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TOO MUCH OF A GOOD THING

Grades: 6 through 8

Time: 50-60 minutes, with follow up discussion (You may wish to assign this as an out of class assignment and then discuss.)

Materials: Too Much of a Good Thing problem (see below); large sheets of paper for drawing diagrams (optional); colored pencils (optional)

Relevant Subjects: Algebra and Mathematics

Math Standards: Depending on how the problem is solved, **Algebra and Functions** or **Numbers and Operations**.

Math Vocabulary:

- Variables •Patterns •Exponents •Base
- Exponential Growth •Growth Factor •Non-linear

Suggestions for Write-up and Rubric

- Students should explain how they solved the problem.
 - Students should include a table, graph, and diagram if used to solve the problem.
 - Students should discuss any patterns they noticed.
 - If students can write equations, they should come up with an equation for finding the number of kittens born in n years.
1. Give students the *Too Much of a Good Thing* problem (See below; decide which level is best for each class or group). Have students read the problem or read it aloud to them. Define the concept of spaying, as needed, and answer any questions.
 2. Students can work individually or in groups. Encourage students to make a diagram if they get stuck.
 3. Once students have solved the problem, discuss why dog and cat overpopulation is a problem, and how spaying and neutering can be an

important step in helping end animal companion overpopulation and save animal lives. You may want to touch on issues such as:

- The fact that millions of healthy dogs and cats are euthanized in the U.S. each year simply because there are not enough homes.
- The fact that every litter adds to the problem.
- How spaying and neutering contribute to the solution.

(You may wish to have information available for students about low cost spay/neuter options in your area.)

4. Have students brainstorm ways they can help (such as, have their own animals spayed and neutered, raise money to help others, educate others, etc.)
5. Have students discuss why the scenario in the problem is theoretically possible, but highly unlikely (litter sizes and sexes of kittens are not constant; not all will live to reproduce; many will die due to illness, accidents, neglect, predators, etc.)
6. Have students make a tree diagram to display in the room, showing how many kittens one cat can have in just three or four years (more than that gets too cumbersome to draw).

Solutions

Problem 1- The total number of cats (y) after 7 years, including the original mom is 509 assuming the first 4 kittens are born in year 1 (year is x). Equations that work: $y = 4(2^{x-1})$ or $y = 2^{(x+1)}$. Assuming the first 4 kittens are born in year 0, the total number of cats including the original mom is 1,021. Equations are $y = 4(2^x)$ or $y = 2^{(x+2)}$

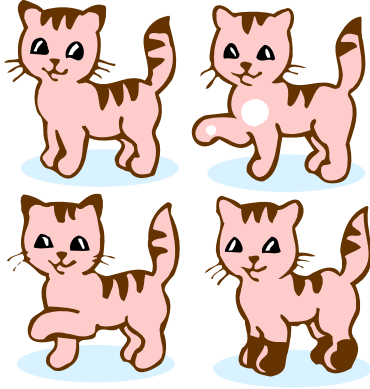
Problem 2- Starting at year 0, there are 13,121 cats. Equation: $y = 4(3^x)$
Starting at year 1, there are 4,373 cats. Equation: $y = 4(3^{x-1})$

Accommodation Suggestions

- Make a table for students and fill in needed years (maybe just first year or second and third so they can see the pattern).
- Start a diagram for students.
- Read and explain the problem.
- Start a graph.
- Define variables (y is the total number of kittens, x is the year) and label them on a graph and table.

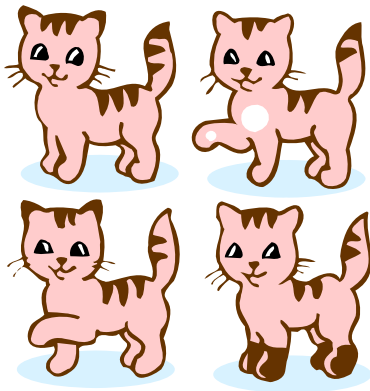
Activity by Pamela Krausz (Math Teacher, Humane Educator)

TOO MUCH OF A GOOD THING (1)



A pregnant cat was dropped off at a local farm. The farm had no other cats. The cat gave birth to four kittens, two females and two males. The farmer was able to get the mother cat spayed, but not the female kittens. The two female kittens had four kittens each, two females and two males. The two female kittens born in year one were spayed, but their female offspring had four kittens each, two females and two males. This pattern continues for seven years - the previous year's females have no more kittens, but each new female has four, two females and two males. Assuming no cats die, how many cats (total number) will there be at the end of year seven?

TOO MUCH OF A GOOD THING (2)



A pregnant cat was dropped off at a local farm. The farm had no other cats. The cat gave birth to four kittens, two females and two males. The next year all the females (including the mother) gave birth to 4 kittens, 2 males and 2 females. The following year all the females again gave birth to 4 kittens, 2 males and 2 females. This pattern continues year after year. How many total cats will there be at the end of seven years if no cats die?