## Last Man Standing

A Hands-On Activity to Introduce Exponential Functions

Name: $\qquad$
Date:
Period: $\qquad$

Learning Goal: I will be able to come up with an exponential equation that models a situation and then graph that exponential function.

1. How many squares with the word "Alive" are there on your paper?

There are $\qquad$ squares that say "Alive"

Today you will try to predict how many survivors there will be after a certain number of rounds. Here's how this game works: You will take all the squares, shake them up really well, then let them fall on the table. You will count how many are alive each round. After doing this, you will try to make a prediction about how many will be alive after a certain number of rounds. Eventually, you will construct your own equation/formula that will make the prediction for you!
2. On your sheet of paper, cut out all the squares. Make sure you don't lose any of them.
3. Make a prediction: How many squares do you think will have the word "Alive" face up when you shake them and pour them out on your desk? (Remember, you start with 100)

I think that $\qquad$ squares will have the word "Alive" face up
4. Take all of your squares, shake them, then pour them out onto the desk in front of you. If a square is facing up and says "Alive", then it is alive and survives until the next round. If the "Alive" part is facing down, then it is dead and does not survive until the next round.
5. How many squares survived the first round?

Only $\qquad$ squares were still alive after the first round
6. Make a prediction: How many squares do you think will still be alive after the second round?

I had $\qquad$ squares survive the first round. Of those, I think $\qquad$ will still be alive
7. Conduct round two. How many squares are still alive after round 2 ?

Only $\qquad$ squares were alive after the second round
8. Based on your findings, how many squares do you think will be alive after the next few rounds?

|  | My prediction: | Actual: |
| :---: | :---: | :---: |
| After Round 3, there will be: |  |  |
| After Round 4, there will be: |  |  |
| After Round 5, there will be: |  |  |

9. In your own words, describe what is happening each round.
10. In your own words, how would you explain to somebody how to calculate how many to expect after a certain round?
11. If you had trouble writing out your own explanation for number 10, here's where an exponential function/equation helps a lot. Here's how we write an exponential function:

$$
y=a(b)^{x}
$$

You'll remember that some exponential functions are growth functions, and some of them are decay functions. How do you decide whether a function is growth or decay? (Hint: What was true about the $b$ part of the function?)
12. Let's think about our game a little bit. Are we going to need a growth function or decay function to model our game? (Are the number of "Alive" squares growing or decaying (dying)?)

On average, we should see about $50 \%$ of our squares die each round. Since we know we're working with a decay function, let's set $b=0.50$, so now we have

$$
y=a(0.50)^{x}
$$

The " $a$ " in this situation represents the amount we start with, so let's make that 100:

$$
y=100(0.50)^{x}
$$

13. Think about our game. What must the $y$ and $x$ represent in this equation?

The $y$ must stand for $\qquad$

The $x$ must stand for
14. Make two tables: One of the actual data you recorded, and one for the equation $y=100(0.50)^{x}$

ACTUAL Data

| Round <br> $(\mathrm{x})$ | Number of <br> survivors I <br> actually counted <br> $(\mathrm{y})$ |
| :---: | :---: |
| 0 | 100 |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

The equation $y=100(0.50)^{x}$

| Round <br> $(x)$ | Number of <br> survivors I <br> should anticipate <br> $(y)$ |
| :---: | :---: |
| 0 | 100 |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |

15. Graph both of these on the same graph, labeling your axes.

16. If you started with 10,000 and played the same game, how many would you expect to still be alive after 5 rounds? 10 rounds? (Use your equation!)
