Exponential Growth Lesson
Skeeter's

AUTHOR: Kyle Kendrick
DATE LESSON TO BE TAUGHT:
GRADE LEVEL: Algebra
SOURCE OF THE LESSON:
http://www.learner.org/channel/workshops/algebra/workshop8/lessonplan2.html

TEKS:

CONCEPT(S)
OBJECTIVES (LEARNER OUTCOMES): The student will be able to

MATERIALS LIST and ADVANCED PREPARATIONS:
10 containers filled with Skeeters. (Skeeters can be any candy, coin, or chip with a mark on one side.) Fill two containers with red Skeeters, two with orange, two with yellow, two with green, and two with purple.

Copies of the Skeeter handout.

Students will need the following:
Graphing calculator

SAFETY:

SUPPLEMENTARY MATERIALS:

Engagement (5 min)

What the Teacher Will Do	Eliciting Questions	Student Responses
As an introduction to various types of growth, show video clips. The first video shows a simple model of cellular growth, increasing by one each time; the second video shows a doubling pattern. You can also demonstrate these growth patterns using chips and an overhead projector. For the first model, place one chip on the transparency, and continue adding one chip at a time. For the second model, start with one chip and then double the number each time. Explain to students that they will be using Skeeters to model population growth during this lesson.	what mathematical operations they could use to represent growth.	addition and multiplication

Exploration ()

What the Teacher Will Do	Eliciting Questions	Student Responses
Distribute the handout for the lesson. Select one person in the group to explain the five populations that are represented in the table. Demonstrate a "shake" of the green population by placing one green Skeeter in the box to represent the initial population and then shaking the box. At the end of the shake, add two green Skeeters for each Skeeter in the box as the growth characteristic.	Based on the information in the table, how many populations do we have?" What is the initial population for each different color? What is the population now, at the end of Shake 1?	 three green Skeeters

What the Teacher Will Do	Eliciting Questions	Student Responses
Demonstrate a second shake of the green skeeters	How many green Skeeters should I now add?"	Add six Skeeters, because you are to add two Skeeters for each Skeeter in the box.
	What is the total population at the end of Shake 2?	the population is now nine Skeeters.
Have each group conduct an exploration for one of the Skeeter populations. (An effective way to do this is to form "exploration stations" by filling ten containers with colored Skeeters - two containers for each color. Distribute one container to each group.)		As they conduct the exploration, have students create a scatterplot for the population, with the shake number along the horizontal axis and the Skeeter population along the vertical axis. (Students should graph the points using paper and pencil, and enter the data for the populations using the STAT feature of their graphing calculators.)
Instruct students to complete the "Pattern" column for Tables 2-6 using the information for the population with which they worked.	By looking at the Skeeter population, find the pattern that can be used to predict the population for each consecutive shake. consider whether the pattern is growing by addition or multiplication.	
Have a student read aloud the description of how to complete the "Process" column. Then present an example of how to complete this column. If that group worked with green, they should respond that the population multiplied by three, or tripled, with each shake. With student input, represent this on the board or overhead projector in the following way: Example:). Pop(0) = Initial Population). Pop(1) = Initial Population × 3). Pop(2) = Initial Population × 3 × 3 By replacing the variable	What pattern did you notice in your population?	

What the Teacher Will Do	Eliciting Questions	Student Responses
"Initial Population" with its value, 1, rewrite these equations as:). Pop(0) = 1). Pop(1) = 1 × 3). Pop(2) = 1 × 3 × 3). Give the groups several minutes to complete Tables 2-6 for the particular population with which they worked. Allow students time to complete the exploration for each of the five colors, creating scatterplots for each exploration. By the end, they should have completed all of Tables 2-6.	Can we rewrite this in a different way?	1×3^2 Students rotate the exploration stations so that each group receives a new color.

Explanation ()

What the Teacher Will Do	Eliciting Questions	Student Responses
Randomly select a group to present their findings for each of the populations. A student from the group should give each color's population for n shakes. Record the equations on the board or overhead projector as follows:). Green:). Pop(n) = 1×3^n	Why do you think the equations for the purple populations vary?	The population is less predictable because the number of Skeeters added is

What the Teacher Will Do	Eliciting Questions	Student Responses
). Purple:). $Pop(n) = 5 \times 1.5^n$. (For the purple population, be sure to request the equations generated by several groups, as the answers will likely differ.)	What percent of the Skeeters [in the purple population] would you expect to show a mark after each shake?"	based on the number that land with a mark showing, and that number may be different for each group after each shake about 50 percent of them will show a mark each time.
With the class, convert the green population equation to a function in x and y. (It may be helpful to refer to the scatterplot, which plotted the number of shakes along the x-intercept and Skeeter population along the y-axis. The class should come up with the following equation: Green: $y = 1 \times 3^x$	How is that 50 percent represented in the equation? What is the value that your groups got for the number that is raised to a power in the equation for purple?	that the value is around 1.5, which is the decimal number used to represent a 50-percent increase.
The purpose of the lesson was to use patterns to form mathematical models. In each equation, the first number represents the initial population. The operation [multiplication or addition] explains how the population grows. And the number attached to x - either the coefficient or the base - explains how quickly the population grows. For these five equations, we have lines and curves. The curves result from multiplication, and the lines result from addition.	Give the groups one minute to come up with equations in x and y for the other four colors. What did the shape of the graph for each of these populations look like?	Yellow: $y = 1 \times 2^x$ Orange: $y = 40 + 2x$ Red: $y = 5 + 20x$ Purple: $y = 5 \times 1.5^x$ The graphs for orange and red were lines (i.e., linear functions), while the graphs for green, yellow, and purple were curves (i.e., exponential functions).

Evaluation ()

What the Teacher Will Do	Eliciting Questions	Student Responses
Hand Out quiz	Quiz 1. a) Write an explicit formula for how the following population Grows Day 0 – 50 Day 1 – 45 Day 2 – 40 Day 4 – 35 b) What will the population be on Day 10? 2. a) Write an explicit formula for how the following population grows Day 0 – 405 Day 1 – 135 Day 2 – 45 b) What will the population be on Day 5?	y=50-5x 0 y=405*((1/3)^x) 5