Have a Heart

(for math)

**Take two minutes and quietly read the first page of these directions. You will answer most of your questions if you do this first.**

Before beginning you must realize that you need all of your candy hearts to do this experiment. You can eat them **after the project is FINISHED**. Not when it is half-way done but when it is totally FINISHED.

1. Count of all of your candy hearts and record the information next to “pour 0” for each trial. Make sure each candy heart has a bank side and a side with writing on it. You should have at least 100 candy hearts.
2. Put all of the hearts into a cup.
3. CAREFULLY pour out the hearts onto the plate.
4. Remove any heart that does not have writing facing up and put them aside. DO NOT MIX THESE HEARTS BACK IN WITH THE OTHERS YOU ARE USING.
5. Count how many hearts **that you have left** (not how many you removed) and record that information in the chart.
6. Put the hearts you just counted back into the cup and repeat steps 3-6 until you only have one or no hearts remaining. You will complete this whole process 3 times (hence the 3 trials).
7. You are going to create a **scatter plot** graph of one of your trials (choose the one with the clearest pattern) on a piece of graph paper. Try to space out the number of pours so that the graph fills a page. Don’t forget to label each axis and state which trial you picked.

|  |  |  |  |
| --- | --- | --- | --- |
| Pour | **Candy Hearts**  **Trial #1** | **Candy Hearts**  **Trial #2** | **Candy Hearts**  **Trial #3** |
| **0** |  |  |  |
| **1** |  |  |  |
| **2** |  |  |  |
| **3** |  |  |  |
| **4** |  |  |  |
| **5** |  |  |  |
| **6** |  |  |  |
| **7** |  |  |  |
| **8** |  |  |  |
| **9** |  |  |  |

1. Connecting your data points.
   1. If your data can be connected with **ONE** straight line then connect it using a ruler.
   2. If your data is a curve, then using freehand SLOWLY AND CAREFULLY connect your data in a curve. (Draw a Curve of Best Fit) **not a bunch of individual lines!**
2. Your graph is either “linear” or “exponential.” What type of graph do you have? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Is the data in your graph rising or falling? (as x increases what is happening to the y?) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Refer to the numbers in your table. There should be a general pattern in the data. Can you estimate some type of general pattern? Describe the pattern. THIS STEP IS IMPORTANT for the remainder of the lesson.
5. If you started with twice as many hearts how would the graph change? Explain your reasoning.
6. How many pours will you need for twice as many hearts? Explain your reasoning.
7. If you started with half as many hearts would it take the same amount of pours to get to the point where you only have one or no hearts left? Explain your answer. **Answer before doing number 15.**
8. Refill the cup with half the amount of hearts you originally started with. See how many pours it takes to get to the point where you only have one or no hearts left. How many pours did it take?
9. Theoretically, how many pours should it take to get to one heart if you started with 200 hearts?

**SHOW YOUR CALCULATIONS BELOW.**

1. Theoretically, how many pours should it take if you started 800 hearts? **Show your calculations.**
2. Using the formulas below create an equation that models your data for this project and write it below the chart. (simplify what is inside the parenthesis)

|  |  |  |
| --- | --- | --- |
| Exponential Growth  y = a(1+r)x | Exponential Decay  y = a(1-r)x | a = initial amount before measuring growth/decay  r = growth/decay rate (often given as a percent)  x = number of time intervals that have passed (pours) |

y =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Assume that you have 100 candy hearts.
2. Adjust your equation above and fill in the chart below so that it shows what happens to the number of candy hearts after 1,2,3,4, and 5 pours.

|  |  |  |
| --- | --- | --- |
| Number of Pours | Equation  Write your equation here  (fill in for known variables)  y = a(1+r)x or y = a(1-r)x | Number of Candy Hearts Remaining (y value) |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |

1. Write a general equation for #19 using x and y: y =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Use your imagination and picture that instead of pouring out candy you were pouring out 100, 6-sided dice. Every die that landed with the number 5 face-up is removed.
   1. Create the exponential decay equation for this scenario.
   2. Use the table feature of your calculator and on a separate piece of graph paper graph the results. Write the table down on the graph along with the equation, and give the graph a title and labels. Create a scale that will allow for the graph to fill a page and clearly represent an exponential curve.
3. This time imagine that you have 100, 20-sided dice. Every time it lands with the number 5 face up it is removed.
   1. Create the exponential decay equation for this scenario.
   2. Use the table feature of your calculator and on a separate piece of graph paper graph the results. Write the table down on the graph along with the equation, and give the graph a title and labels. Create a scale that will allow for the graph to fill a page and clearly represent an exponential curve.
4. The Facts of Life: When two candy hearts really love each other, they go on a date to the shipyard, buy a cozy little shelf space at CVS and wait for the stork to bring them their candy heart babies. Every time that the stork makes a delivery, the size of the family triples.
   1. Create the exponential growth equation for this scenario.
   2. Use the table feature of your calculator and on a separate piece of graph paper graph the results. Write the table down on the graph along with the equation, and give the graph a title and labels. Create a scale that will allow for the graph to fill a page and clearly represent an exponential curve.
5. Look at the number in the parenthesis for each of your 4 equations in questions 19-22. How does that number affect the graphs? Be specific.
6. Write down one new concept you learned while doing this experiment. Write a few sentences explaining this concept in detail (not a few words) a poor answer will result in a poor grade.

**Each Group will turn in: 1 copy of these two pages with the answers. 1 copy of each of the 4 graphs that were completed in this project.**

**NEATNESS MATTERS! TAKE PRIDE IN YOUR WORK IF YOU EXPECT A GOOD GRADE!!!**