

Exponential Growth

Mrs. Garey, Mrs. Megibbon, Mrs. Wagner 5/6/08

9th Grade

Algebra 1B

20 – 30 students

of IEPs None

Goals and Objectives: Students recognize mathematical relationships in different contexts through investigation. Students make connections by drawing on prior knowledge to form conclusions. Students use recognition to relate mathematical situations to real world situations.

Connections:

Big Idea: Algebraic Thinking

High school students extend analysis and use of functions and focus on linear, quadratic, absolute value and exponential functions. They explore parametric changes on graphs of functions.

MA-HS-AT-S-PRF13 Students will graph linear, absolute value, quadratic and exponential functions and identify their key characteristics.

MA-HS-5.1.1 Students will identify multiple representations (tables, graphs, equations) of functions (linear, quadratic, absolute value, exponential) in real-world or mathematical problems. DOK 2

MA-HS-5.1.4

Students will recognize and solve problems that can be modeled using an exponential function, such as compound interest

MA-HS-5.1.8 Students will identify the changes and explain how changes in parameters affect graphs of functions (linear, quadratic, absolute value, exponential) (e.g., compare $y = x^2$, $y = 2x^2$, $y = (x-4)^2$, and $y = x^2+3$). DOK 2

Context:

This lesson is designed to be an introduction to exponential functions. The class has background knowledge in linear functions, slope, and rate of change. They will investigate exponential functions with a comparison their background knowledge of linear functions.

Essential Question: What are the similarities and differences between a linear function and an exponential function?

Resources:

Poster board

Calculators

Graph Paper

Markers

Exponential Scenarios

Procedure:

As the class enters the room they are given salary options to choose from. They make their choice and document it on their paper. They are then placed into heterogeneous groups to discuss their choice and why they made it. As group they are to come to consensus on the best option and prepare a presentation justifying their choice. Supplies are available; they can prepare a table, a chart, a graph, or an equation to support their decision.

The groups present.

Discussion takes place making connections to the various methods presented. (a diagram, an organized list, a rule, a graph, an equation) Similarities and differences in the two scenarios are discussed.

Students then go back to their groups. Each group is given a scenario to present to the class describing what type of function they were given and how they came to that conclusion.

Again the discussion is led around similarities and differences in the functions.

The extension of each scenario is then assigned as individual homework.

Student Assessment:

Formative assessment is done on the discussions as well as the presentations. Group work is closely monitored throughout the lesson. Summative assessment is done later in the unit with a quiz and at the end of the unit with a test.

Reflection: The kids surprised me with their enthusiasm and knowledge. They came up with some good products, utilizing their problem solving skills and background knowledge. I do think in future instruction I need to emphasize the use of tables to present data. The time was difficult for me to judge, I need to keep things moving at a productive pace, but not too fast as to prohibit their thought process. The lesson can be refined but is a good start, and definitely a worthwhile practice.

BELLWORK

Added actual bellwork scenario as well as a scenario for each group with extension exercises. The groups will look at exponential and linear functions. One group will have a scenario that is not a function.

Which salary option would you choose?

\$10,000/week for one year

OR

A salary that begins at 1 penny and doubles each week for a year

Record your answer and the reasons you made your selection here

BELLWORK

Which salary option would you choose?

\$10,000/week for one year

OR

A salary that begins at 1 penny and doubles each week for a year

Record your answer and the reasons you made your selection here

Scenario One:

Two students who were both born on December 21st, the date of the winter solstice, decide that it would be great not to have to attend school on that day. Therefore, they start a rumor that schools will be closed to celebrate the winter solstice. So, on December 1st, one of the students told two of her friends that school would be closed. On the next day, each of these students tells 2 students and on consecutive days, each of the new students tells 2 more students and so on.

What type of function is the spreading of the rumor?

How did you make that decision?

EXTENSION:

If there are 8,000 students in the school district, the question arises as to whether the rumor was started early enough for everyone to have heard it?

Scenario Two

A tract of land that had once been cleared was now overgrown with weeds and brush, including spotted knapweed (a Class A noxious weed). This land separated an urban neighborhood from the nearby national forested lands, and a few miles beyond that was a National Park. Although this tract of land was private property, it has several trails across it, used by people living nearby to access the forests beyond. A local mountain bike club requested permission from the owner to cross the land and join the forest trail system rather than drive their vehicles from town to the trail system. Securing permission, the club organized a 50 mile "City To the Park" benefit ride to advertise their new club and help vitalize their town and the nearby National Park with this popular recreational activity.

The event went off as planned, but 150 bicyclists cutting across the weekend tract of land also carried broken bits of seed-bearing knapweed branches caught in the gears of their bikes and knapweed seed caught in the deep lugs of their tires. After a few miles of jarring along the forest trails, 300 seeds were dislodged.

What type of function is the spreading of the seeds?

How did you make that decision?

EXTENSION:

Assuming 50% will germinate and grow to maturity, and a mature plant may develop 1000 seeds, how many plants grew after the event, how many seeds would be produced for the seed bank, and how many plants would appear in the forest the following year?

Scenario Three:

Imagine a baby that grows .25 inches per month. She starts out at 20 inches long.

What type of function is the baby's growth?

How did you make that decision?

EXTENSION:

How long will she be at the end of her 20th month?

Scenario Four:

A utility company charges a fixed monthly rate plus a constant rate for each unit of power consumed. The fixed rate is \$25, and the cost for each unit of power is \$0.02

What type of function is the cost of power?

How did you make that decision?

EXTENSION:

What would the utility bill be if a family consumed 150 units of power Monday thru Friday and 200 units of power on Saturday and Sunday in the month of February? (Assume 28 days, 4 full weeks, in the month)

Scenario Five:

On Monday the cost of gasoline was \$3.56, on Tuesday it was \$3.45, on Wednesday it was \$3.47. Thursday of the same week the price went to \$3.50 and Friday thru Sunday gas cost \$3.64.

What type of function is the cost of gasoline?

How did you make that decision?

EXTENSION:

Can you write a rule that predicts the cost of gasoline? What is the average cost of gasoline per gallon? How much money would you save filling a 25 gallon tank on Tuesday versus filling the same tank on Saturday?