NAME _____ DATE _____ PERIOD _____

1B Bell Exercise
Monday 4-7-08

Hands-On Algebra

Modeling an Exponential Function

Materials

full sheet of paper (8.5 in. x 11 in.)

Related Reference: http://new.math.uiuc.edu/eggmath/Expon/

Step 1 Fold a full sheet of paper in half. Unfold it and record in the table below how many sections are formed by the creases. Then refold the paper. ↖ parts

Folds (x)	Sections (y)	(x, y)
1		
2		
3		
4		
5		
6		

Step 2 Fold the paper in half again. Record how many sections are formed by the creases. Refold the paper.

Step 3 Continue folding in half and recording the number of sections until you can no longer fold the paper.

Answer/do the following:

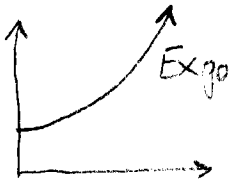
1. How many folds could you make? (total)

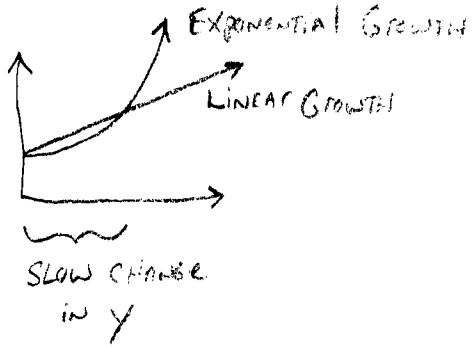
2. How many sections were formed? (total)

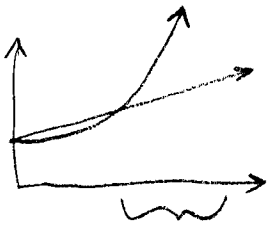
✱ 3. Graph the ordered pairs in your table. Describe the graph.

Use graph paper!

The Bell Exercise Exponential Function $y = 2^x$ is an example of what is called "exponential growth" because as x gets bigger, the RATE at which y gets bigger keeps growing!







which keeps getting more and more rapid!

Ex) populations, money, number of transistors (Moores law), etc.

A key feature of exponential grow is that as you get more of something, it grows even faster ⇒ grow, faster, grows more, faster+ etc., etc.!

- Look at new.math.uiuc.edu website.

A common way to express exponential growth is to say what percent something grows each time period.

Lets say Susan Moore 5-12 has 1000 students. What would be the difference in the schools population if it grew at a linear rate of 50 students per year, or, if it grew at 5% per year? Say for 20 years? Say for 40 years?

Linear		Exponential
1000		1000
+50		+50 = (1000)(.05)
1050		1050
+50	← WHY ARE THESE DIFFERENT? →	+52 = (1050)(.05) LOOK
1100		1102
⋮		⋮
⌄		⌄

Exponential growth starts out "sneaky slow", but if it continues... !!!

	LINEAR		Exponential	
Year	Population	Linear +50	Population	Exponential +5%
0	1000	1050	1000.00	1050.00
1	1050	1100	1050.00	1102.50
2	1100	1150	1102.50	1157.63
3	1150	1200	1157.63	1215.51
4	1200	1250	1215.51	1276.28
5	1250	1300	1276.28	1340.10
6	1300	1350	1340.10	1407.10
7	1350	1400	1407.10	1477.46
8	1400	1450	1477.46	1551.33
9	1450	1500	1551.33	1628.89
10	1500	1550	1628.89	1710.34
11	1550	1600	1710.34	1795.86
12	1600	1650	1795.86	1885.65
13	1650	1700	1885.65	1979.93
14	1700	1750	1979.93	2078.93
15	1750	1800	2078.93	2182.87
16	1800	1850	2182.87	2292.02
17	1850	1900	2292.02	2406.62
18	1900	1950	2406.62	2526.95
19	1950	2000	2526.95	2653.30
20	2000	2050	2653.30	2785.96
21	2050	2100	2785.96	2925.26
22	2100	2150	2925.26	3071.52
23	2150	2200	3071.52	3225.10
24	2200	2250	3225.10	3386.35
25	2250	2300	3386.35	3555.67
26	2300	2350	3555.67	3733.46
27	2350	2400	3733.46	3920.13
28	2400	2450	3920.13	4116.14
29	2450	2500	4116.14	4321.94
30	2500	2550	4321.94	4538.04
31	2550	2600	4538.04	4764.94
32	2600	2650	4764.94	5003.19
33	2650	2700	5003.19	5253.35
34	2700	2750	5253.35	5516.02
35	2750	2800	5516.02	5791.82
36	2800	2850	5791.82	6081.41
37	2850	2900	6081.41	6385.48
38	2900	2950	6385.48	6704.75
39	2950	3000	6704.75	7039.99
40	3000	3050	7039.99	7391.99

THERE IS A SHORTER WAY TO WRITE EXPONENTIAL GROWTH CALCULATIONS WHEN YOU KNOW the percent change each period (A very common real-life situation)

Ex) (POPULATION) To find the population of SMITHS assuming STARTING population is 1000 and change is +5% = +0.05 per year.

The population after 40 years is:

$$P(40) = 1000(1+.05)^{40}$$
$$= 1000(1.05)^{40}$$
$$= 7039.99 = \underline{7040}$$

Ex) (MONEY) You would use the same calculation to find how much money you would have if you earned 5% per year for 40 years (compounded annually) on your starting principal of $1000.

The General Equation for Exponential Growth is:

$$y = C(1+r)^{t}$$

- y: Final Amount
- C: Starting Amount
- r: Percent change converted to a decimal per time interval
- t: Number of time intervals

Ex) $7040 = 1000(1+.05)^{40}$

- $.05$: Rate per year
- 40: Years

These units must match, you cannot mix months with years for example.

Ex 1 Pg 561 1971 ⇒ 294,105 females in HS sports, ↑ 8.5% per year. Model with equation. How many in 2001

$y = 294105(1+.085)^{t}$ t in years since 1971

2001 ⇒ 30 years $y = 294105(1.085)^{30} = 3,399,340$

Homework:
- Read Ch 10-6
- Pg 563 # 4 and 5