12 - 6 - 03

1

Final	200	pts	
Labs	240	pts	
HW	100	pts	
Reading	100	pts	Open through Tomoroww 11:55 PM
Tests	360	pts	(Add 20% to your tests)
	1000	pts	

Bonus ??

No Template for Ch 11 HW. 1, 5, 6

Graduating Seniors Grades on SAIL by 5 PM Tues

All others by 5 PM Fri

1. Identify the following scenarios as having linear, exponential, or logistic models. Additionally, write appropriate equations for the models, specifying variables and values of parameters where possible.

a) The number of computers affected by a virus starts at 10 and increases 25% each hour.

Exponential - constant % increase

$y = \underline{10} \cdot \underline{1.25}^t$ $a = 1 + \%$ increase $= 1.25 = 125\%$

$y =$ # computers $t =$ time (hrs)

b) The number of cars parking on campus grew at a rate of 10% per year for several years but will level off at the 2400 spaces available.

Logistic - early exponential & levels off

early growth (peak in growth)

pg 120 $\frac{\Delta y}{\Delta t} = \underline{.10}\, y \cdot \left(1 - \frac{y}{2400}\right)$ carrying cap.

$y =$ # cars .... $t =$ time (yrs)

c) the average size of the crabs caught in Corpus Christi Bay was 11.8 ounces and has been decreasing by 0.2 ounces per year.

Linear - constant amount decrease

$y = \underline{-.2}\, t + \underline{11.8}$

$y =$ ~~wt~~ wt of crabs (oz) $t =$ time (yrs)

2. The Corpus Christi Caller Times reported that mosquito repellent sales are up 550% at a local grocery store. Use this reported increase to express the relationship between last years sales, S(0), and this year's sales, S(1), in two different ways.

550% = relative growth

Tables

$\frac{\Delta S}{S} = 550\% = 5.50$

$\frac{S(1)}{S(0)} = 1 + 550\%$ $S(1) = (1 + 550\%) \cdot S(0)$

Formula

3

3. Water is leaking from a swimming pool. After being left for some number of days, the drop of the level is measured in inches.

Linear

X (# days)	Y (inches)	$\Delta y / \Delta x$		$\Delta y / y$ if ΔX is constant! Need logs		
1	1					
5	2.1	1.1/4				
6.5	3	.9/1.5				
8	5	2/1.5				

a) Based on the data that appears above, would a linear model be appropriate for the relationship between time since the pool was full and the drop in level? (Your answer is less important than your justification of it.)

Yes if $\Delta y/\Delta x$ col is ~ constant
No if not.
Or Graph.

b) ~~Regardless of your answer to (a), what is the best linear model relating X and Y?~~

c) Using your model, predict the drop in level of the pool after a 15 day vacation. (If you can't do (b), use Y = .75X + .8.)

$Y = .75X + .8$

Let $X = 15$ $\quad Y = .75(15) + .8$

$=$

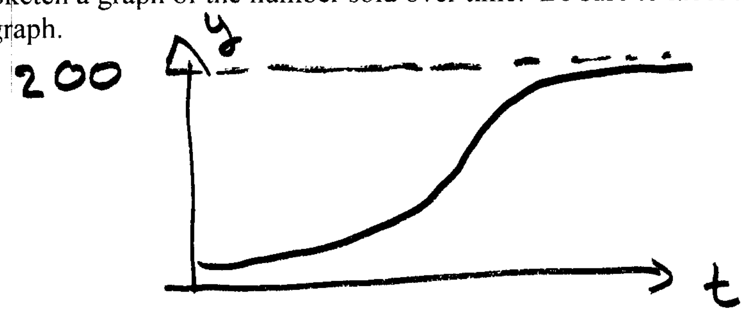
5. Rabbit print overalls, sold by S-Mart, are all the rage at day care centers across the country. When they were first introduced, the number sold was increasing at a rate of 2% per day. Marketing experts estimate that they will be able to sell 200 thousand of the overalls.

a) Write a logistic equation that models the number of overalls sold. Be explicit about the variables.

$$\frac{\Delta y}{\Delta t} = .02\, y \cdot \left(1 - \frac{y}{200}\right)$$

y = # overalls (thous) t = time (days)

b) Sketch a graph of the number sold over time. Be sure to label the axes for your graph.



c) How many overalls would be sold in a day if 80 thousand had been sold up to that day?

Find Δy if $y = 80$ & $\Delta t = 1$

$$\Delta y = (.02)(80)\left(1 - \frac{80}{200}\right)$$

d) For the following numbers of overalls sold, when is the number sold per day the greatest: After 10 thousand were sold, after 100 thousand were sold, or after 150 thousand were sold?

Peak Δy at $\frac{1}{2} L = \frac{1}{2}(200) = 100$

4. On an island near New Zealand there are two species, Mutton Birds and Tiger Snakes. The chicks of the birds are the only food available for the snakes, and they can only eat the smaller chicks, within a week after the chicks are born. Otherwise, the chicks will become too large for the snakes to eat. The Lotka-Volterra Equations for the number of birds (B) and the number of snakes (S) are

$$\Delta B/\Delta t = .24\ B - .01\ BS - .008\ B^2 \qquad \text{and} \qquad \Delta S/\Delta t = .001\ BS - .1\ S$$

a) Find the equilibrium points for the model.

Solve $\Delta B = 0$ & $\Delta S = 0$ simultaneously

$\boxed{(0,0)\ \&\ (30,0)}$

$\Delta B = 0$

$B = 0$ or $.24 - .01S - .008B = 0$

$\Delta S = 0$ $\quad S = 0$ or $.001B - .1 = 0$ $\quad B = \frac{.1}{.001} = 1000$

$(0,0)$	$S=0$ $\quad .24 - .008B = 0$ $30 = B = .24/.008$
$B=0$ $B=1000$	$B = 1000$ $S < 0$ $.24 - .01S - 8 = 0$ $-.01S = 7.76$

Evolutionary biologists have found that the Tiger Snakes are adapting to their situation by increasing in size and being able to eat slightly older chicks. This has changed the equations to

$$\Delta B/\Delta t = .24\ B - .024\ BS - .008\ B^2 \qquad \text{and} \qquad \Delta S/\Delta t = .002\ BS - .1\ S$$

b) Identify the coefficients that have changed and explain why they have been changed the way they have.

Snakes gain more
Birds lose more.

c) Bird lovers have suggested that, in order to be fair to the birds, the snakes should be removed from the island. What would happen to the population of birds in that case?

$S = 0 \qquad \frac{\Delta B}{\Delta t} = .24B - .008B^2$

Logistic Growth

p 120

Birds increase to $L = \frac{a}{b} = \frac{.24}{.008}$

8. In making cookies, Sarah Claus has available 300 sacks of flour, 90 sacks of chocolate, 40 jars of ginger, 3 bags of sprinkles, 10 hours of mixing time and 30 hours of oven time. She wants to make ginger snaps, apple crisps, chocolate cookies and bell cookies. The report below is from Ms. Claus' solution of how to make the greatest number of dozens of each kind of cookies.

Microsoft Excel 8.0 Sensitivity Report
Report Created: 12/10/2001 11:13:16 AM

(a)

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B2	Ginger Snaps	11.14361702	0	1	4	0.502994012
C2	Chocolate	60	0	1	1E+30	0.279255319
D2	Apple Crisps	144.2819149	0	1	1.012048193	0.8
E2	Bells	0	-0.558510638	1	0.558510638	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
F4	Flour	67.7712766	0	300	1E+30	232.2287234
F5	Chocolate	49.1143617	0 (c)	90	1E+30	40.8856383
F6	Ginger	40	0.558510638 (d)	40	67.96812749	10.03592814
F7	Sprinkles	3	11.17021277	3	2.520577144	3
F8	Mixing	7.164228723	0	10	1E+30	2.835771277
F9	Oven	30	5.319148936	30	8.38	21.7

(b)

a) How many dozens of each type of cookie and cookies in all should Ms. Claus make?

e) Should Ms. Claus buy a mixer or an oven?

Oven – shadow Price > 0

f) If Ms. Claus had more chocolate, would she be able to make more cookies? If so, how many more? If not, why not? No

g) If Ms. Claus had more ginger, would she be able to make more cookies? If so, how many more? If not, why not? Yes. $68 \times (.5) = 34$ more dozen cookies

allowable increase