**9g--Decaying Dice**

Read through steps 1-6 below and **answer questions a-c before carrying out the investigation.**

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| **Investigation Steps** |
| 1. Get your hands on 30 6-sided dice and put them in a container.  2. Find a safe place where you can roll 30 dice at once, like a tray (or the container itself, if it is large enough).  3. Roll the remaining dice (or shake the container thoroughly).  4. Remove any dice that display a "1" and set them aside.  5. Write down how many dice remain.  6. Go back to step 3 and repeat. Stop when you have rolled the dice ten times. |

**Pre-investigation questions:**

1. When you roll 30 dice, how many 1’s do you predict you are likely to roll? Why?
2. After you remove the 1’s on the first roll, what *fraction* of the original number of dice do you predict will remain?
3. How many times do you predict you will have to roll the dice and remove the 1’s before you get to a point where you don’t roll any 1’s?

**Conduct the Investigation:**

Record the number of 1’s and the number of dice remaining after each roll.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Roll | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Number of 1’s | X |  |  |  |  |  |  |  |  |  |  |
| Number of Dice Remaining | 30 |  |  |  |  |  |  |  |  |  |  |

**Now for some mathematical modeling:**

1. Create a scatter plot with number of dice remaining on the vertical axis and roll number on the horizontal axis. Discuss what you see.



1. Based on what you know about exponential functions and the behavior of dice, explain in words why an exponential model would be appropriate for this situation.
2. Write a function of the form *d(x)* = *abx* to model the relationship between the roll number, *x*, and the number of dice remaining, *d*(*x*). Your job here is to decide what numbers to use in place of *a* and *b*. This should *not* be based on the data you collected -- it is a mathematical model for how dice behave.
3. Graph your function on the same set of axes as your scatter plot.
4. Compare and contrast the graphed model *d*(*x*) to the outcome of the experiment shown in the scatter plot.
5. Suppose someone repeated this activity, except they started with 100 8-sided dice instead of 30 6-sided dice. Write a new function that would model this situation.