

Who Started It All
by – Jacklyn Bonneau

Activity overview
Abstract

Concepts

- *Spread of Disease models.*
 - *Tracing back the spread of an outbreak of contagious disease to find the source.*
-

Teacher preparation

Teachers will need to download the student worksheet as well as the TNS file. Teachers also need to gather 4 x 6 well plates, small paper cups for each student, pipettes for each student, a dropper bottle of phenolphthalein and make a 1 M solution of NaOH (a weaker solution also works, it depends upon the number of “sharing of bodily fluids” you do.) Each student needs to be assigned a place on the well like A-2 and use that location each time only as a check at the end.

Classroom management tips

Have students do the sharing and donating of the sample after each sharing before you take out the N-Spires. Be sure students list their contacts as they “share”. The reason to give a sample after each sharing is so that we can know how many are infected after each step. You will not reveal the results of these until later.

Students then should predict how many people will be infected and enter those values into there lists.



You will then test and count the infected samples to analyze again.

TI-Nspire Applications

This activity uses TI-Nspire and/or TI-Nspire CAS lists and spreadsheets as well as geometry and graphing.

Step-by-step directions

1. Make solution for “infected student” and place it into a numbered Dixie cup. This cup should be half full. Record that number.
2. Make enough numbered Dixie cups for all students in the classroom filled with plain water. All cups should be half full.
3. As students enter the classroom each students gets a cup of “bodily fluid”. Be sure the infected cup is out if not all cups are used!
4. Explain the procedure to your students;
 - a. Exchange a dropper full of fluid both ways and stir
 - b. Record your partner
 - c. Leave a sample in the appropriate spot in the front
 - d. Repeat five times (less for smaller classes)
5. Pass out inspired and have student do predicted results
6. Go around and drop phenolphthalein in each cup at end to find infected folks

7. Add droops of phenolphthalein to spot plates. Count and post the number infected at end of each exchange. Have student enter this into their Nspires and data sheet 3.
8. Analyze as on the student worksheet.

Assessment and evaluation (*NOTE: this section can be separate or included in the step-by-step directions.*)

- *Suggestions for assessing the activity (for the teacher) and the student (for understanding and content)*
- *re-teaching ideas if students aren't successful understanding the concept*
- *Optional: Answers to student questions in the Student TI-Nspire document and/or student worksheet*

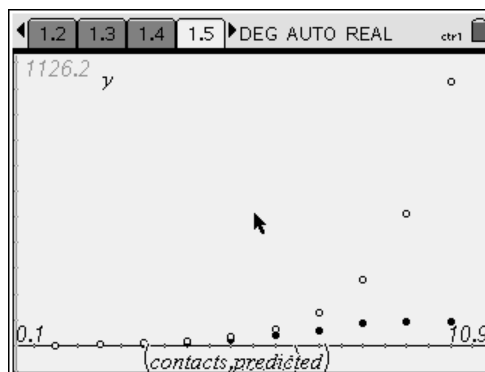
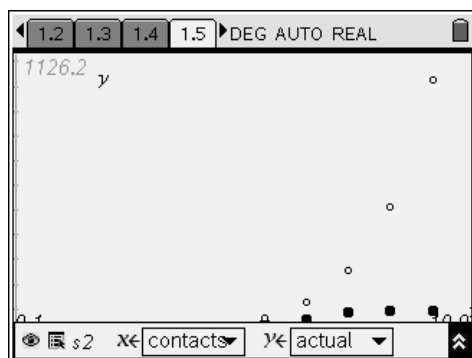
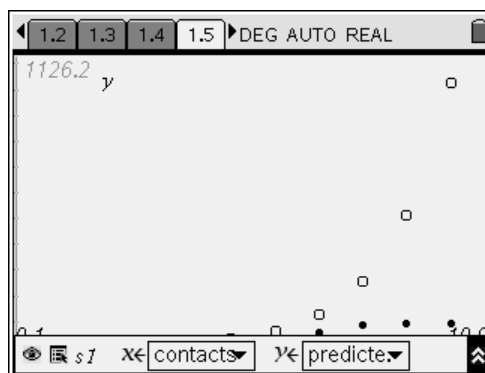
Activity extensions

- *This activity can be done with science probes using to test results. Either pH if you contaminate with NaOH or conductivity if you use NaCl to make infected cup.*
- *If you have test lines you can expand this to talk about contamination within groups. You will find that one line becomes more infected then the other.*
- *Although this is a forensics activity it easily applies to biology or mathematics.*

Student TI-Nspire Document

Who Started it All - at the end of this sheet

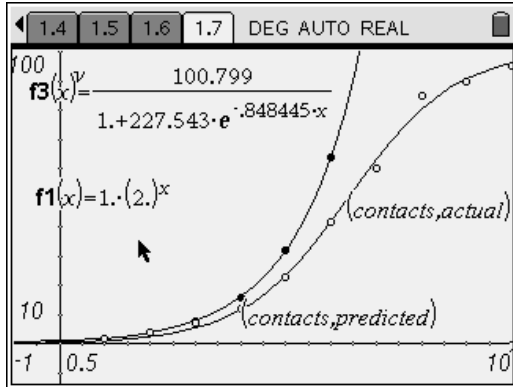
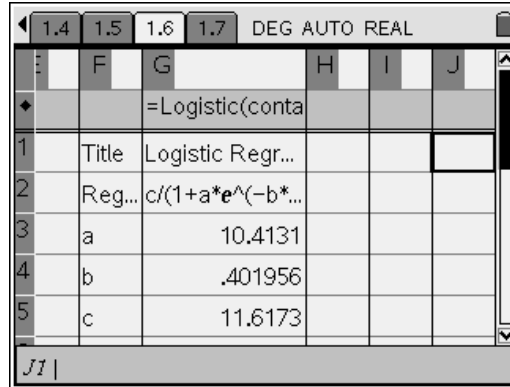
	A contacts	B predicted	C actual	D
		$=2^{\wedge}\text{contacts}$		
1	1	2	2	
2	2	4	4	
3	3	8	7	
4	4	16	12	
5	5	32	23	



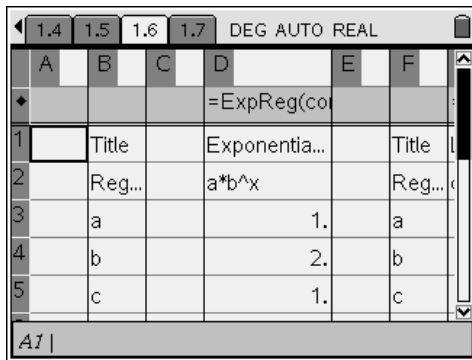
Who Started it All

by: Jacklyn Bonneau
 Grade level: secondary
 Subject: Forensics or Biology
 Time required: 45 to 90 minutes

Materials: N-Spire

	F	G	H	I	J
		=Logistic(conta			
1	Title	Logistic Regr...			
2	Reg...	$c/(1+a \cdot e^{(-b \cdot x)}$			
3	a	10.4131			
4	b	.401956			
5	c	11.6173			



	A	B	C	D	E	F
				=ExpReg(co		
1	Title		Exponentia...		Title	l
2	Reg...		$a \cdot b^x$		Reg...	c
3	a		1.		a	
4	b		2.		b	
5	c		1.		c	

Student Worksheet

Directions for Activity

Step-by-step directions

1. Pick up a cup of your bodily fluids for this activity. Record your cup number.
2. You will now “contacts” several students
 - a. Exchange a dropper full of fluid both ways and stir
 - b. Record your partner in data table one on this sheet.
 - c. Leave a sample in the appropriate spot in the front
 - d. Repeat five times
3. Obtain an Nspire and open the document Who Started it All
4. In the first data table on the NSpire enter the first two columns with contacts number and the number of folks you predict to be infected.
5. Record the number of infected people per contacts from the class data from your teacher.
6. Add this to the Data table here and in column three on the NSpire.

Data

Using the table below, assume you have 90 students in this class and we begin with one infected student. If you randomly exchange fluids with one other person for 7 different contacts, how many individuals will be infected after each contact? How many contacts will it take to infect the entire class?

Prelab Question	
Contacts	Number infected
0	
1	
2	
3	
4	
5	

6	
7	

Profile of Your Contacts	
Contacts	Who You "Contacted"
0	
1	
2	
3	
4	
5	
6	
7	

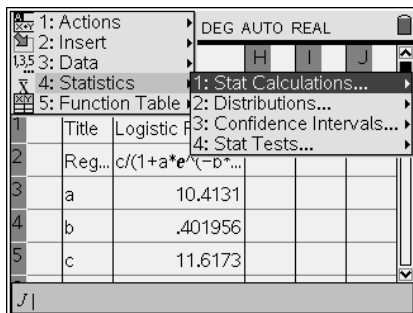
Class Data	
Contacts	Number infected
0	
1	
2	
3	
4	
5	
6	
7	

Analysis

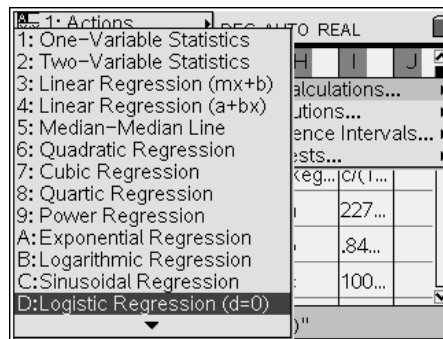
- On the graph set up the scatter plot to graph contacts and predicted as s1.
- Set contacts and actual as s2.
- Go back to the data table now and we will find the equations for the functions.
 - Move the cursor to the calculate box right below the label in column D
 - Press MENU>STAT>STAT CALC>EXPONENTIAL for predicted. Choose the correct X and Y list from the pull down menu and the tab until you get to OK and click it.

Does the exponential fit work well? Which data does it apply to? What is the equation that was derived?

- Go back to the data table and move your cursor to the calculator column under the H column and repeat the above.
 - Press MENU>STAT>STAT CALC> LOGISTIC REG (d=0).
 - Choose the other variables for X and Y from the pull down menus. Tab to OK and click.



1	Title	Logistic F			
2	Reg...	$c/(1+a*e^{(-b^x)})$			
3	a	10.4131			
4	b	.401956			
5	c	11.6173			



1	Actions	DEG AUTO REAL
1	One-Variable Statistics	
2	Two-Variable Statistics	
3	Linear Regression (mx+b)	
4	Linear Regression (a+bx)	
5	Median-Median Line	
6	Quadratic Regression	
7	Cubic Regression	
8	Quartic Regression	
9	Power Regression	
A	Exponential Regression	
B	Logarithmic Regression	
C	Sinusoidal Regression	
D	Logistic Regression (d=0)	

Which set of data (predicted or actual) best fits the logistic model?

Explain why the data tapers off at the end.

Determine when you were infected and by whom.



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Looking at the class data can you tell who started it all?