Fish Population Lab
# An Exploration of Exponential Models

Exploration 1

1. Count the number of fish in the pond and record the number under year 0 in your population chart.
2. Gently pour all of the fish onto the paper towel. All of the fish that land with the "M" up are deceased; place them aside. Record the number of living fish under year 1.
3. Replace the live fish in the cup and repeat step two until year 8, or all fish are deceased, whichever comes first.

Year	0	1	2	3	4	5	6	7	8
# of living fish									

4. Describe the pattern that you see. (Be specific.)

   Does this more closely match exponential growth or decay? How can you tell?

5. If you started the exploration with more fish, would the pattern stay the same? Why or why not?

6. Make a scatterplot of your data below. Only draw quadrant I. Make sure to label your axes. Draw a smooth curve to connect the points.
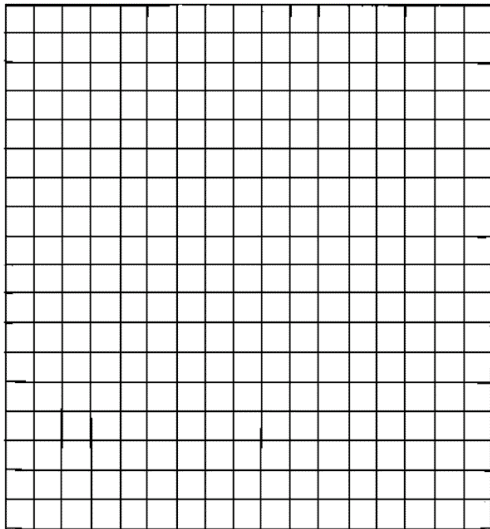
7. Using the appropriate model (growth or decay) from your notes, write an equation that best fits your data from the chart above. Remember that your model will still have x and y!

8. Graph this equation on the graph, using a different color. How does it compare to your scatterplot?

9. Use the model you wrote in #7 to make predictions for the following situations:
   a. Number of fish after 6 months? _____
   b. Number of fish after 18 months? _____
   c. Number of fish in 25 years?_____

10. **Rewrite** the model from #7 to answer the following questions.
    a. The initial population is 1,200 fish. How many will remain after 11 years?

    b. The initial population is 15,000 fish. How many will remain after 13.5 years?

    c. The initial population is 3,000 fish. How many years will it be until there are 12 fish?
    (Bonus!)

Exploration 2
11. Place two fish in the cup and record the number under year 0 in your population chart. Place the rest of the fish in a "holding tank".
12. Gently pour **the two** fish onto the paper towel. The number of fish with an "M" showing will be added to the pond from the holding tank. (Ex. If 1 lands "M" side up, then there will be 2 (original) + 1 = 3 in the cup). Record the new number in the chart.
13. Pour out all of the fish and repeat step 12. Continue until year 8 or you have run out of fish in your holding tank, whichever comes first.

Year	0	1	2	3	4	5	6	7	8
# of living fish									

14. Describe the pattern that you see. (Be specific.)

    Does this more closely match exponential growth or decay? How can you tell?

15. What would happen if this trend continued indefinitely? In nature, what keeps this from occurring?

16. Make a scatterplot of your data below. Only draw quadrant I. Make sure to label your axes.
    Draw a smooth curve to connect the points.
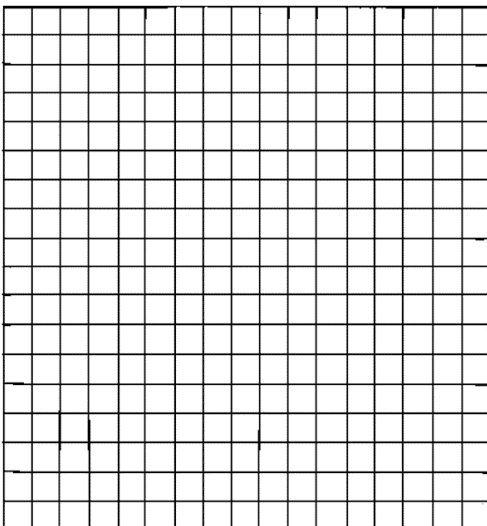
17. Using the appropriate model (growth or decay) from your notes, write an equation that best fits your data from the chart above. Remember that your model will still have x and y!

18. Graph this equation on the graph, using a different color. How does it compare to your scatterplot?

19. Use the model you wrote in #17 to make predictions for the following situations:
    a. Number of fish after 6 months? _____
    b. Number of fish after 18 months? _____
    c. Number of fish in 25 years?_____

20. **Rewrite** the model from #17 to answer the following questions.
    a. The initial population is 1,200 fish. How many will exist in 11 years?

    b. The initial population is 15,000 fish. How many will exist in 13.5 years?

    c. The initial population is 3,000 fish. How many years will it be until there are at least 1 million fish? *(Bonus!)*

Exploration 3a
21. Place 40 fish in the cup. Record this number under year 0 in the chart below.
22. Remove 5 fish each year, recording each new value in the chart. Continue until all fish are deceased.
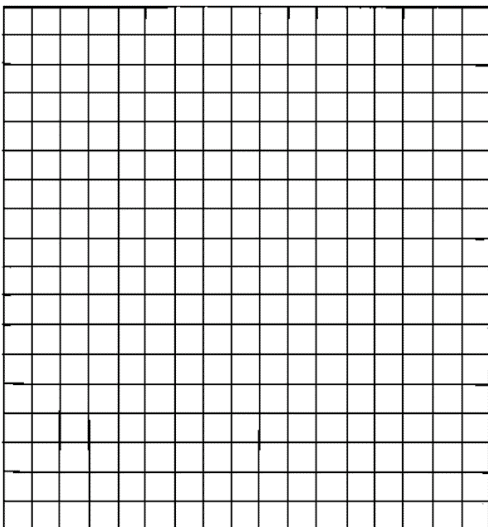
Year	0	1	2	3	4	5	6	7	8
# of living fish									

23. Describe the pattern that you see. (Be specific.)

Is this growth or decay?
Is this an exponential pattern? Why or why not?

24. Make a scatterplot of your data below. Only draw quadrant I. Make sure to label your axes. Draw a line to connect the points.

25. Using the slope-intercept model, write an equation that best fits your data from the chart above. Remember that your model will still have x and y!

26. Graph this equation on the graph, using a different color. How does it compare to your scatterplot?

27. How is this similar to the exponential decay model? How is it different?

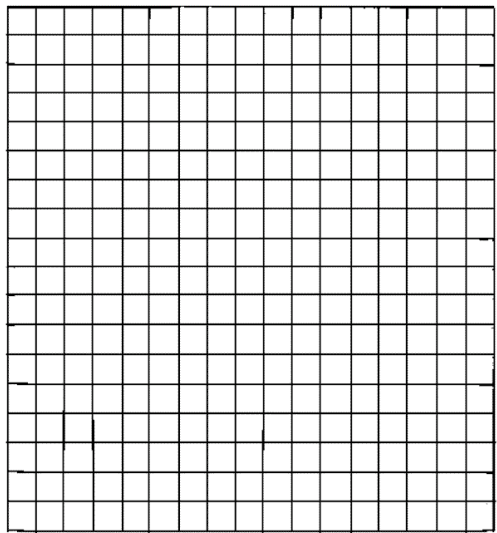**Exploration 3b**

28. Continue the pattern below.

Year	0	1	2	3	4	5	6	7	8
# of living fish	0	2	4	6	8				

29. Describe the pattern that you see. (Be specific.)

Is this growth or decay?
Is this an exponential pattern? Why or why not?

30. Make a scatterplot of your data. Only draw quadrant I. Make sure to label your axes. Draw a line to connect the points.

31. Using the slope-intercept model, write an equation that best fits your data from the chart above. Remember that your model will still have x and y!

32. Graph this equation on the graph, using a different color. How does it compare to your scatterplot?

33. How is this similar to the exponential growth model? How is it different?

34. The pattern above is frequently called a doubling pattern. Why?

35. **Explain and demonstrate** the difference between y = 2x and y = 2^x. Use a separate page and graph paper.