Calculate Success!
Middle School Activities with the TI-73

How Much Will I Spend?
The Calculator Game
My Calculator, CBL and Me

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Paul and Chris were in the mall, studying a large gum ball machine. They noticed that there were 7 colors of gumballs. Chris thinks he can spend 7¢ and have a gumball of each color. Paul doesn’t think that is very likely and is quite sure he will spend at least a dollar to get all seven colors.

How many pennies do you think it would take to get a gumball of each color?

We will suppose that the gumballs are evenly distributed and that one gumball will be purchased for each penny put into the machine. We will simulate this problem by using the random number generator on your calculator.

<table>
<thead>
<tr>
<th></th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
<th>Trial 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Blue</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>2.</td>
<td>Green</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>3.</td>
<td>Orange</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>4.</td>
<td>Pink</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>5.</td>
<td>Red</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>6.</td>
<td>White</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
<tr>
<td>7.</td>
<td>Yellow</td>
<td>________</td>
<td>________</td>
<td>________</td>
<td>________</td>
</tr>
</tbody>
</table>

Total Cost   ________  ________  ________  ________  ________
How Much Will I Spend?

Objective:
In this activity students will discover about how much they would spend to get one each of the seven different colors of gumballs from a gumball machine. The gumballs are randomly distributed. One variable statistics will be calculated, the data recorded in a list will be graphed as a box-and-whisker plot and analyzed.

Materials:
TI-73 Calculator
Gumball Machine (optional)

Procedure:
1. It may be necessary to seed the random number generator before beginning the activity. This is done as follows: Type the last four digits of your phone number and store in rand. That is, \(1234 \ X\ 1 \ \forall \ \Psi:\ \text{rand, } \beta\).
2. Press 1!!Zto paste randInt (on the home screen). Type \(\Psi \Y\, \delta\E\) to represent the seven colors of gumballs. Press \(\beta\) to get the first random integer. If the first number is a two, then with your first penny you got a green gumball. See recording sheet. Put a tally mark next to the number that you got. Press \(\beta\) again and continue until you have a tally by each of the seven colors. Count the tally marks to see how many pennies you spent on the first trial. Record the total tally marks.
3. Each student should run 5 trials.
4. Each student will read aloud the number of pennies spent on each trial as everyone records those numbers in List 1 of their calculator. To do this press 3, then arrow below the headliner of L1 to enter the data. If L1 has values in it, arrow to the headliner, press : \(\beta\). Now data can be entered.
5. When all calculators have the data, scroll through the list and discuss the maximum and minimum number of gumballs that were purchased. Discuss how the list could be used to find the median. The calculator will order the numbers in a list. Press \(-\ X\ \forall\) where the options are 1: to sort ascending order or 2: sort in descending order. If we press \(\beta - 3 \ \beta\ E\ \beta\) to let the calculator know what list we are sorting, the calculator will indicate that the sorting is Done. Press 3 to see the data in ascending
order. Now the maximum and minimum values are easy to locate. How many entries do you have? Then what number in the data list is the median? The middle number if the list has an odd number of data points or the average of the two middle numbers if you have an even set of data points represents the median.

6. Other statistics related to this data could be calculated. Press $-\lambda$ to get on the home screen (calculating screen). Press $-3\forall\forall[ - 3 \beta \varepsilon \beta$ to obtain the mean of the list.

7. Return to $-3\forall\forall$ to see other values of your data that can be calculated.

8. An appropriate graph with this one data list would be a box-and-whisker plot. Press $-\varepsilon \beta$, turn the plot On and choose the last icon type, which is a box and whisker plot with outliers. For Xlist select L1, by pressing $-3\beta$. Freq should be 1. Press $(\vartheta$ to view the box-and-whisker plot. Now by pressing ) the visual of the median is displayed. Half of the trials are represented to the left of this line, while the other half are represented on the right. Trace left !to obtain Q1, which stands for Quartile 1. This value indicates that $1/4^{th}$ of the trials were less than this value. A second trace to the left gives the minimum number of gumballs purchased. Tracing to the right $\forall$ will indicate Quartile 3. This value indicates that $1/4^{th}$ of the trials were greater than this value. Another trace to the right will display the maximum number of gumballs purchased. Each section of the box-and-whisker plot represents $1/4^{th}$ of the trials.

**Conclusion:**
Have students sketch the box-and-whisker plot and label the values at each quartile. In their own words, explain the graph and what the statistics that have been gathered mean to them. Class discussion of this activity might include prizes given by fast food restaurants or prizes put in cereal boxes and how manufacturers use this idea for marketing.

**The Calculator Game**

**Objective:**
Students will be timed printing the word “calculator” as many times as possible in 10-second intervals. They will enter their data into lists and graph a scatter plot and look at the line of best fit.
Materials:
Graphing Calculator
Stop Watch or Untimer Program on calculator
Recording Sheet

Procedure:
1. Link the Untimer Program on each calculator.
2. Students should work in pairs. One student will time, using the Untimer Program, and verify the word counts as the other prints the word “calculator” as many times as possible in the allotted time. The time will be 5-second intervals and the words will be counted to the nearest tenth of a word. Note: There are 10 letters in the word “calculator”, so record to the nearest tenth of a word.
3. After each trial the data will be recorded on the Recording Sheet.
4. Students will switch roles so that each team member gets individual data.
5. When the data has been collected, the students will calculate the number of words per second for each period that time was collected. Discuss how to find the number of words per second, then check that each student is calculating correctly. Did everyone write at the same rate? Did you have the same rate for each period of time? Average the rates for each of the timed periods. Are all of your averages the same?
6. When the data has been collected, the students will input their data into two lists. The lists will be named “TIME” and “WORDS”. In list “TIME”, they will input 0, 5, 10, 15, 20, 25, and 30. In list “WORDS” they will input the number of words for each of the timed periods.
7. Set up the scatter plot by pressing −, ε, β. Set up plot 1. Set up an appropriate window by pressing ‐ and selecting values for x (number of seconds) and y (number of words), as shown. Then press *.
8. Does there appear to be a correlation in the data? If so, what type of correlation? Did you write at a constant rate?

9. To find the trend of the points and to find an average rate, we will use the formula $y = r \cdot x$, where $y$ is the number of words, $r$ is the rate and $x$ is the time in seconds. **Words = \text{words/sec} \times \text{number of seconds}**. In &, write $y = r \cdot x$ using the text editor. Then substitute in your calculated average rate that you calculated for $r$. Press * after the equation is written.

10. What does the value “$r$” mean? In the graph above, it means that .41 or about .4 of a word was written per second. This could also be interpreted as 4 letters per second.

11. Use this “line of best fit” and the table of values that it generates, by pressing =*. From the table determine the number of words that you could write in 5 minutes (300 seconds). Compare the values between students. How realistic do you think this value would be?

**Conclusion:**
Students enjoy competition. This activity helps the student understand unit rates. Middle school students may not understand the meaning of the equation of a line, but they do work with formulas and with trend lines. It might be interesting to compare student’s graphs, especially the slopes, and have the students discuss the differences.

<table>
<thead>
<tr>
<th>RECORDING SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TIME</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>
My Calculator, CBL and Me

Objective:
To gather data using the data logger, CBL and a temperature probe. Students will interpret a line graph created over a given period of time.

Materials:
TI-73 Calculator
CBL with temperature probe
Unit-to-unit link cord
TI-Graph Link and Computer (optional)

Procedure:
1. Students will work in groups of 2 or 3 for this activity. Each group will have a calculator, CBL and temperature probe.
2. Press the 9 key on the calculator. From this menu select 2:CBL/CBR and from the CBL/CBR App menu select 2:DATA LOGGER.
   Since we are using a temperature probe, set up the screen as follows.
   ![Screen Setup](image)
   In this case temperatures will be taken every 15 seconds and 60 samples will be taken. Therefore, this will be a 15-minute activity. This could be altered to fit class schedules. We have selected Fahrenheit for this activity, however Celsius would be appropriate. We also selected Real Time, meaning that the graph will appear as the data is collected. With the directions On, follow the program.
3. Students may go to various places to collect data.
   Some suggestions for the probe: (a) a cup of hot coffee, (b) an ice pack from the clinic, (c) ice water, (d) a car or the trunk of the car, (e) soil, or (f) see what the students will do. Students need to be informed about cleanliness and putting the probes in their mouths.
4. After 15 minutes a graph will be displayed on the calculator.
   A. Students might transfer their data to an overhead calculator. They will find their data is stored in lists named TEMP and TTEMP (for time).
   B. Students might use graph link and print their graphs as well as a description using the computer. See below.

**Conclusion:**
This is a great activity for integrating math, science, and health classes. Students enjoy telling the class the story of their data collection. The overhead calculator works well for showing the class.

**Student Sample**

Our probe was put in the back seat of a car about 3:00 in the afternoon. We started collecting data as we left the building. Notice that the beginning temperature was 77.6°F. In 75 seconds the temperature was 99.4°F, which was the approximate outdoor temperature. We closed the car door and collected data for the remaining 15 minutes. In just ten minutes the temperature was 126.4°F. The temperature peaked at 129.5°F as the last data that was collected.

This activity really made us think about the affects of leaving a child in a car for just a short time. The temperature rose very quickly.