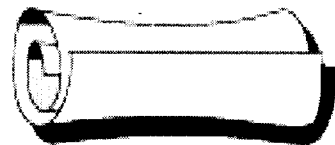


Thickest Piece of Paper in the World

Exponents
Exponential Growth
Problem Solving
Decimals
Scatter Plots



Standards: Problem Solving, Communication, Reasoning, Estimation, Patterns, Algebra, and Measurement

Materials: fx-7400G and 1 piece of notebook paper

Calculator Use: RUN and STAT Menus, OPTN, LISTS, ^ key

A piece of notebook paper is about 0.0032 inches thick. Fold a piece of notebook paper in half. Repeat this procedure 4 times. How thick is the **stack**? How would you calculate the thickness?

Fill in the table below for 6 such folds.

? represents a high level question

Interest made on invested money is an example of exponential growth. Where else have you heard exponential growth mentioned?

How to Reuse Previous Expressions from the RUN Menu

Enter $0.0032(2)^{10}$
Press EXE

To reuse use this expression substituting 15 for 10:

Press right arrow key
move cursor to 0
5
EXE

<u>Number of folds</u>	<u>Thickness of stack (in inches)</u>
0	0.0032
1	A. _____
2	B. _____
3	C. _____
4	D. _____
5	E. _____
6	F. _____

? How fast is the stack's thickness increasing? **G.** _____

Does color of the paper have anything to do with the paper's thickness? **H.** _____

Is all paper the same thickness? **I.** _____ Why or why not? **J.** _____

This type of increase is called Exponential Growth. The general formula is

$$y = a(C)^x$$

where **a** is the initial amount you start with, **C** is the change factor, and **x** is the number of times the change occurs.

The **initial amount** is the thickness of the piece of paper before it is folded. The **change factor** is what is happening to the stack's thickness each time it is folded.

For the paper folding experiment, what is:

the initial amount (**a**)? **K.** _____ the change factor (**C**)? **L.** _____

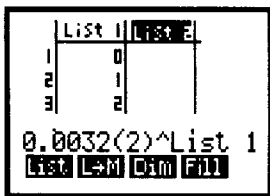
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How to Draw a Scatter Plot

Enter the STAT menu
 Enter the values 0 to 15 in LIST 1.
 Fill LIST 2 using the expression
 $0.0032(2)^{\text{LIST1}}$
 Press QUIT
 F1(GRPH)
 F1(GPH1)

How to Use an Expression to Fill a List.

Highlight the top of LIST 2 as shown below.



With data in List 1,
 Enter: 0.0032
 (2)
 ^
 OPTN
 F1 (LIST)
 F1 (List)
 1

The screen will be similar to the one shown above.
 Press EXE.

How to Alter a Data Graph

Press QUIT
 F1 (GRPH)
 > (right of F4)
 F4 (SET)

Use the arrow keys to highlight the mode to change. For example, if you want your data points to be x's rather than little boxes, highlight **M-Type** and press F2 (x).

Write a formula by substituting your values for **a** and **C** into the general formula $y = a(C)^x$. **M.** _____.

Find the thickness of your stack after ten folds by substituting 10 for **x** in the right side of the formula and solving for **y**. **N.** _____.

What is the thickness after 15 folds? **O.** _____

Convert the 15 fold thickness to feet. **P.** _____

Graphing Exponential Data

In the STAT MENU, enter the number of folds in List 1. Fill List 2 with the paper thickness after each fold. Highlight the top of List 2 and enter $0.0032(2)^{\text{List 1}}$. The results are shown in Figure 1. Graph a scatter plot by pressing

QUIT F1(GRPH) F1(GPH1)

An example of a similar scatter plot is shown in Figure 2.

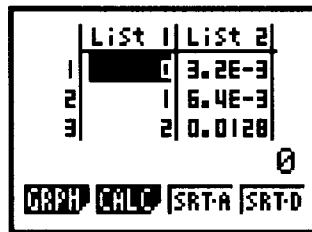


Figure 1

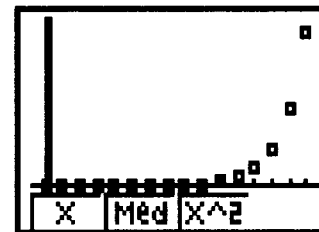
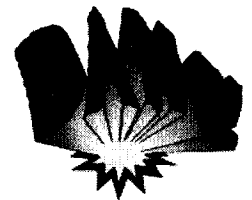


Figure 2

By looking at your scatter plot, would the equation for the data be linear? **Q.** _____

? Explain your response. **R.**

? How would you identify the difference between a linear and exponential model? **S.**



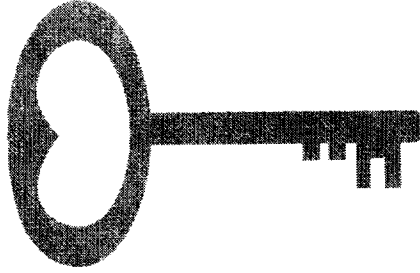
How thick would your stack be after 25 folds? **T.** _____

What unit of measure is best used to express this thickness? **U.** _____
 Why? **V.**

What is the greatest number of folds you can actually make? **W.** _____

Does the size or thickness of the paper used matter? **X.**

Solution Key



Thickest Piece of Paper in the World

- A.** 0.0064 **B.** 0.0128 **C.** 0.0256 **D.** 0.0512 **E.** 0.1024
- F.** 0.2048 **G.** By a factor of 2. It is doubling or multiplied by 2.
- H.** No. **I.** No. **J.** Bonded paper and stock paper are thicker than notebook paper
- K.** 0.0032 **L.** 2 **M.** $y = 0.0032(2)^x$ **N.** 3.2768 inches
- O.** 104.8576 inches **P.** $8.738\overline{13}$ feet **Q.** No.
- R.** Linear data models a straight line. This data models a curve.
- S.** A linear model represents data that takes the shape of a straight line. An exponential model represents data that takes the shape of a curve.
- T.** 107,374.1824 inches
- U.** Miles **V.** Easier to understand. Most people do not realize how large 100,000 inches are.
- W.** 7 to 8 folds **X.** Most definitely.