

Each group gets: a) 1 paper plate, b) cup(s) of M&Ms. c) one of these sheets per person.

Collect data...

- 1) Pour all your M&Ms out onto the paper plate.
- 2) Count the M&Ms on your plate and enter the number in the 'Toss 0' line in the data table below:

Toss	Remaining M&Ms
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

3) Leave the M&Ms that landed 'm' side up, and remove the ones that landed 'm' side down. (You may eat the removed M&Ms if you like :)

4) Count the remaining M&Ms on your plate and enter that number in the Toss 1 line.

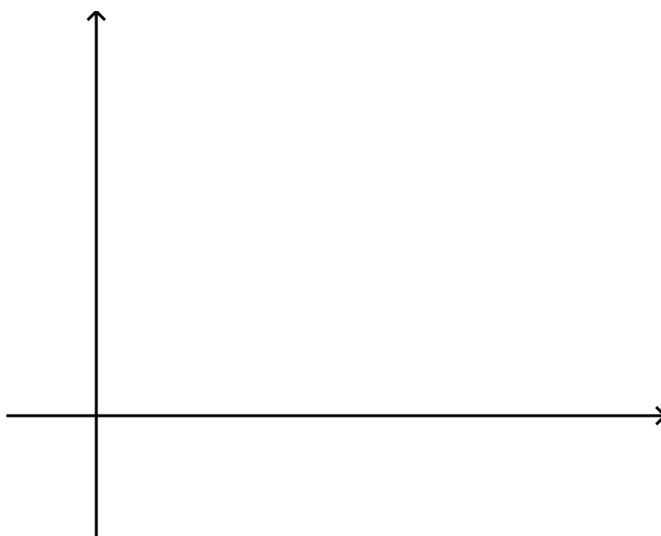
5) Gather all of the M&Ms from your plate and put them into your cup. Shake them up, and pour them out again onto your plate.

6) Repeat steps 3-5, removing the M&Ms that landed 'm' side down, counting the remaining M&Ms and entering counts for each toss in your data table. Continue this until all of the M&Ms have been removed.

Graph and find equation models...

7) Graph your data by hand on the axes (plot the points). Draw a curve through your data points.

8) Which type of equation will fit this curve?



9) Here are two equation models that may fit your equation:

$$Q(t) = Q_0 e^{kt}$$

$$Q(t) = Q_0 \left(\frac{1}{2}\right)^{kt}$$

where Q is the quantity of M&Ms remaining, t is the 'toss' number, and Q_0 and k are constants.

Pick one of these equation models, and plug in your data for toss 0 ($t=0$) to solve for Q_0 (the initial quantity). You now have an equation model where only the constant k is unknown.

10) Select another data point (toward the end of your data, but not the zero value) and using your value for Q_0 , solve for the constant k. Write your completed equation model for your data below:

11) Now use the other equation model (the one you didn't pick) and repeat steps 9 and 10 to create another equation model for your data. Write it below:

Check your equation models using your calculator...

12) Follow the steps below to enter your data points into your calculator. We will be using your calculators 'lists' and 'stat plots' features.

- a) Turn on your calculator and clear out any equations in Y1, Y2, etc.
- b) Press 'STAT', and in the 'EDIT' menu, select 'Edit' (by pressing enter).
- c) If your lists are not already cleared out, use up arrow to move to the top of a column (highlighting L1, L2, etc.) and with the name of the list column highlighted, press 'CLEAR', then 'ENTER'. Clear all of your lists out.
- d) Enter your 'toss' numbers (0, 1, 2, etc.) into list 1 by putting your cursor on the first space, entering '0', then pressing 'ENTER'. The cursor automatically moves down to the next entry. Enter all the toss values you used (0, 1, 2,.....12.) **Do not include any points where the M&M count is zero.**
- e) Enter your 'remaining M&Ms' values into list 2 by moving your cursor to the top of the column and entering values across from the matching toss entries.
- f) Press '2nd' 'MODE' (quit) to exit data entry, then '2nd', 'Y=' (statplot) to see the stat plot screen. With 1 highlighted, press 'ENTER'.
- g) With Plot1 highlighted at the top, and cursor blinking on 'ON', press 'ENTER' to turn on stat plot 1. Your Xlist should say L1 and Ylist should say L2 (if it doesn't ask the teacher for help.)
- h) Press '2nd' 'MODE' (quit) to exit stat plot setup, then press 'WINDOW' and set your window for X from 0 to 10 and Y from 0 to 300.
- i) Press 'ZOOM', then '9' (zoom stat). You should see a plot showing your data points.

Compare your equation models with the plotted points...

13) Press 'Y=' and enter one of your equation models for Y1.

14) Press 'ZOOM', '9' to see the stat plot again and this time your curve will also appear on the screen. How well does your equation match your data?

Let your calculator's exponential regression feature calculate an equation for you...

13) Now we're going to let the calculator create an equation for us and put it into Y2 that models the plotted data points. Start by pressing 'STAT', then right arrow to the 'CALC' menu, then arrow down to ExpReg, and press 'ENTER'. Your screen should say: ExpReg

14) Tell the calculator to use list 1 for the plotted x values: '2nd', 'STAT', with L1 highlighted, press 'ENTER'. Then press the comma ',' key.

15) Tell the calculator to use list 2 for the plotted y values: '2nd', 'STAT', arrow down to L1, press 'ENTER'. Then press the comma ',' key.

16) Tell the calculator to put the resulting equation into Y2: Press 'VARS', right arrow to the Y-VARS menu, with 'Function' highlighted, press 'ENTER', arrow down to 'Y2' and press 'ENTER'.

17) At this point, your screen should say: ExpReg L1, L2, Y2. Press 'ENTER' again to run the exponential regression function.

18) If the function ran correctly, it should display something like this:

$$y=a*b^x$$

$$a=255.9619345$$

$$b=.5467572882$$

For the above example, the calculator is telling you that your equation could be:

$$y = 255.9619345(0.5467572882)^x$$

19) Press 'ZOOM', '9' to see the stat plot again and the calculator's equation curve in Y2 should be added along with your original curve in Y1.

20) Eat any leftover M&Ms :)