

IB Math Studies 2
Unit 3, Lesson 1

Objectives		Skills
The students will be able to: - Explore exponential growth in the context of disease transmission		
Materials and Handouts		Homework
- IB sample problem - Worksheet - Projector for PowerPoint and YouTube - Beakers - Cups - Eyedropper - Phenolphthalein - Sodium hydroxide - Water - Bucket		WS #1
Time	Activity	
15 min	Do Now/Overview <ul style="list-style-type: none"> - Have students try to guess the U.S. and world populations (314,881,361 and 7,056,390,156 from http://www.census.gov/main/www/popclock.html) - Watch a clip from the movie Contagion (point out math at 1:17): http://mathspig.wordpress.com/tag/contagion-math-error/ - Students write down the math that Jude Law states and then figure out how long it would take to reach 1 billion deaths, the population of the U.S., and the population of the world. 	
35 min	Disease Detectives <ul style="list-style-type: none"> - http://cosm.georgiasouthern.edu/biology/mbi/modules/kelly/disease%20detectives.pdf - #1: 2 rounds - Try to identify the infected person. Pick up the discarded liquids and dispose of them by diluting and pouring down the science lab sink. - #2: 3 rounds - Graphing activity. Pick up the discarded liquids and dispose of them by diluting and pouring down the science lab sink. 	
3 min	Closing <ul style="list-style-type: none"> - Students begin work on homework. 	

Reflection: Most students were wrong with the population of the U.S. (guessing way over—usually 2 billion). Ran into issues with broken speakers, rushing to make copies, and with a spill. Round 1 went well, with four people infected. I thought we could dispose of the liquids using my Halloween bucket, but it leaked. Had to do cleanup and then rush the second round of 3 interactions, and forgot to do the estimated number of infections for Round 1. Did do it for round 2, after finding the actual. My intern pointed out that there were only 7 because two infected people could have traded with one another. Also had to skip the graphing activity. Can start with that in Lesson 2 for Section C. Turned exit ticket into homework.

Name: _____ Section: _____ Date: _____

IB Math Studies 2

Ms. Buenafe

Unit 3, Lesson 1: Introduction to Exponential Functions

Who Will Survive?



What do you think the population of the U.S. is? _____

What do you think the population of the world is? _____

U.S. Population: _____ World Population: _____

Contagion: Number of Deaths

Watch the clip and write down the number of deaths that Jude Law says, then continue the pattern. Does it match what he predicts for 3 months?

Day	Number of Deaths
1	
2	
3	
4	
5	
6	

Estimate when the population of the U.S will die from the disease.

Estimate when the population of the world will die from the disease.

Disease Detectives

World populations are at an all-time high and are expected to increase even more in the next decades and centuries. Human populations are in closer contact than ever before – and that can be dangerous. Increased contact between humans increases the risk of disease transmission among a population. Each time a human interacts with another person, they run the risk of spreading a disease causing agent, even if the person doesn't know he/she is sick! More alarming still, in today's world of international travel, an infected individual can cross oceans and spread a disease before he/she starts to show symptoms (ex., SARS). Today, you will be modeling just how quickly a disease can spread, and relating it back to the ecological concepts of carrying capacity and population growth (logistic vs. exponential).

Please clear your desks of all materials except a pencil and the worksheet. Ms. Buenafe will give you a cup filled with a clear solution. This solution represents your body. Only one person in the class will have a cup that is “infected.” **Do NOT drink from the cup or spill the contents.**

During this activity, you will interact with two other students. To interact with another student, pour all of your solution into your partner's cup. Then have your partner pour all of the mixed solution back into your empty cup. Finally, pour half of the mixed solution back into your partner's empty cup.

Write down who you interacted with: _____

Wait for the signal from your teacher, and then move to another part of the classroom and interact with a second student. After you have finished your second interaction, return to your seat.

Write down who you interacted with: _____

Your teacher will come around and put an “infection indicator” in your cup. If you have exchanged solutions with the original infected person or someone else after they became infected, you are now infected and your solution will turn pink. If you have not exchanged solutions with anyone who was infected, your solution will not turn color.

Estimate how many students you think are now infected: _____

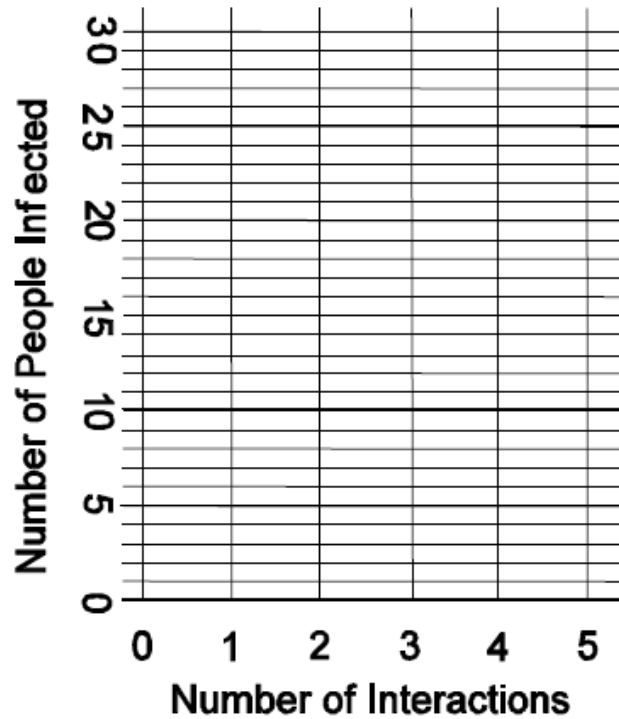
Ms. Buenafe will ask you to raise your hand if infected. Record the actual number: _____

You will do another set of interactions, again with only ONE infected cup. This time there will be **three** rounds of interactions. For each interaction, be sure to move to a different part of the room with different students. Return to your seat when you have finished.

Write down the three people you interacted with:

Estimate how many students you think are now infected: _____

Ms. Buenafe will ask you to raise your hand if infected. Record the actual number: : _____



- Plot a point to indicate that one person was infected before any interactions.
- How many people would be infected after one interaction? ____ Add this point to the graph!
- Plot the number of people who were infected after two interactions (from #2).
- Plot the number of people who were infected after three interactions (from #4).
- Draw a line-of-best fit for the points on the graph.

Did the number of people infected increase by the same amount after interactions with 1, 2, and 3 people?

Which interaction resulted in the smallest increase in the number of infected people? _____

Which interaction resulted in the largest increase in the number of infected people? _____

Do you notice a trend in the way the number of infected individuals is increasing?

Name: _____

Section: _____

Date: _____

IB Math Studies 2

Ms. Buenafe

Unit 3: Exponential Functions

Lesson 1: Introduction to Exponential Functions Exit Ticket (10 points)

Sample IB Question

In an experiment it is found that a culture of bacteria triples in number every four hours.

There are 200 bacteria at the start of the experiment.

Hours	0	4	8	12	16
No. of bacteria	200	600	a	5400	16200

- (a) Find the value of a . (1)
- (b) Calculate how many bacteria there will be after one day. (2)
- (c) Find how long it will take for there to be two million bacteria. (3)

IB Connection

What are the factors that affect population growth that you learned about in IB Biology?

Would spread of a disease be truly exponential? What factors would affect it?