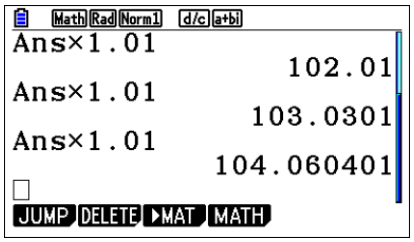
Exponential Explorations

John Diehl
Hinsdale central HS, IL (retired); Casio Teacher Advisory Council

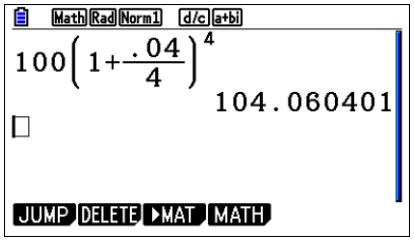
Exploration 1: Money in the Bank

Suppose $100 is deposited in an account earning 4% interest per year.

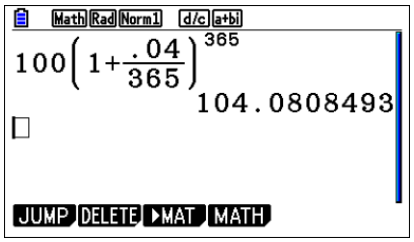
A. Compute the amount of money in the account for each of the first 4 quarters.

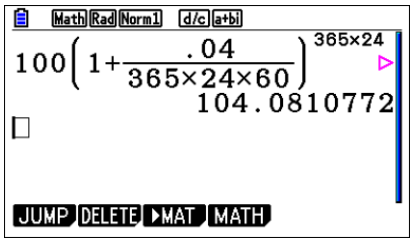


B. Compute the amount in the account after 1 year.

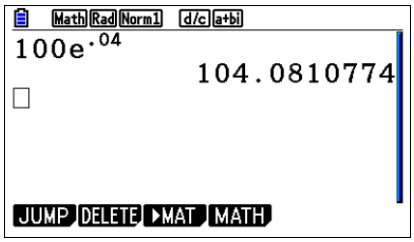


C. How does the amount change if the interest were computed daily? What about every minute?

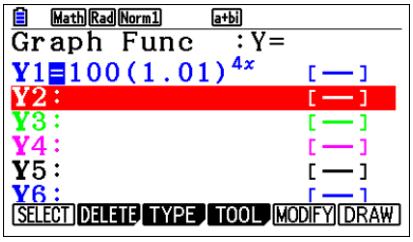




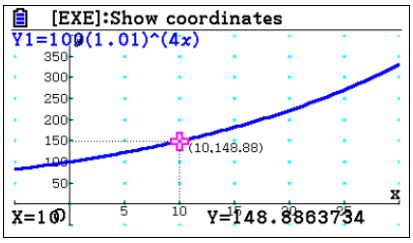
D. Use the formula $A=Pe^{rt}$ to compute the amount after 1 year if the interest is computed continuously.



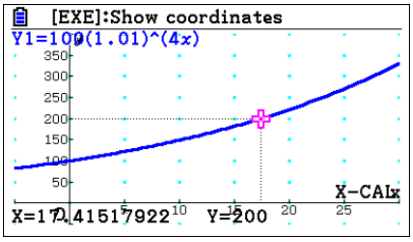
E. Sketch a graph of the amount of money in the bank as a function of time, in years.



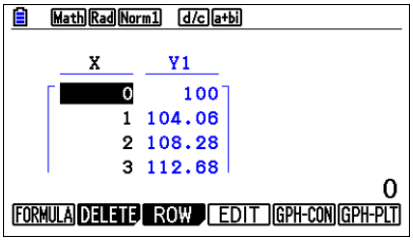
F. Use the graph to compute the amount of money in the account after 10 years.



G. Use the graph to compute how long it will take to double the amount of money.

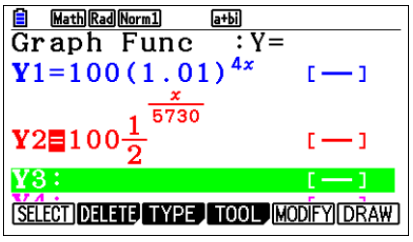


H. Construct a table of values showing years and amount of money.

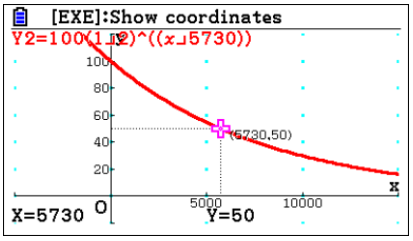


Exploration 2: Mr. Decay

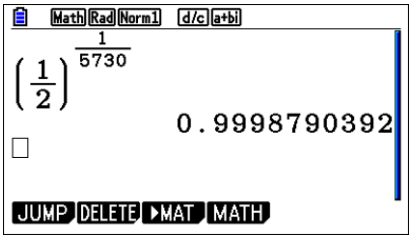
Carbon-14 has a half-life of 5730 years, meaning we expect half of the atoms to decay in that time. Let's illustrate the pattern, starting with 100 atoms.



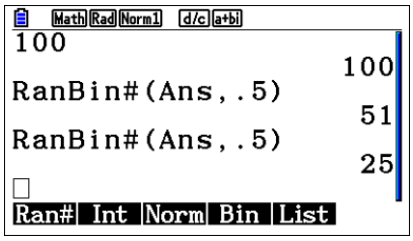
A. Sketch a graph of the number of atoms remaining as a function of time, in years.



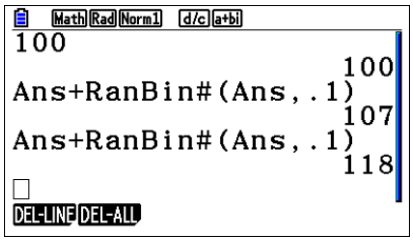
B. What is the base if we rewrite this function in the form $y=ab^x$?



C. Simulate the number of atoms if the decay occurs randomly.

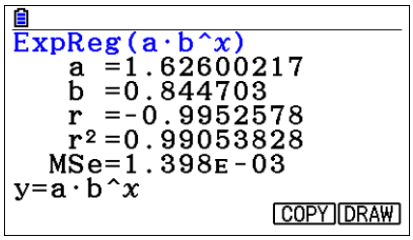


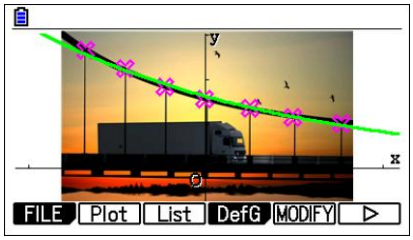
D. Simulate population growth with an initial population of 100 and a predicted growth rate of 0.1.



Exploration 3: Bridge Mix

A. Plot a point at the top of each bridge cable. Use regression to find an exponential model.

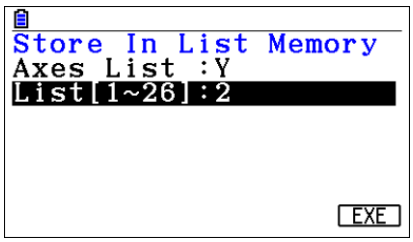




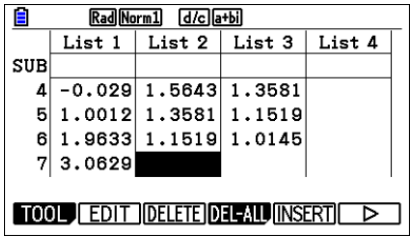
B. Use the 7 ordered pairs to estimate the area under the curve.

Sample solution:

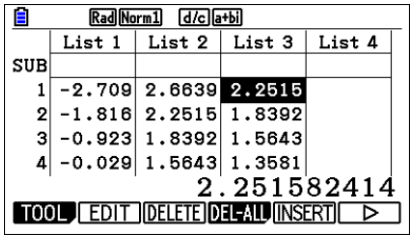
- Store the lists to the list editor



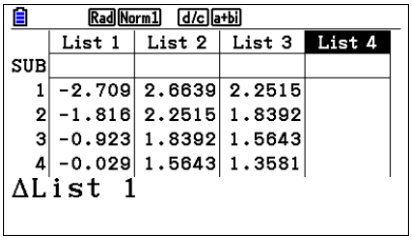
- Copy List2 into List3

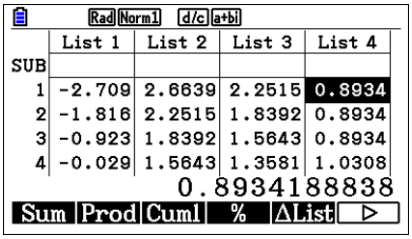


- Delete the last value of List2. It now has the larger base for each trapezoid.
- Delete the first value of List3. It now has the smaller base for each trapezoid.

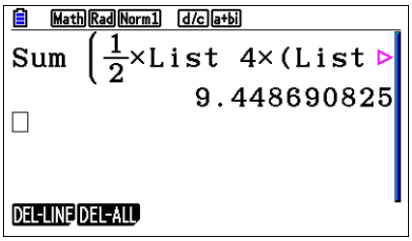


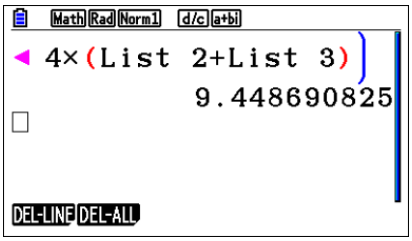
- Define List4 as ΔList1. It now has the height of each trapezoid.





- Compute the total area





C. Use an integral to compute the area, and compare the results.