# Get a Half-Life!: Student Worksheet

**Name:** _____

## Hook

A decay function is one in which the values decrease by a constant factor, but it is not linear! These functions are often used to model the decay of a radioactive element. The half-life of a substance is the time it takes to reduce its initial effectiveness by one-half.

## Group Arrangement

Students work in pairs

## Tools

Each pair needs:

- 1 cup of *m&m*'s
- 1 paper plate or box
- 1 graphing calculator

## Procedure

A. Collect the Data

1. Pour *m&m*'s out and count your beginning sample size (N). This will be your N value when T = 0. Enter this value in the table below and put the *m&m*'s back in the cup.
2. Shake the cup gently and pour the *m&m*'s out in the box or on the paper plate.
3. Remove all the *m&m*'s with an "m" showing. (You may eat these *m&m*'s only!)

4. Count the remaining *m&m*'s and enter this value of N into your table next to T = 1.
5. Put the remaining *m&m*'s back in the cup.
6. Repeat this process until there are no longer any *m&m*'s with the letter "m" when you empty your cup.

| **Trial Number (T)** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|---|
| **# of remaining *m&m*'s (N)** | | | | | | | | |

B. Use the Calculator

1. Clear out the calculator:
   Press [2nd][Y=]. Enter [4]. Press [ENTER]. This turns off all plots.
   Press [Y=], [CLEAR], down arrow and [CLEAR] until all equations are cleared.
   Press [STAT], [ENTER] to view tables. To clear Lists, press up arrow to highlight L1, press [CLEAR], [ENTER]. Use arrow keys to highlight any other lists and clear.
2. Enter the data from the table above:
   Press [STAT], choose EDIT by pressing [ENTER] and enter values of T in L1 using down arrow keys and [ENTER].
   Use right arrow key to move over to L2 and enter the values of N in L2.

3. Graph the Data
   Press [STAT PLOT] ([2nd][Y=]), choose 1 by pressing [ENTER].
   Highlight: ON
   Broken line graph
   Xlist: L1
   Ylist: L2
   Mark: first one
   Press [ZOOM], then [9] to set up appropriate window and see graph.
4. Have the calculator determine the best equation for the data.
   **Linear:**
   Press [STAT]. Choose CALC[5].
   Type in L1, L2 (press [2nd][1][,][2nd][2] then [ENTER]). You will see y = ax + b and values for a, b, and r.
   Press [Y=], set cursor next to Y1=, press [VARS][5], arrow over to EQ, press [7], the [GRAPH].

   **Quadratic:**
   Press [STAT], choose CALC [6], then type in L1, L2 (like above) and press [ENTER].
   Press [Y=]. Set your cursor next to Y2=.
   Press [VARS][5], arrow over to EQ, press [7], the [GRAPH]. (Adjust the window here to see more of this graph)

**Exponential:**
Press [STAT] and choose CALC . Choose A by using the down arrow key until you see "A ExpReg". Press [ENTER].
Type in L1, L2 as before and then [ENTER]. You will see y = a*b^x ($y = ab^x$) and values for a, b, and r.
Press [Y=] and set your cursor next to Y3=.
Press [VARS], choose [5], arrow over to EQ, press [7], then [GRAPH].

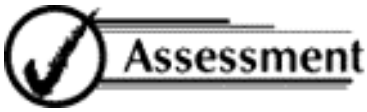
C. Analyze the Data

1. Which graph most clearly approximates a "curve of best fit" for your data?

2. Why is this called a "half-life"?

3. What is a good estimate for the length of a "half-life" of *m&m*'s based on <u>your</u> research?


As a result of this activity, students learn to model a real-life situation by collecting data from a few trials, graphing the data, and then drawing a curve of best fit. The student must decide which of the equations best fits his/her data. Sometimes when a student gathers his/her own data, the graph does not make a perfect line or curve.




1 Describe the factors that influenced you to choose your "curve of best fit".

2. Explain how each of the three types of equations, linear, quadratic, and exponential, are different.