

Popcorn

Each kernel of popcorn contains a small drop of water. The soft starch is surrounded by the kernel's hard outer surface. As the kernel heats up, the water begins to expand, and pressure builds against the hard starch. Eventually, this hard surface gives way, causing the popcorn to explode. The soft starch becomes inflated and bursts, turning the kernel inside out. The steam inside the kernel is released, and the popcorn is popped!

Standards: Problem Solving, Communication, Reasoning, Connections, Algebra, and Functions

Materials: *CFX-9850G or CFX-9850Ga PLUS*

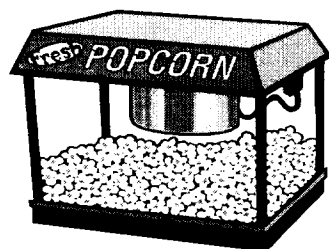
Calculator Menus: RUN and STAT



The oldest ears of popcorn ever found are believed to be 5,600 years old. They were discovered in 1948 and 1950 in the Bat Cave located in west central New Mexico. In tombs on the east coast of Peru, researchers have found grains of popcorn 1,000 years old. The grains have been so well-preserved that they will still pop. In southwestern Utah, a 1,000-year-old popped kernel of popcorn was found in a dry cave inhabited by predecessors of the Pueblo Indians. Ancient popcorn poppers — shallow vessels with a hole on the top, have been found on the north coast of Peru and date back to the pre-Incan Mohica Culture around 300 AD. The above information was found at the Popcorn Institute, Chicago IL (<http://www.popcorn.org/epindex.htm>).

This information indicates popcorn has been around for thousands of years. The Popcorn Institute sponsored a study of popping corn with an air popper and with a hot oil popper. The volume of popcorn generated is influenced by the amount of moisture present in the popcorn.

One study done by D. D. Metzger investigated the two methods of popping corn where different amounts of moisture were present in the corn. They performed the experiment 3 times for each moisture level and the average results are presented in Table 1 where the volume is represented by the number of cubic centimeters of popcorn per gram of kernels.



Altering the StatGraph Settings

In the STAT Menu
Press F1 (GRPH)
F6 (SET)
Highlight setting to change.
Use F1-F6 to alter settings.

Popcorn History

Popcorn probably originated in Mexico, but it was grown in China, Sumatra and India years before Columbus visited America. It is believed that the first use of wild and early cultivated corn was popping.

Moisture %	Air Popped Volume	Oil Popped Volume
7.9	27.7	23.3
8.8	32.3	27.5
10.8	45.0	39.5
13.0	51.6	43.2
14.6	58.0	44.5
16.3	53.5	40.0
18.3	40.1	30.4

Table 1

Popcorn

Entering Data in a List

In the STAT Menu
Place the cursor in row 1
column 1 of List 1.
Enter the desired value
Press EXE key
Repeat process.

Deleting a List

In the STAT Menu
Place the cursor List to
delete.
Press F6 (▷)
F4 (DEL-A)
F1 (YES)

Turning On Multiple StatGraphs

In the STAT Menu
Press F1 (GRPH)
F4 (SEL)
Highlight StatGraph and
use F1 or F2 to turn on or
off.
Press F6 (DRAW).

Getting Quadratic Regression Values

In the STAT Menu
Press F2 (CALC)
F3 (REG)
F2 (X²)

Metzger, D. D., K. H. Hsu,
K. E. Ziegler, and C. J.
Bern. "Effect of moisture
Content on Popcorn Popping
Volume for Oil and
Hot-Air Popping" *Cereal
Chemistry* 66 (3), 1989:247-
248.

From the data presented in Table 1, what amount of moisture provides the greatest volume of popcorn per unit? **A.** _____

Which popping method gives the greatest volume of popcorn? **B.** _____

What moisture change results in the greatest modification in popcorn volume? **C.** _____

In the STAT Menu on the CFX-9850G. Enter the values from Table 1 into LISTS 1-3 where List 1 is the Moisture %, List 2 is the Air Popped Volume, and List 3 is the Oil Popped Volume.

Establish a scatter plot in Graph 1 (GPH1) using List 1 as the Xlist and List 2 as the Ylist and a scatter plot in Graph 2 using List 1 as the Xlist and List 3 as the Ylist.

You want to graph both scatter plots on the same screen.

Press F4 (SEL)
Highlight StatGraph1 and press F1 (ON).
Highlight StatGraph2 and press F1 (ON).
Press F6 (DRAW). See Figure 1.

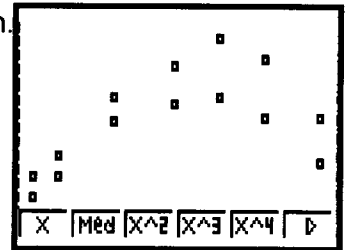
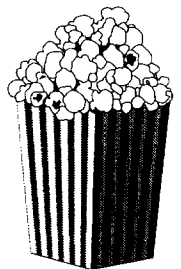


Figure 1

You want to draw the line of best fit for both scatter plots. With Figure 1 on your screen:

Press F3 (X²). The top left corner of the screen indicates which StatGraph is selected. Press EXE key followed by F6 (DRAW) to graph the line of best fit for the selected StatGraph. To graph the other StatGraph, press F3 (X²) and arrow down to select the remaining StatGraph. Press EXE key followed by F6 (DRAW) to graph the line of best fit for this selected StatGraph.

Describe the two lines of best fit for the data. **D.**



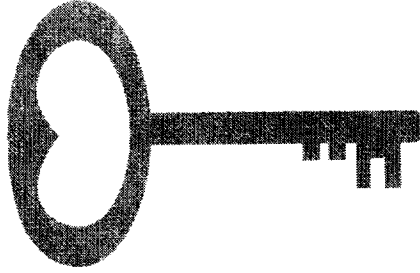
Which of the two lines of best is most accurate for the given data? **E.**

Conduct an experiment with both types of popcorn poppers. Which one provides the greatest volume of popcorn? **F.**

Which popcorn tastes better - - from the air popper or from the hot oil popper? **G.**

Which type of popcorn is more economical? **H.**

Solution Key



Popcorn

- A.** 14.6%
- B.** Hot air.
- C.** Between 8.8 and 10.8%. Notice that the increase in moisture is not linear.
- D.** Parabolas opening down.
- E.** StatGraph2, Moisture vs Oil
- F. - H.** Answers will vary.