Session #328, Beatini
Hand-Held Technology + Hands-On Activities = CCSS Success!

Algebra
"Double Your Pleasure" Lab

Name(s):

Period: Date:

Conducting the Experiment:

1. Put 4 M&Ms in a cup.

2. Pour the candies onto a sheet of paper. Count the number of M's showing. **Add TWICE this number of M&Ms to your pile.** Record the new total of M&Ms. This constitutes one trial.

3. Return the M&Ms to the cup. Repeat step 2 until you don't have enough to add the appropriate amount.

4. Record your results in a table.

TRIAL NUMBER	NUMBER OF M&Ms	CLASS DATA	MEAN

Analyzing the Data:

5. Collect data for the entire class.

6. Find the mean number of M&Ms for the class for each trial number.

7. Make a graph of the mean number of M&Ms versus the trial number. Let x = the trial number.

8. Discuss the characteristics of your resulting graph.

9. Predict how many trials it would take to have more than 500 M&Ms. Explain how you made your prediction.

10. How would your graph be affected if you started with 10 M&M's instead of 4?

Algebra
Radioactive Decay Simulation

Name(s):

Period: Date:

Materials: paper plate, small cup of M&M's, plastic baggie

The particles that make up the atoms of radioactive elements are unstable. In a certain time period, the particles change so that the atoms will become a different element. This process is called **radioactive decay**. The M&M's represent atoms. Each time you repeat the procedure counts as one year.

Investigation

1. Pour the M&M's onto the paper plate so that the candies are one layer thick. Inspect the candies. Eat those candies that *do not* have an "M" showing on one side (Look closely at the yellow ones because the "M" is hard to see.). For our purposes, the candies we use ***must*** be marked. Count the marked M&M's. Write this number in your table as your starting value.

2. Put all the marked candies into the cup and dump them onto the plate so that the candies are one layer thick.

3. Count all the M&M's with the "M" showing and put them into the baggie. These represent atoms that have decayed, so they are safe for you to eat later.

4. Count the remaining M&M's and record this number in your table. Put them back into the cup.

5. REPEAT STEPS 2,3, and 4 UNTIL ALL THE M&M'S ARE REMOVED. Use as many trials as you need to complete this task.

Time (years)	**Number of M&M's Remaining**	**Ratio**
0		
1		
2		
3		
4		
5		
6		
7		

Analysis

A. Let x represent elapsed time in years, and let y represent the number of M&M's remaining. Use an appropriate viewing window and make a scatter plot of the data. What do you notice about the graph?

B. Calculate the ratio of M&M's remaining between successive years. That is, divide the number of M&M's after year one by the number of M&M's after zero years; then divide the number of M&M's after two years by the number of M&M's after one year; and so on. How do the ratios compare?

C. Choose one representative ratio. Call this ratio *r*. This ratio represents the fraction of M&M's remaining. Explain how and why you made your choice.

D. At what rate did your M&M's decay?

E. Write an exponential equation that models the relationship between time elapsed and the number of M&M's remaining.

F. Graph the equation with the scatter plot. How well does it fit the data?

G. In your equation, what is the real world meaning of your value for a? Explain!

H. In your equation, what is the real world meaning of your value for b? Explain!

I. Using your calculator, find the best fit exponential model, accurate to three decimal places. Write this equation for the best fit exponential model. Graph it. How well does it fit the data?

K. Consider the connection among the numbers in **your** model. How are these numbers related to the number of M&M's you started with?

L. How many years did it take until about half of the original number of M&M's remained?

M. Theoretically, what do you think your value for *r* should have been?

N. Can you account for any difference between your experimental value and the theoretical value for r?

Algebra
Radioactive Decay Simulation (Sector)

Name(s):

Period: Date:

Materials: paper plate with a marked central angle, small cup of M&M's

The particles that make up the atoms of radioactive elements are unstable. In a certain time period, the particles change so that the atoms will become a different element. This process is called **radioactive decay**. The M&M's represent atoms. Each time you repeat the procedure counts as one year.

Investigation

A. Count all the M&M's in your cup. This is your starting amount.

B. Determine the best way to drop the M&M's so they are randomly distributed on the plate. Determine a plan for handling M&M's that miss the plate. Additionally, make a plan for handling those M&M's that land on the lines of your plate. Count all the M&M's.

C. Drop the M&M's so they are randomly distributed on the plate. Those candies that fall in the designated area have decayed and are now safe. Remove them, count them, and record the number in the table. **You may eat them if you wish!** The remaining candy is still radioactive! Scoop these up and drop them randomly over the plate again. ***Year 0 is the starting amount.***

Time (Years)	**Number of M&M's Remainin g**	**Ratio**
0 (Starting Amount)		
1		
2		
3		
4		
5		
6		
7		

C. Repeat step B at least seven times. Record the data pairs (*time, M&M's remaining on the plate*) in the table.

D. Now, after you have completed seven or more trials, end the experiment by counting all the remaining candy that is still radio- active. **Eat the leftover M&M's at your own risk!!!**

Analysis

1. Let x represent elapsed time in years, and let y represent the number of M&M's remaining. Use an appropriate viewing window and make a scatter plot of the data. What do you notice about the graph?

2. Calculate the ratio of M&M's remaining between successive years. That is, divide the number of M&M's after year one by the number of M&M's after zero years; then divide the number of M&M's after two years by the number of M&M's after one year; and so on. How do the ratios compare?

3. Choose one representative ratio. Explain how and why you made your choice.

4. At what rate did your M&M's decay?

5. Write an exponential equation that models the relationship between time elapsed and the number of M&M's remaining.

6. Graph the equation with the scatter plot. How well does it fit the data?

7. In your equation, what is the real world meaning of your value for a? Explain!

8. In your equation, what is the real world meaning of your value for b? Explain!

9. Using your calculator, find the best fit exponential model, accurate to three decimal places. Graph it. How well does it fit the data?

10. Consider the connection among the numbers in your model. How are these numbers related to the number of M&M's you started with and the angle measure on your plate?

11. What theoretical model could you have written without conducting the simulation?

12. Describe the difference between paper plates for the equations $y = 360(0.72)^x$ and $y = 360\ (0.82)^x$?

Bonus: What do you think would happen if you changed the angle to an angle whose vertex isn't at the center of the plate?