Exponential Growth Activity/Answer Key

Name: _____ Group Number:_____

Date:_____ Period:_____

Directions: Work on the following problems as a group. You need a graphing calculator.

Problem One:

One single bacteria lands on a kitchen counter. It divides into two parts every 5 minutes. Fill out the chart below to show how many bacterium are on the counter:

# of 5 minute periods	0	1	2	3	4	5	6	7	8	9	10	11
# of bacteria	1	2	4	8	16	32	64	128	256	512	1024	2048

How many 5-minute periods are there in one hour? 12

How many bacteria are on the counter after one hour? 4096

Make a scatterplot of your data on your calculator. Copy it below, labeling the axes.

Answers will vary. Students should label the x-axis as # of 5 minute periods and the y-axis as # of bacteria. The students also should label both axes with an appropriate numerical scale. The points should display and exponential pattern.

Describe the pattern you see. Include if the data increases, decreases, is linear, not linear, constant, or non-constant.

Answers may vary. Students should include increasing at a non-constant rate. The data starts increasing slowly and then increases quickly. It is not linear.

Think about how you filled out your table. 4 can be written as 2 x 2 or 2^2. 8 can be written as 2 x 2 x 2 or 2^3.

Express the number of bacteria after 4 five-minute periods using exponents. 2^4

Express the number of bacteria after 5 five-minute periods using exponents. 2^5

Express the number of bacteria after 12 five-minute periods using exponents. 2^12

Express the number of bacteria after *x* five-minute periods using exponents. 2^x

Type your exponential expressions in your calculator. How do your answers compare to the data in the chart?

Students should find that the equation matches the scatterplot.

2^2, 2^3, 2^4, and 2^12 are **exponential expressions.**

2^x is an **exponential equation.**

Type y = 2^x in your calculator. Set the window to match the scatterplot you copied above. How does this equation compare to your scatterplot.

Again, the curve should go through the points on the scatterplot.

What was the starting point for your data? 1

Remember that y = 1 x 2^x = 2^x

Problem Two

Your parents want to give you a weekly allowance of $50. Even though that is a lot of money, you come up with a better plan. On May 31, your parents will give you one cent ($0.01). Every day, you will be given double the amount from the day before. Your parents agree, and give you one penny to start.

Fill out the table below to explore what happens to your daily allowance.

une	1	2	3	4	5	6	7	14	21	28
$	.02	.04	.08	.16	.32	.64	1.28	163.84	20971.52	

How much money will your parents owe you on June 30? $10737418.24

Will you get it? No Why or why not? Too much money!!

Express the amount of money earned on June 30 using exponents. .01(2^30)

Now write an equation for x days. Remember, the starting point is not 1 this time. y=.01(2^x)y

Graph the scatterplot on your calculator and copy it below. Also graph the equation you wrote above. If the scatterplot and rule do not match, adjust your equation until they do.

The rule and the scatterplot should match. Some students may use 2^x as the equation and forget the starting point. Studens should label the x-axis with dates and y-axis as money.

Problem Three:

You get an email that school will be closed tomorrow. The email instructs you to forward it to three of your friends. Your friends will send it three of their friends and so on and so on. How many people must forward the email so that all 500 students enorlled at school stay home?

Fill in the table:

# of email enders	0	1	2	3	4	5	6	7	8
# of tudents hat know	1	3	9	27	81	243	729	2187	6561

Make a scatterplot of your data. Copy it below:

Students should label the x-axis as # of email senders and y-axis as # of students that know. Again both axes should be labeled with an appropriate numerical scale.

How does this situation compare to the other two problems?

The numbers are being tripled, not doubled. The numbers increase very quickly.

Write a y = equation for this situation. Remember, the numbers are not being doubled.

Y = 3^x

Graph your equation on your calculator. Does the graph match your scatterplot? Adjust your equation until it does.

Summary:

Explain the roles of a and b in the equation below. How do the values of a and b affect the table and graph of the equation?

y = a (b^x) a is the starting point and b is what the numbers are multiplied by each stepa a **Extension:**
Set the window of your calculator to:

x min: 0

x max: 100

xscl: 10

y min: 0

y max: 3000

yscl: 100

Explore the following equations. Describe in words a situation that would match the equation. Use your imagination!

y = 2^x

y = 5 x 2^x

y = .5 x 2 ^x