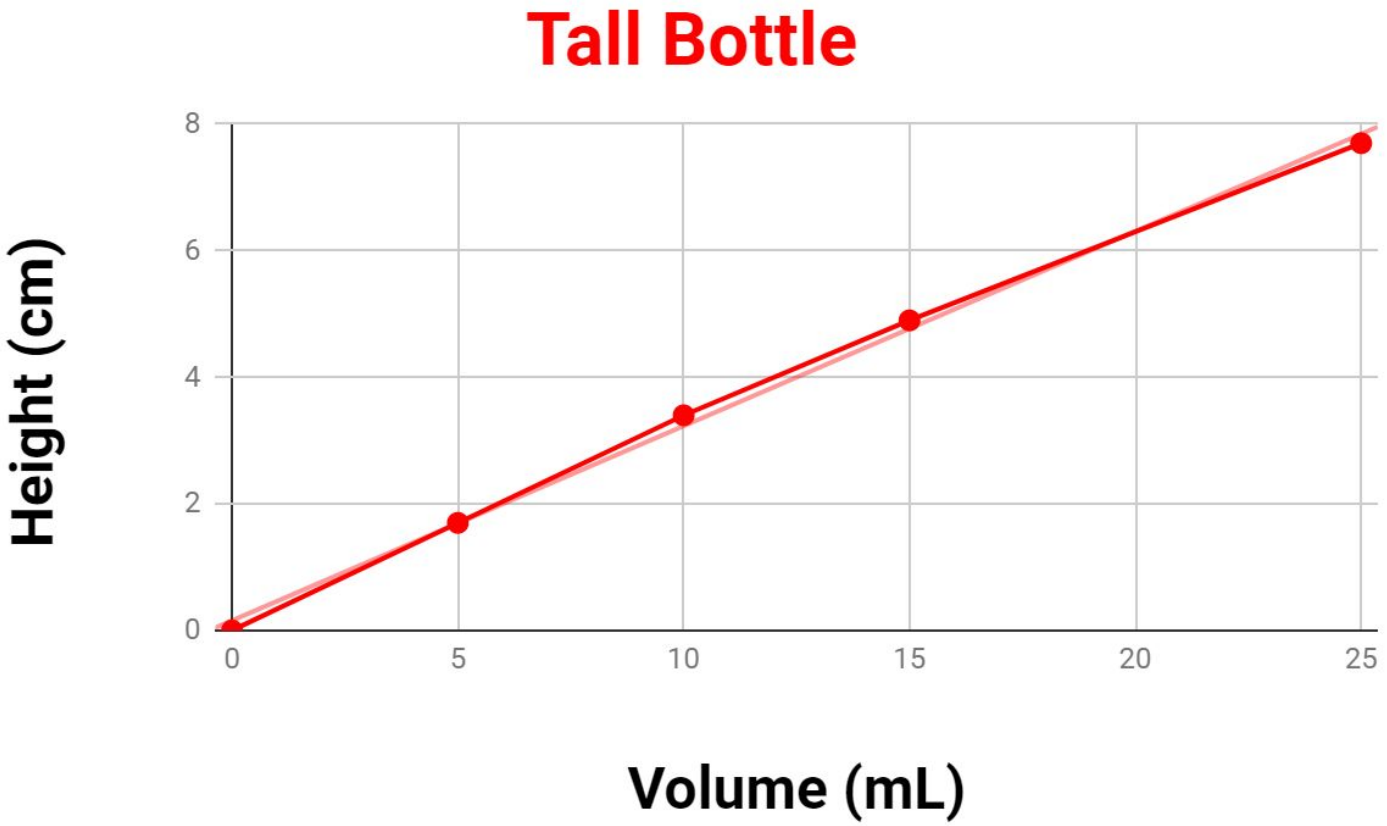
Volume (mL)	Height (cm)
0	0
10	1.2
20	2.4
30	3.7
40	4.9
50	6.1

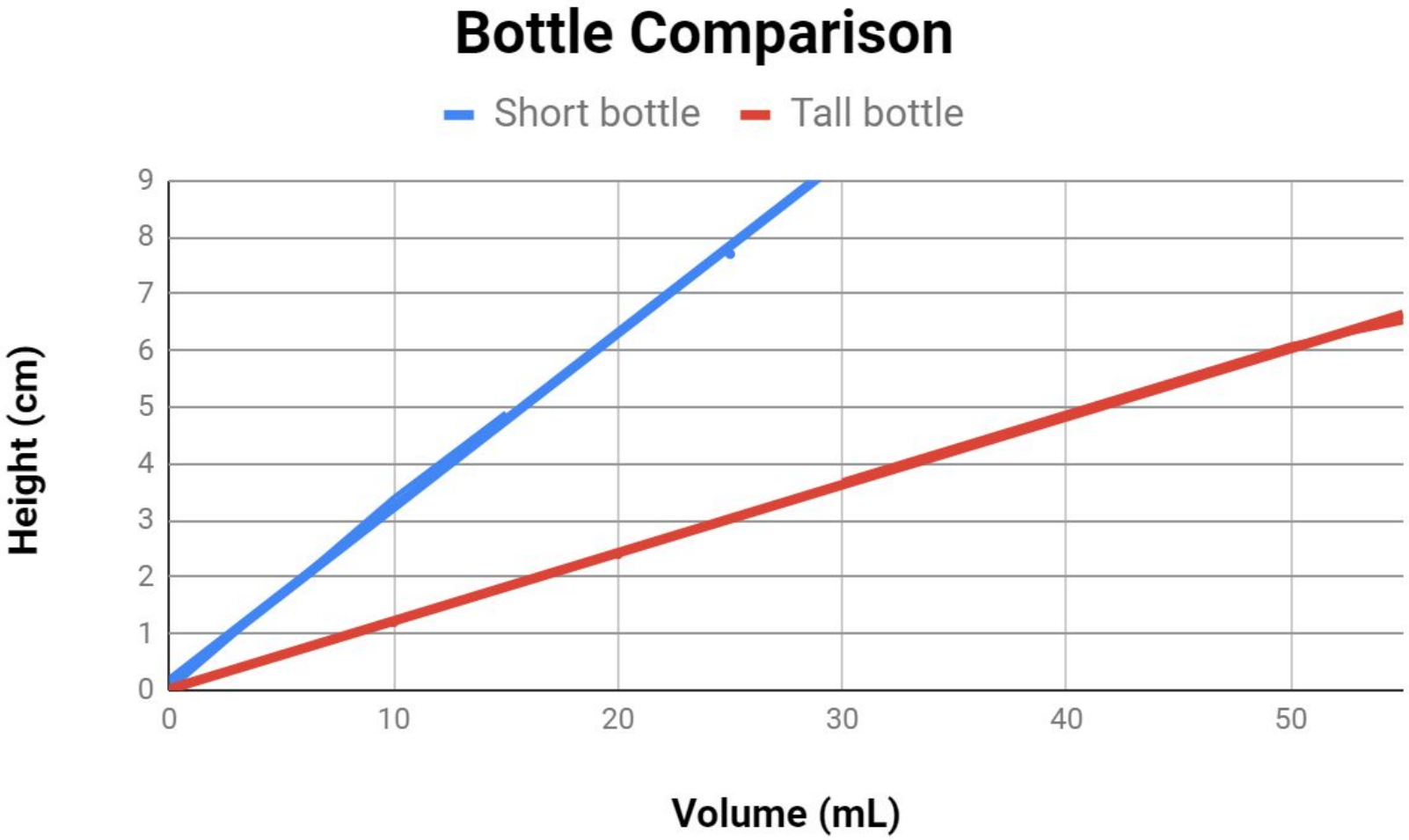



6
5
4
3
2
1


10
9
8
7
6
5
4
3
2
1

Volume (mL)	Height (cm)
0	0
5	1.7
10	3.4
15	4.9
25	7.7

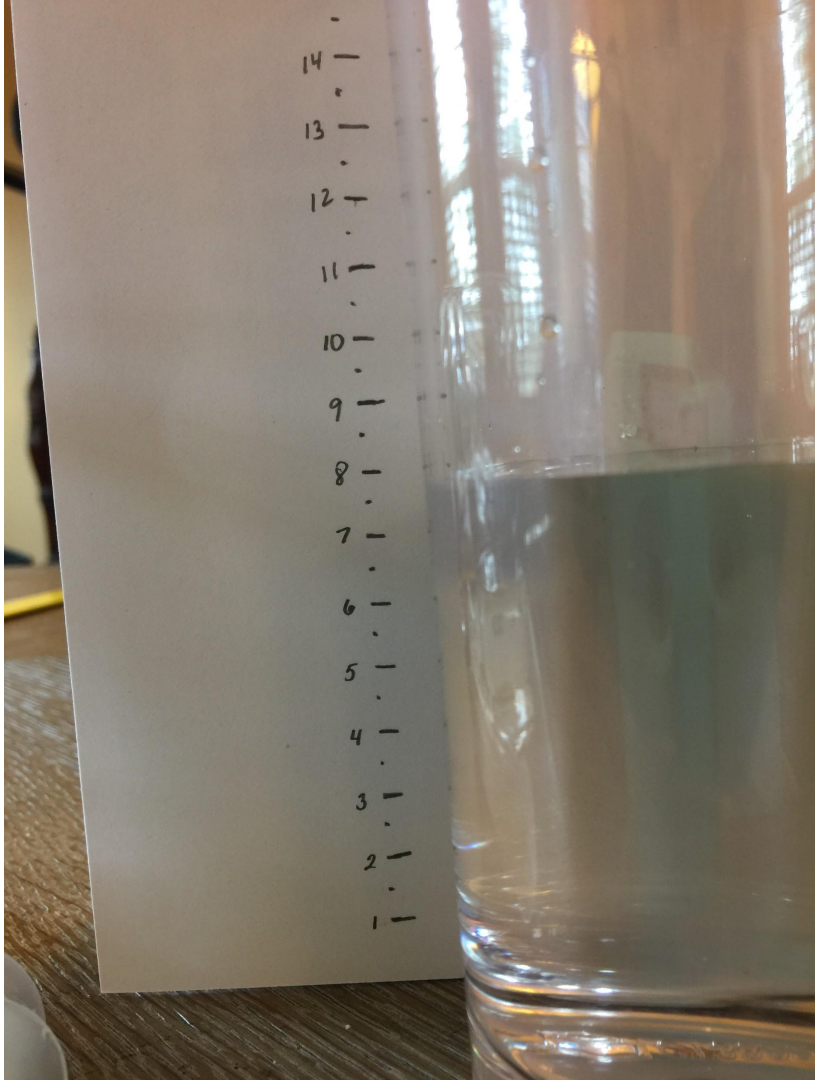



Bottle Comparison
Short bottle
Tall bottle
Height (cm)
0
1
2
3
4
5
6
7
8
9
0
10
20
30
40
50
Volume (mL)

$$V = \pi r^2 h$$

$$\frac{h}{V} = \frac{1}{\pi r^2}$$

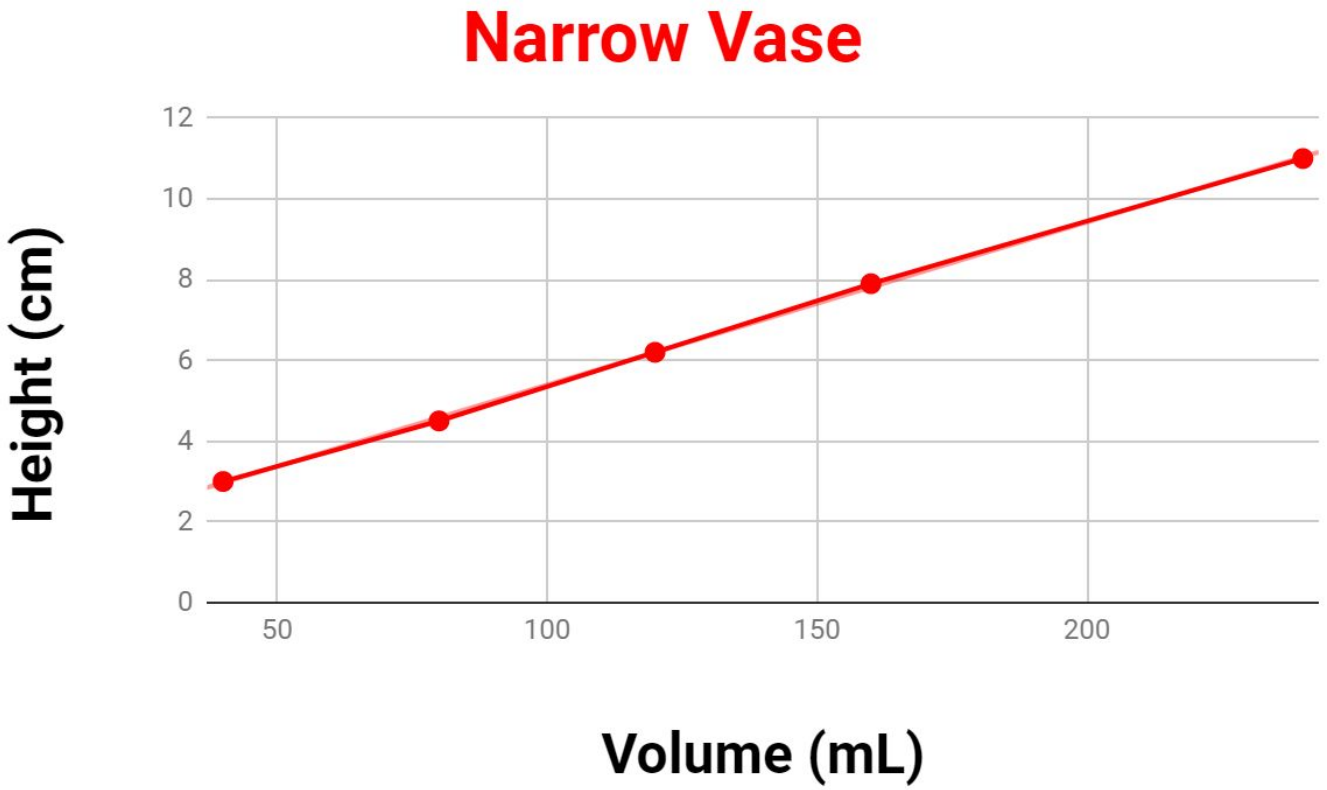
$$\frac{h}{V} = 0.035$$



Volume (mL)	Height (cm)
0	0
40	3.0
80	4.5
120	6.2
160	7.9
240	11.0

$$V = \pi r^2 h$$

$$\frac{h}{V} = \frac{1}{\pi r^2}$$



Slope from volume formula is 0.035 cm/mL
Slope from “rise/run” is 0.040 cm/mL

$$V = r^2 h$$

$$\frac{h}{V} = \frac{1}{r^2}$$

Can a similar prediction be made for the slope (h/V) if the container is square?

What would a student need to do in order to demonstrate this relationship?

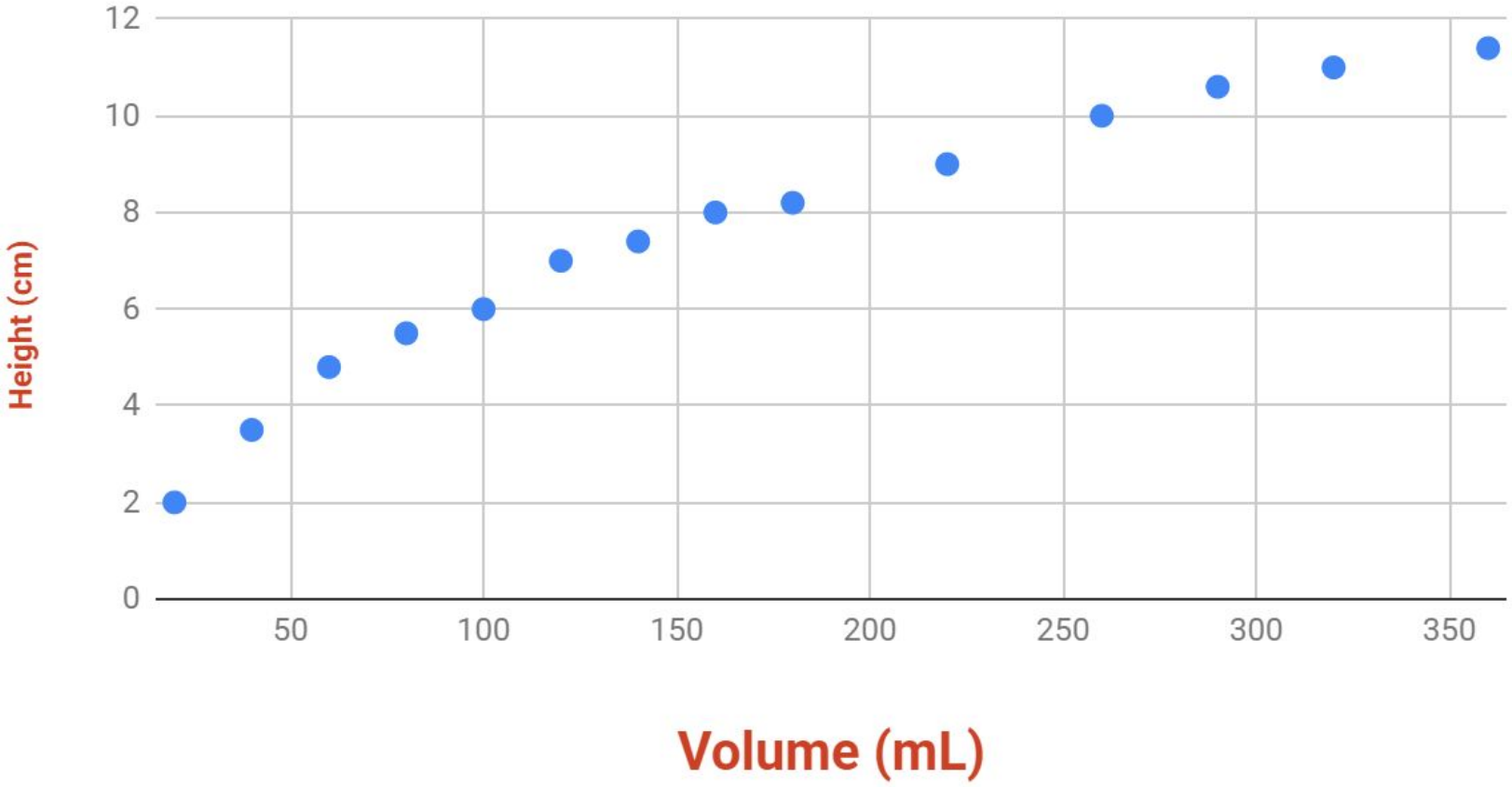
Cone

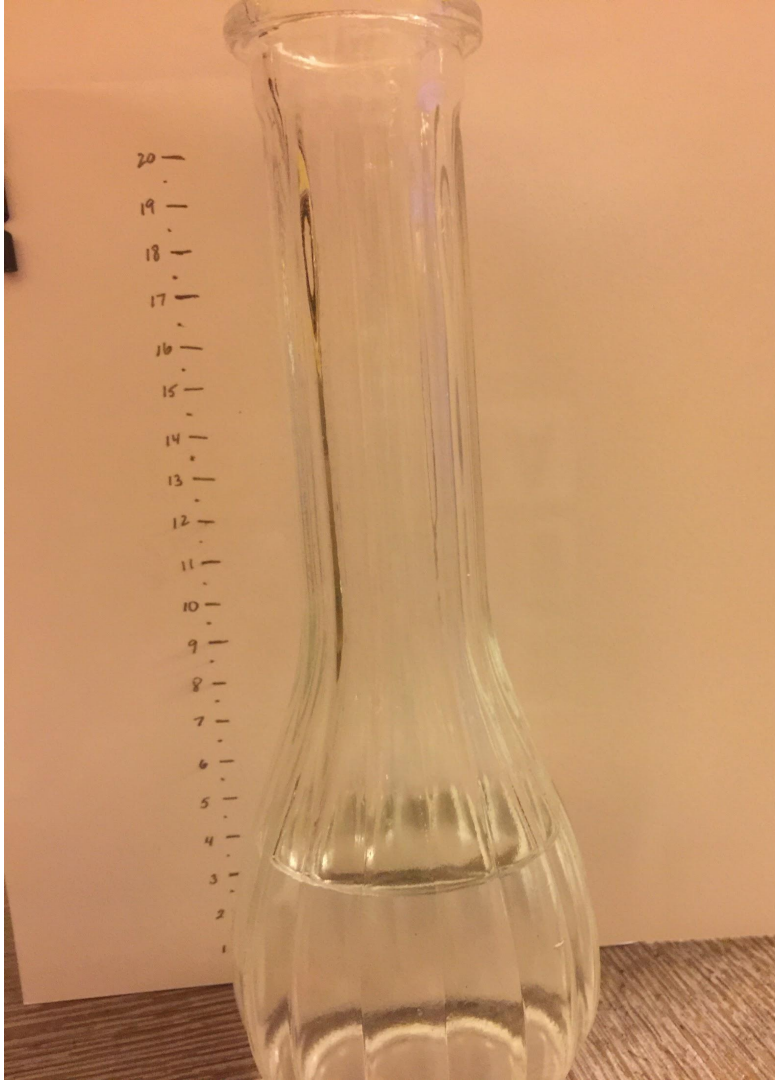
Predictions?

What will your students think?

How to measure the height?

Orange Cone

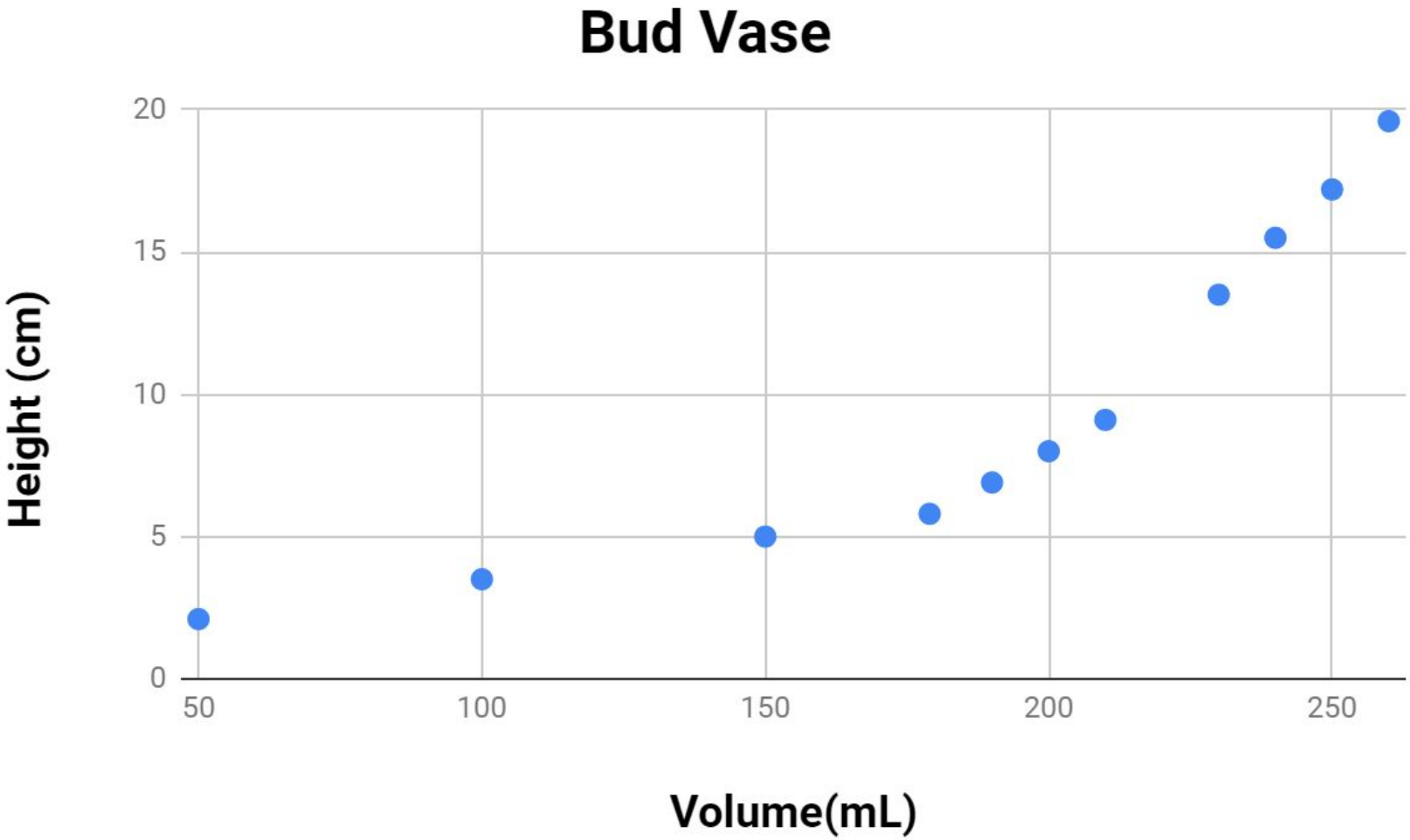




Bud Vase

Predictions?

What will your students think?


Bud Vase
Height (cm)
20
15
10
5
0
50
100
150
200
250
Volume(mL)

Topics:

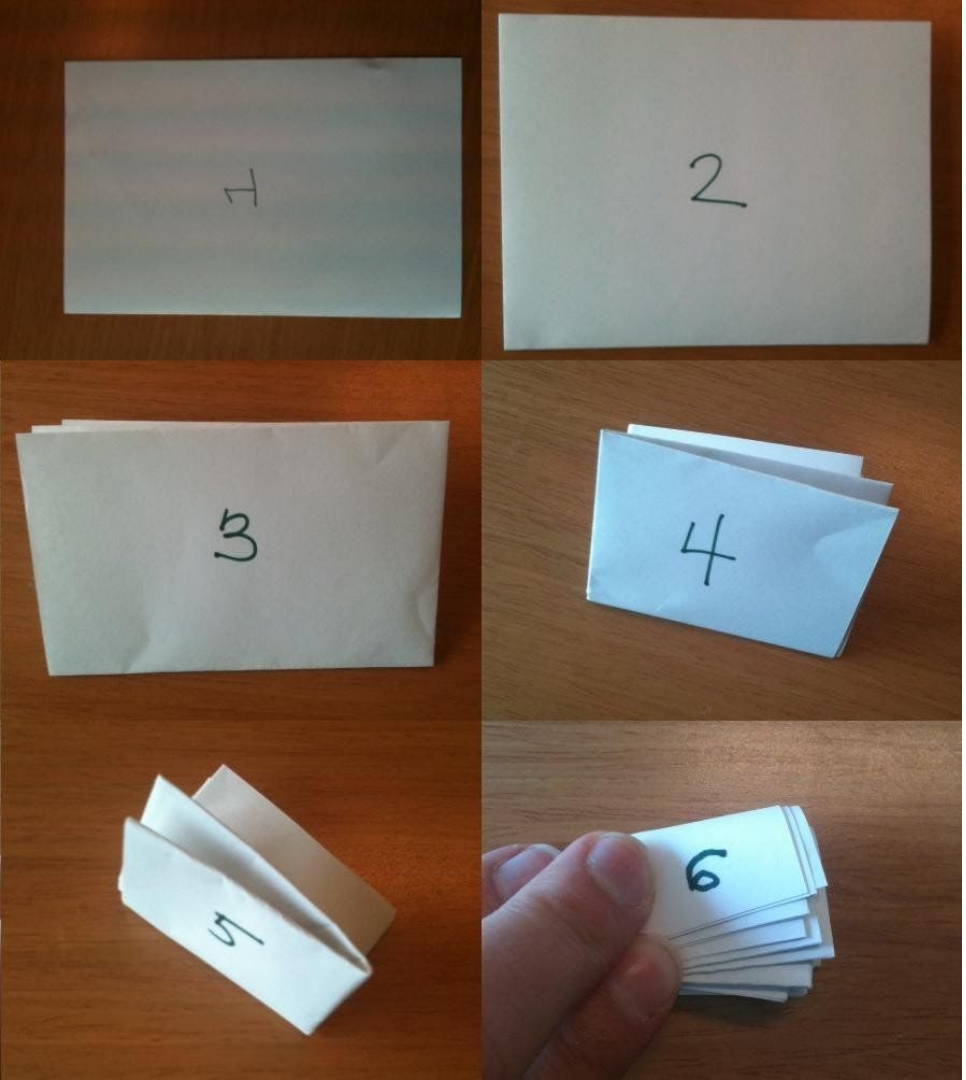
- Plotting points
- Determining equation
- Meaning of slope
- Volume
- Rates
- Measuring
- Data collection
- Accuracy
- Interpolation

If using a spreadsheet:

- Scatterplot of class data
- Generating a graph
- Line of best fit
- Correlation

Falling Rhythm

https://www.exploratorium.edu/snacks/falling-rhythm



www.cpalms.org

Piles of Paper

Really only 7 folds?

$$L = \frac{\pi \cdot t}{6} \cdot (2^n + 4)(2^n - 1)$$

https://www.scienceabc.com/eyeopeners/can-you-really-fold-a-piece-of-paper-only-7-times.html

Inequalities

Directions: Create 5 ordered pairs using the whole digits 0 – 9 exactly one time each.

Then, create a linear inequality such that:

1. Two of the ordered pairs are solutions to the linear inequality.

2. Two of the ordered pairs are not solutions to the linear inequality.

3. One of the ordered pairs is on the boundary line but not a solution to the linear inequality.

https://www.openmiddle.com/linear-inequalities-in-two-variables/

Inequalities

Directions: Create 5 ordered pairs using the whole digits 0 – 9 exactly one time each.

https://www.openmiddle.com/linear-inequalities-in-two-variables/

http://www.graphingstories.com/