Go over homework and quiz problems.

Answer questions about the list of topics to be covered on the test.

Review Exercise: Suppose a population starts with 100 individuals and has a 2% monthly growth rate.

a. Write the formula for that growth.
b. Estimate the doubling time to the nearest whole number of months.
c. Evaluate your formula in part a. for that number of months.
d. Is your estimate of the doubling time too short or too long or exactly correct?
e. If it was not exactly correct, make a better estimate of the doubling time. (That is, make an estimate that shows you know how to move in the correct direction.)
f. Use your revised estimate to write a doubling formula.

As a class, we will do this problem and obtain these answers:

a. $A = 100(1.02)^n$ where n is in months. b. 72/2=36. I estimate 36 months.

c. $A = 100(1.02)^{36} = 203.99$. d. My estimate of 36 months is a little too long. It really doubles sooner. e. My better estimate is 35.5 months. f. My doubling formula is $A = 100(2)^{n/35.5}$

New material:

Lesson 10. Sometimes when people want to make a graph of exponential data so that they can see the patterns more easily, they choose to use logarithms in a very interesting way. Activity 1 here shows how to make a semi-log graph, and it shows you how the pattern you see when you make a semi-log graph is exactly the same as if you had just graphed the logarithms of the y-values instead of the y-values themselves. When you do this, then exponential data will show up as a straight line. That is, data which looks like a straight line on a semilog graph is actually exponential data.

In class, go over the discussion and activity 1.

Homework:

Homework: Lesson 6, pages 280-284. 9, 10, 12, 14, 15, 17, 19, 20

Homework: Pages 321-327. 1. Graph the same three ways that we did in Activity 1. Graph it on regular graph paper. Then graph it on semilog paper. Then make a third column with logarithms and graph that on regular graph paper.

Quiz:

1. Lesson 6, page 284. 19

2. Lesson 10. pages 321-327. 7 and 8.

More discussion of Truth Tables (from Day 4):

I believe that more work with truth tables will help you resolve some of the difficulties you are having deciding how to use De'Morgan's laws for negation of compound statements.

Definition: The negation of a statement is the statement that has exactly the opposite truth values.

Example 1: We are going to use truth tables to investigate how to write the negation of the statement "a and b" in order to see how it relates to "or."

Here's a truth table for the statement "a and b".

a	**b**	**a and b**
T	T	T
T	F	F
F	T	F
F	F	F

Notice that in the first two columns, we put a **systematic** listing of **all** the possibilities for whether statements a and b are true or false.

In the third column, we list whether the compound statement "a and b" is true or false for the given values of the truth of the simple statements.

A negation of a statement means that True and False are reversed. So this is a truth table for the negation of the statement "a and b."

a	**b**	**a and b**	**~(a and b)**
T	T	T	F
T	F	F	T
F	T	F	T
F	F	F	T

Now, earlier I said that we use the "inclusive or" in math for several reasons, and one of those has to do with the negation of "a and b."

Let's investigate the statement "not a or not b" where we understand this to be the inclusive or.

a	**b**	**~a**	**~b**	**~a or ~b**
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

Notice that, if we had used the "exclusive or" then the last line of the table would have given us a False and so it would not have matched the negation of the compound statement "a and b."

Example 2: Now we will investigate the negation of the compound statement "a or b".

a	**b**	**a or b**	**~(a or b)**
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

Now let's look at the statement "not a and not b"

a	**b**	**~a**	**~b**	**~a and ~b**
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

So we can see from these truth tables that the negative of the statement "a or b" is logically equivalent to "not a and not b"

Examples 1 and 2 are summarized as "DeMorgan's Laws" in Section 2, on page 57.

Example 3: What does the double negative mean?

In logic, where any statement is either true or false, then "not true" must mean false. So then "not false" must mean true.

a	**not a**	**not (not a)**
T	F	T
F	T	F

So "not (not a)" is logically equivalent to "a".

Exercise 1: Make a truth table for each of these three compound statements. When you are finished, determine whether either Statement 2 or Statement 3 is the negation of Statement 1.

Statement 1: "Not p and q" Statement 2: "p and not q" Statement 3: "p or not q"

Comment: We'll know if a statement is the negation if its truth values are exactly the opposite of the original statement.

Statement 1					Statement 2			
p	q	not p	not p and q		p	q	not q	p and not q
T	T	F	F					
T	F	F	F					
F	T	T	T					
F	F	T	F					

Statement 1					Statement 3			
p	q	not p	not p and q		p	q	not q	p or not q
T	T	F	F					
T	F	F	F					
F	T	T	T					
F	F	T	F					

So, does Statement 2 have truth values exactly opposite from Statement 1? Does Statement 3 have truth values exactly opposite from Statement 1?

Could you have predicted this result from simply using DeMorgan's Laws?

Was it helpful to go through making the truth tables to illustrate it?

Exercise 2: Make a truth table for each of these three compound statements. When you are finished, determine whether either Statement 2 or Statement 3 is the negation of Statement 1.

Statement 1: "Not p or q" Statement 2: "p and not q" Statement 3: "p or not q"

Exercise 3: Is either Statement 2 or Statement 3 is the negation of Statement 1? Use your knowledge of DeMorgan's laws or a truth table to determine this.

Statement 1: "Not p and not q" Statement 2: "p and q" Statement 3: "p or q"

Exercise 4: Is either Statement 2 or Statement 3 is the negation of Statement 1? Use your knowledge of DeMorgan's laws or a truth table to determine this.

Statement 1: "Not p or not q" Statement 2: "p and q" Statement 3: "p or q"

Answers:
Exercise 1: Statement 3 is the negation of Statement 1.
Exercise 2: Statement 2 is the negation of Statement 1.
Exercise 3: Statement 3 is the negation of Statement 1.
Exercise 4: Statement 2 is the negation of Statement 1.