Radioactive Dice
Functions & Modeling

Name:____________________________

Date:______________

Consider a large number of these special 12-sided dice that "decay" and are removed from the group when they land on their single marked face. Let's model this behavior mathematically.

1. What fraction of the original number of dice would you expect to remain after the **first** roll?

2. How many dice would you expect to remain after the **first** roll?
(HINT: You'll have to leave this in terms of a **variable**)

3. How many dice would you expect to remain after the **second** roll?
(HINT: These dice survived the first *and* second roll.)

4. How many dice would you expect to remain after the r^{th} roll? **Design an equation** that relates the remaining number of dice to the original number of dice and the number of rolls that have occurred.

Building Blocks

Construct your answers out of **numbers** and the **variables** and **operations** found in the boxes below.

You may use them any number of times.

Variables

N_0 - the original number of dice

$N(r)$ - number of dice remaining after **r** rolls.

r - the number of rolls that have taken place

Operations

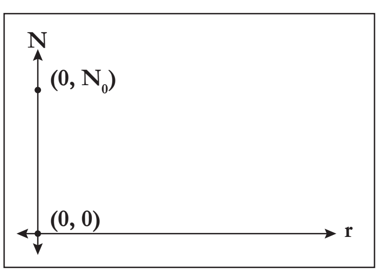
$a \cdot b = c$ multiplication

$\frac{c}{b} = a$ division

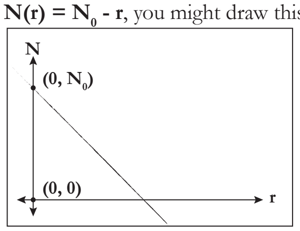
$x^z = y$ exponentiation

$\log_x y = z$ the logarithm

5. Graph the general shape of your equation from #4 on the plot below. Feel free to refer to a graphing calculator or app.



For example, if your equation were **N(r) = N$_0$ - r**, you might draw this:



6. What fraction of the original number of dice would you expect to remain after the r^{th} roll? **Modify your equation** from #4 into one that relates the fraction of original dice remaining to the number of rolls that have occurred.

7. Solve this modified equation for r. When the equation from #6 is solved for **r**, the result will allow you to figure out how many rolls it would take to "decay" to a certain fraction of the original population. Use the back of this sheet, if necessary.

8. How many rolls would it take to reach 50% of the original number of dice? Feel free to use a calculator. It's okay if your answer is not a whole number. This is the theoretical **half-life** of 12-sided dice!