Sec I – Unit 8 Linear vs Exponential Name Key ID: 1

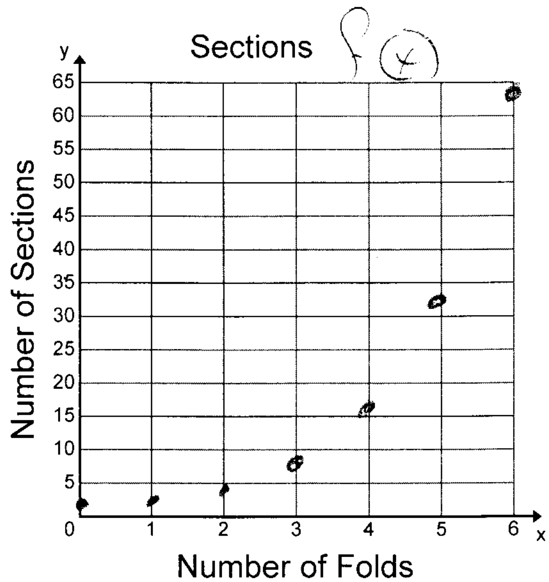
Notes: Day 5 Exp Growth and Decay Date________________ Period______

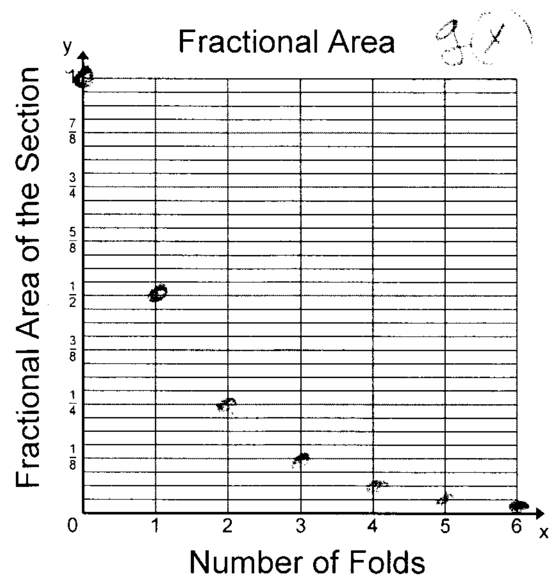
Investigation

1. Take a piece of paper and fold it in half. You now have two equal sized sections each with the area of half the original area.
2. Fold the paper in half again. How many sections of paper do you have? What is the area of each section compared to the area of the original piece of paper?
3. Continue this process until you cannot fold the paper anymore. Fill in the table below as you go.

Number of Folds	0	1	2	3	4	5	6
Number of Sections	1	2	4	8	16	32	64
Fractional Area of the Section	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$

4. Graph each situation below.





5. Write an equation that will allow you to determine the number of sections of paper for any number of folds.

$f(x) = 1(2)^x$

6. Write an equation that will allow you to determine the fractional area of each section for any number of folds.

$g(x) = 1(\frac{1}{2})^x$

7. Use your equations to determine the number of sections of a piece of paper after 15 folds (assume it is possible to fold the paper 15 times) and the fractional area of those sections.

$f(15) = 1(2)^{15}$

$= 32768$

$g(x) = 1(\frac{1}{2})^{15}$

$= 0.0000305$

$= \frac{1}{32768}$

Exponential Growth Vs Exponential Decay (Notes: Page 2)

Exponential Growth

$f(t)=a(1+r)^t$ or $f(t)=P(1+r)^t$

(1+)

Exponential Decay

$f(t)=a(1-r)^t$ or $f(t)=P(1-r)^t$

(1 −)

a or P - represents the principal amount
r - represents the rate of change (percentage written as a decimal)
t - represents time

Growth add 1 / decay subtract from 1

1. Determine the multiplier for each growth rate or decay rate.

factor (what I put into my calculator)

a) 15% growth
0.15 ⟹ 1 + 0.15 = 1.15

b) doubling

c) 6% decay
0.06 ; 1 − 0.06 = 0.94

d) 0.5% growth
0.005 1.005 1.005

e) cut by one third
1 − 1/3 = 2/3

f) 3.8% decay
0.038 1 − 0.038 = 0.962

g) 25% growth
0.25 1 + .25 = 1.25

h) 76% decay
0.76 1 − 0.76 = 0.24

i) 1% decay
0.01 1 − .01 = 0.99

j) 200% growth
2.00 1 + 2.00 = 3.0

k) 0.15% decay
0.0015 1 − 0.0015
= 0.9985

k) 6.5% growth
0.065 = 1 + 0.065
= 1.065

2. State whether the formula models growth or decay. $f(x)=a\cdot b^x$ a: start b: factor

a) $f(x)=1\left(\frac{1}{2}\right)^x$ a: 1 b: ½ decay

b) $f(t)=1(1.5)^t$ a: 1 b: 1.5 growth

c) $f(x)=\frac{1}{3}\cdot 4^x$ a: ⅓ b: 4 growth

d) $f(t)=100(0.85)^t$ a: 100 b: 0.85 decay

e). $f(x)=1(3)^x$: a: 1 b: 3 growth

f) $f(x)=1(0.25)^x$: a: 1 b: 0.25 decay

g) $f(x)=1(1.01)^x$: a: 1 b = 1.01 growth

h) $f(t)=2(0.033)^t$: a: 2 b: 0.033 decay

3. Simple growth and decay problems. State the starting point, a, and then the factor of change, b. Remember to convert the percentage to a decimal before adding or subtracting from 1.

a) The population of a town is 50,000 and is increasing at a rate of 3% each year. Write the equation to model this situation, **and** find the population after 10 years.

a: 50000 b: 3% = 0.03 growth

$f(x) = 50000(1.03)^x$ 1 + .03 = 1.03

$f(10) = 50000(1.03)^{10}$

$= 67195.82$

b) You borrow $1,000 from the bank and pay off the loan at 5% per month. Write the equation to model this situation, **and** find how much debt you still have after a year. 12 months

a: 1000 b: 5% decay

$f(x) = 1000(0.95)^x$ 0.05 ; 1 − 0.05 = 0.95

$f(12) = 1000(0.95)^{12}$

540.36

c) A fully inflated child's raft for a pool is losing 6.1% of its air every day. The raft originally contained 4,500 cubic inches of air. Write the equation to model this situation, **and** find the amount of air left in the raft after 2 weeks. 14 days

a: 4500 b: 6.1% decay

0.061 1 − 0.061 = 0.939

$f(x) = 4500(0.939)^x$

$f(14) = 4500(0.939)^{14}$

= 1864.36 cubic inches