Reaching the Breaking Point

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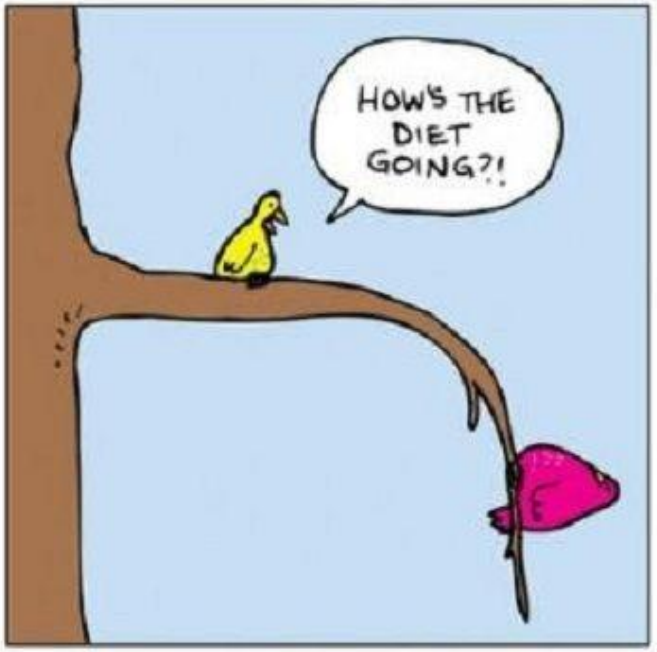
You probably know that a lighter tree climber can crawl farther out on a branch than a heavier climber before the branch is in danger of breaking.



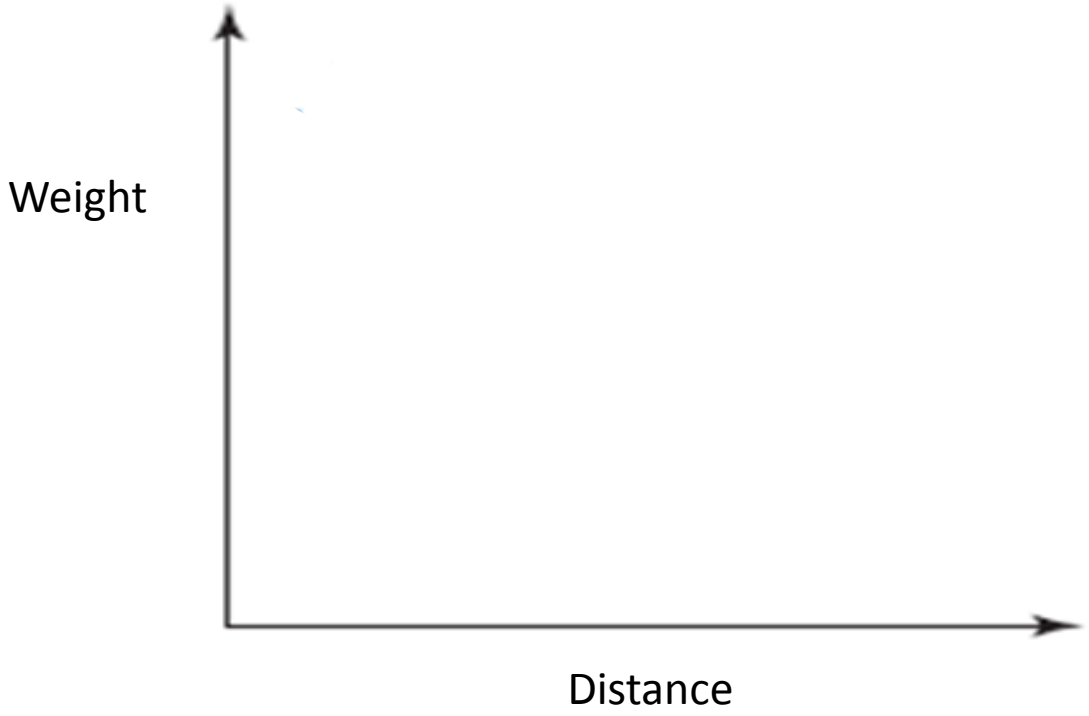

© Photo Workshop Adventures

Question

What is the relationship between the weight of a climber and the distance the climber can safely crawl out on the branch?

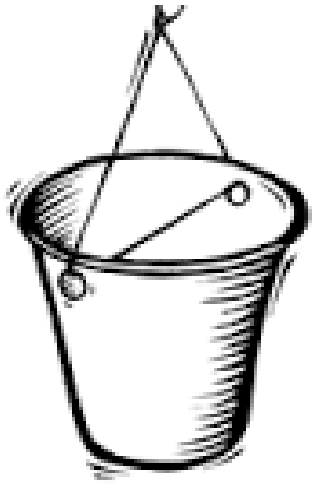
Adapted from *Discovering Advanced Algebra* (Key Curriculum Press), pp. 536-537

Is this relationship linear, like line A, or does it resemble one of the curves, B or C?



Materials Needed for the Experiment

- small paper cup with string threaded through two holes and tied together
- 50-90 pennies
- metric ruler
- scotch tape
- 10-15 pieces of spaghetti
- TI-Nspire handheld



Data Collection

You will be working in groups of two or three. Each group will be assigned spaghetti lengths for which data will be collected and recorded.

- Lay a piece of spaghetti on a table so that its length is perpendicular to one side of the table and one end extends over the edge of the table.
- Hang the cup by the string on the spaghetti about 1-2 cm away from the end of the spaghetti. Use tape to hold the string in place.

Data Collection (cont.)

- Measure the length of the spaghetti **from the edge of the table to the point where the string is holding the cup (not the end of the spaghetti)** and move the spaghetti until it has the assigned length. Use tape to hold the spaghetti in place.
- Place your weights (pennies) into the cup one at a time until the spaghetti breaks. Record the length of the spaghetti and the maximum number of pennies that the spaghetti was able to support.

Data Analysis

- Enter the compiled data in two lists on a TI-Nspire handheld. Let the length (in cm) be the independent variable and the maximum weight that the spaghetti is able to support (in units of number of pennies) be the dependent variable.
- Then create a scatterplot using the Data and Statistics app.

Data Analysis (cont.)

- Find the best mathematical model using statistical analysis and be able to justify the model you selected.

Reflection 1

Does the relationship appear to be linear? If not, describe the appearance of the graph.

Reflection 2

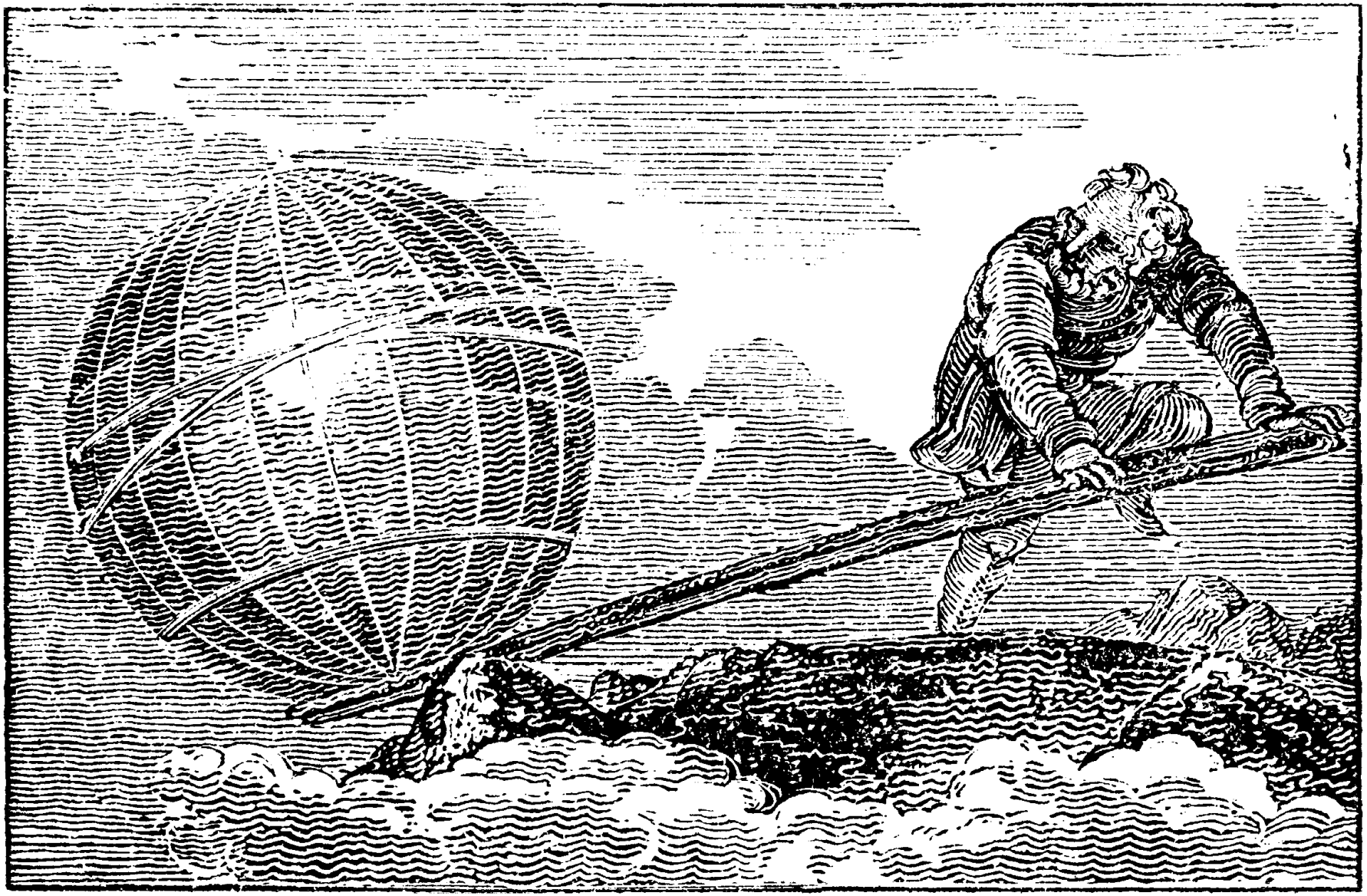
Describe the relationship between the length of the spaghetti and the maximum weight that the spaghetti is able to support.

Reflection 3

Write the mathematical function that describes the relationship between the length of the spaghetti and the maximum weight that the spaghetti is able to support.

"Give me a lever long enough and a place to stand, and I will move the earth."

Archimedes (287-212 B.C.)



Archimedes' Law of the Lever

$$W_L \times D_L = W_R \times D_R$$

Thank you!

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