ALGEBRA I ACTIVITY 16:
SIMULATING COIN TOSS PROBABILITY
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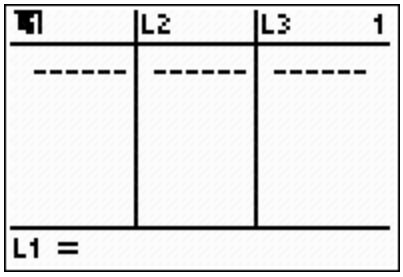
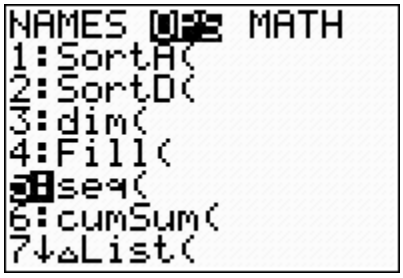
ACTIVITY OVERVIEW:
In this activity we will

- Use sequence command and random integer command to simulate a coin toss experiment
- Use operations on lists to analyze the experimental probability of getting heads
- Create a scatter plot to examine how the experimental probability changes as number of trials increases

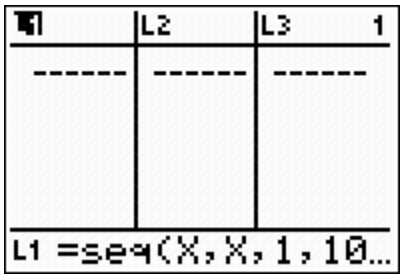


How does the probability of getting heads when tossing a coin change in an experiment as the number of trials increases? Use the calculator to simulate a coin toss to see.

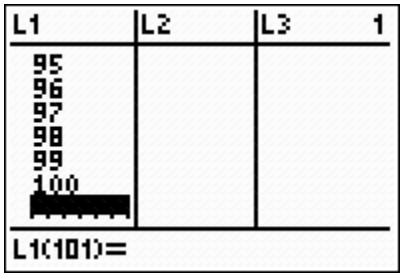
Press [STAT] [ENTER] to access lists. Arrow up to the top of L1 as shown above. Press [2nd] [STAT], arrow over to **OPS** (operations) menu and select **5:seq(**. When you press [ENTER] this command will be pasted to the command line for L1.



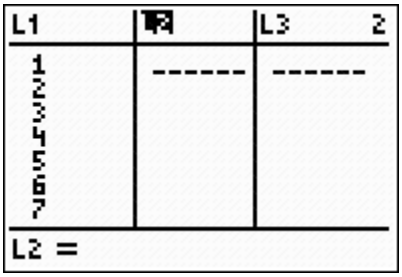
Complete the command **Seq(X,X,1,100,1)**. This will instruct the calculator to fill the list by evaluating the expression X for variable X with values 1 to 100 counting by 1's. This will keep track of how many times the coin has been tossed up to 100 times.



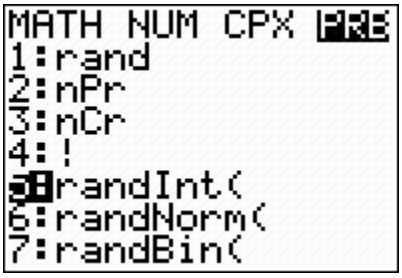
Press [ENTER]. Press the up arrow twice to loop to the bottom of the list and see that the final entries appear as shown.



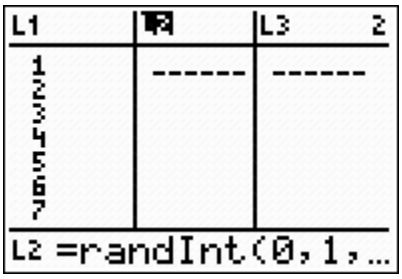
Arrow to the top of L2.



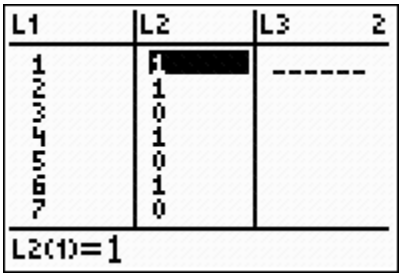
Press [MATH]. Arrow over to the **PRB** (probability) menu and select **5:randInt(**. When you press [ENTER] this command will be pasted to the command line for L2.



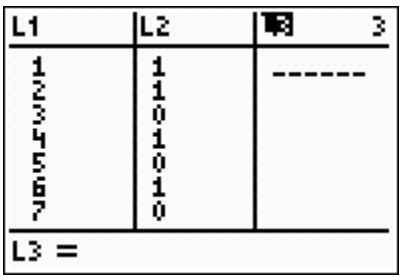
Complete the command **randInt(0,1,100)**. This will instruct the calculator to randomly generate a list of integers 0 and 1. In the simulation, 0 will represent tails and 1 will represent heads.



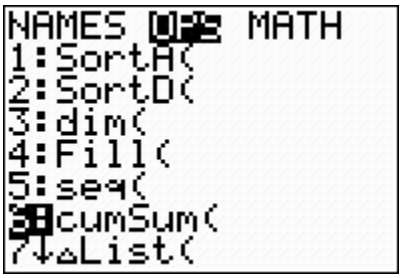
Press [ENTER]. Did you get heads the first time (1) or tails (0). [**NOTE**: Your numbers should not be identical to those shown. From this point on your numbers and screens will vary from those shown.] After one trial, what was your experimental probability to tossing heads? After two trials? Three?



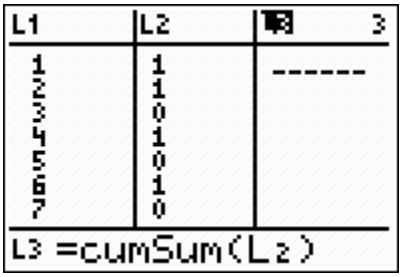
Allow the calculator to calculate the experimental probabilities after each toss. Arrow to the top of L3. You will instruct L3 to keep track of how many heads have been achieved after each toss.



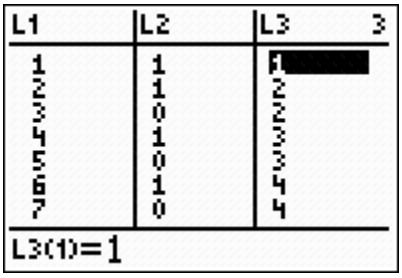
Press [2nd][STAT]. Arrow to **OPS** and select **6:cumSum(**. When you press [ENTER] this command will be pasted to the command line for L3.



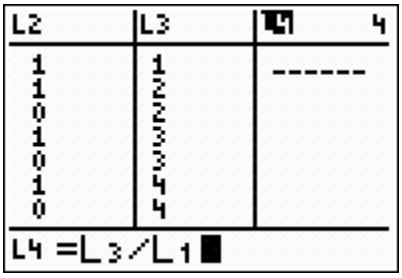
Complete the command **cumSum(L2)**. Remember, to access the name for L2 press 2nd 2. This will instruct the calculator to sum L2 after each toss.



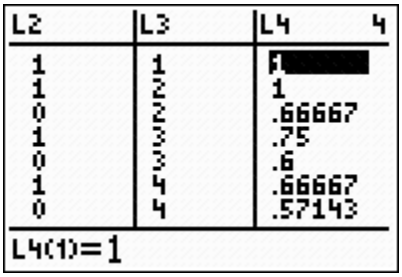
Press ENTER. L3 now represents the total number of heads. Examine the sums. After how many tosses had you achieved 4 heads?



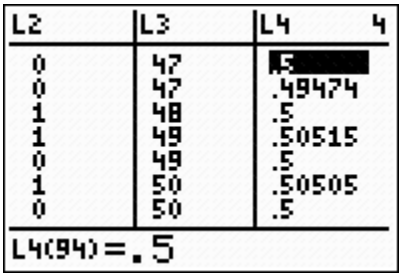
To find the experimental probability of getting heads after each toss in the sequence of 100 tosses, you would divide the total number of heads (L3) by the number of trials (L1). Arrow to the top of L4. Enter the command as shown.



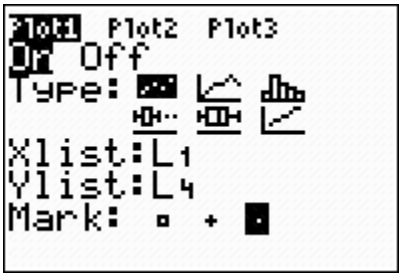
Press ENTER. L4 now represents the ratio of number of heads to number of tosses, or experimental probability. Everyone has a probability of either 1 or 0 after the first toss. Why? How do the probabilities change after that?



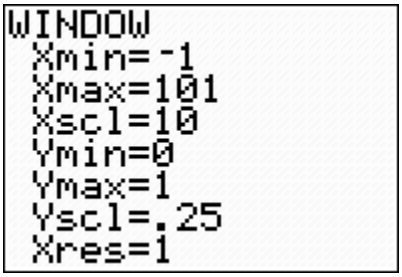
Press the up arrow twice to loop to the bottom of the list. Scroll to examine how the probabilities appear as you approached 100 tosses. What do you notice? Why?



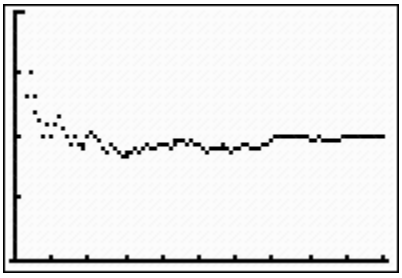
To make a visual examination of how the probabilities changed as the number of trials increased, set up a scatter plot. Press 2nd Y= 1. Turn the Plot 1 **On** by pressing ENTER, and set the other items as shown.



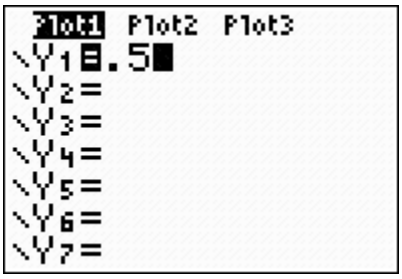
Press WINDOW. Set the window as shown.



Press GRAPH. What do you observe about the shape of your graph? How does it compare to the shapes of your classmates graphs?



What is the theoretical probability of tossing heads in a coin toss? Press Y= and enter the theoretical probability into Y1. This will graph a horizontal line to represent this probability so you can observe how it relates to the experimental probability.



Press GRAPH. What do you observe about the probabilities from your experiment versus the theoretical probability?