

LessonTitle: Exponential Function Labs		Alg 7.9
Utah State Core Standard and Indicators Algebra Standard 2.1 Process Standards 1-5		
Summary		
In this series of lessons, students work on problems with contexts involving exponential growth. First is an investigation related to the book <u>One Grain of Rice</u> . Second, they examine the length of a fractal. Third, is a credit card investigation.		
Enduring Understanding	Essential Questions	
Nonlinear functions are found in many real world situations. Growth patterns and rates of change determine the equations and graphs of nonlinear functions.	What is exponential growth? What are some real world contexts in which we find exponential growth?	
Skill Focus	Vocabulary Focus	
Exponential and quadratic patterns, equations, graphs		
Assessment		
Materials: graphing calculators		
Launch		
Explore		
Summarize		
Apply		

Directions:

The following labs are meant to introduce contexts in which we find exponential and quadratic equations. We suggest that you intersperse the following labs with factoring and solving quadratic equations assignments. The connection to real contexts will help give purpose to the factoring and solving problems. At the conclusion of this module, students will investigate and present their own exponential and quadratic lab projects.

7.9a One Grain of Rice: Read the first few pages of the book One Grain of Rice, A Mathematical Folktale. Ask students to predict the book’s conclusion or how much rice Rani will have in one month. If you cannot locate a copy of the book, just use a simple paper tearing activity. At each stage tear each piece of paper in half (stage 1--1 piece of paper, stage 2--2 pieces, stage 3--4 pieces etc.)

After students have shared their conclusions and methods, explore the problem on the graphing calculator. Generate equations to post in lists in order to obtain amount of rice on any given day or total rice collected on any given day. Discuss the window, especially the y max and the y scale.

7.9b How Long is this Fractal? (see below)

7.9c Credit Card Investigation: (see below)

Information for potential use:

- Exponential and quadratic functions involve repeated multiplication. That is, instead of having a constant pattern of change (the change is the same at every step--linear), the change at every step increases or decreases. If the repeated multiplication involves a decimal then the change is decay instead of growth.
- Quadratic functions involve two solutions and an increasing rate of change. The graph of a quadratic equation is a parabola curving in opposite directions. The standard form of a quadratic function is $y = ax^2 + bx + c$.
- Exponential change involves repeated multiplication of the same base.. The standard exponential change equation is $y = ab^x$. The variable (x) is the number of times the change occurs, the exponent. The rate of change (b) is repeated at each stage. The original population or amount is (a). Exponential change approaches a limit.

Alg 7.9

Exponential Function Labs

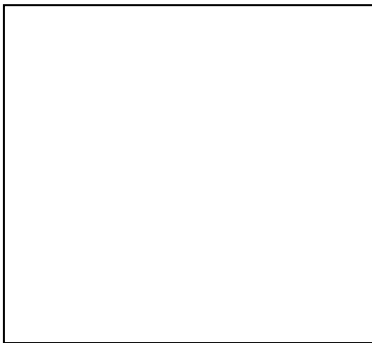
One Grain of Rice

Problem solve to predict the conclusion of the book or how much rice Rani will have after 30 days. You may wish to think about two questions: 1) How much rice will she receive on the 31st day and 2) how much rice she will have in total?

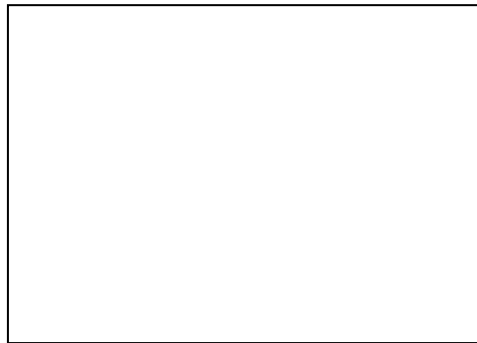
You may use any tools you wish, graphing calculator, formulas, graphs, etc.

What did you do to make your predictions?

Data:



Graphs:



Equations: _____

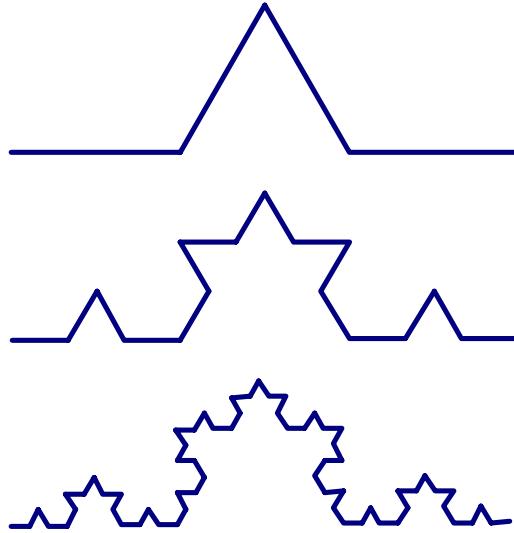
Observations & Conclusions:

What are some things you learned about using the graphing calculator as a tool?

Alg 7.9b

How Long is This Fractal?

Stage 1: Length = 1 unit



Stage	# of segments	Segment length	Total length (fraction)	Total length (decimal)
1	1	1	1	1
2	4	1/3	4/3	1.33

y = _____ y = _____ y = _____

Using stage as the x value, create equations for finding the above.

At what stage do you believe the line Koch Curve will begin to look like a curve?

Will the total length continue to increase forever?

Is there a limit toward which the total length approaches? If so, what do you think it is?

Alg 7.9c Items Bought With Your Credit Card

(Use with Credit Card Payment)

Select *at least* eight items to purchase with your credit card from any of your catalogs. You have a credit card limit of \$3000. Spend as close to \$3000 as possible but do not go over. As you select items that you want to purchase, cut them out to place on your poster and record the item and price in the table below.

ITEMS	COST
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.
11.	11.
12.	12.
Total:	

Alg 7.9d Credit Card Payment

Name _____

It has been thirty days since you purchased the items you selected from your catalogs. It is now time to pay off your credit card payment of \$3000. The annual interest rate that you will be paying is 20%.

Calculate the monthly interest rate that you will be charged by using the annual interest rate given above . _____

1. Using the monthly interest rate, determine how much extra money you would end up paying if you pay \$1000 a month for three months. Will you be able to pay off your credit card payment in this amount of time?
2. Using the monthly interest rate, determine how much extra money you would end up paying if you pay \$500 a month for six months. Will you be able to pay off your credit card payment in this amount of time?
3. Using the monthly interest rate, determine how much extra money you would end up paying if you pay \$250 a month for twelve months. Will you be able to pay off your credit card payment in this amount of time?
4. Using the monthly interest rate, determine how much extra money you would end up paying if you pay \$50 a month for five years. Will you be able to pay off your credit card payment in this amount of time?
5. Using the monthly interest rate, determine how much extra money you would end up paying if you pay the entire \$3000 the first month for. Will you be able to pay off your credit card payment in this amount of time?

Credit Card Analysis Questions

Name _____

1. How does the total amount paid compare with the total amount originally charged?
2. In which of the payment scenarios did the total amount paid most closely resemble the total amount originally charged to your card? Why?
3. Under what conditions would you be most affected by the interest rate of a credit card?
4. Under what conditions would you not be affected by the interest rate of a credit card?
5. Under what conditions should you use a credit card?
6. When should you not use a credit card?
Write a paragraph about what you learned from this “Credit Card Activity.”

Consider making a personal pledge of some sort regarding responsible credit card use for you and your parents to sign.

I PLEDGE _____

Student Signature _____

Parent Signature _____

Graphs