NOTES & HOMEWORK

Name_____

Date _____ Period _____

Exploring Exponential Functions

Quick Review: *base* → b^x ← *exponent*

Exploring Exponential Patterns:

Number of Folds	Number of Rectangles	Pattern	Written with Exponents
0			
1			
2			
3			
4			
5			

1. What do you notice in the number of rectangles as the number of folds increases? Explain.

2. Suppose you could continue to fold the paper. Extend your table to include 10 folds. How many rectangles would there be?

3. Use an exponent to write each number:

1.) $3 \cdot 3 \cdot 3 \cdot 3$ = _____   2.) $(-2)(-2)(-2)$ = _____   3.) 125 = _____

Example 1:
Suppose there are 20 rabbits on an island and that the rabbit population can triple every half-year. How many rabbits would there be after 2 years?

Time	Number of Rabbits
Initial	20
½ year	$20 \cdot 3 =$
1 year	
1 ½ years	
2 years	

After 2 years, there would be _____ rabbits.

Evaluating Exponential Functions

You can write the pattern you found in the folded paper example with a variable as an exponent. To find the number of rectangles r created by n folds, use the function $r = 2^n$. You read the expression 2^n as "2 to the nth power." The number of rectangles increases *exponentially* as the paper-folding continues.

Substitute 10 for n in the function $r = 2^n$. Use your calculator to find the value for r.

$$r = 2^{10}$$
$$r = \underline{\hspace{1.5in}}$$

Calculator Hint: To evaluate 2^n for $n = 10$, press 2 ^ 10 ENTER.

How does your answer compare to your answer to your answer in Question 2?

The function $r = 2^n$ is an **<u>exponential function</u>**.

Example 2:

Evaluate each exponential function
a.) $y = 5^x$ for $x = 2, 3, 4$

x	$y = 5^x$	y
2		
3		
4		

b.) $t(n) = 4(3^n)$ for the domains $\{3, 6\}$

n	$t(n) = 4(3^n)$	$t(n)$
3		
6		

Practice:

Which function is greater at the given value?

1.) $y = 5^x$ and $y = x^5$ at $x = 5$ 2.) $f = 10 \cdot 2^t$ and $f = 200 \cdot t^2$ at $t = 7$

Evaluate each function for the domain $\{1, 2, 3, 4, 5\}$
1.)

x	$f(x) = 4^x$	$f(x)$
1		
2		
3		
4		
5		

Is the function *increasing, decreasing,* or *neither?* \underline{\hspace{2.5in}}

Evaluate each function for the domain {1, 2, 3, 4, 5}

2.)

x	$f(x) = 100 \cdot 0.3^x$	$f(x)$
1		
2		
3		
4		
5		

Is the function *increasing, decreasing,* or *neither?* _____

Multiplication and Exponents:

Rewrite each product below into expanded form and then rewrite it in exponential form with a single base.

1.) $3^4 \cdot 3^2 =$

2.) $x^3 \cdot x^5 =$

3.) $10^3 \cdot 10^6 =$

What's happening to the exponents? _____

Multiplication Property of Exponents

For any nonzero value of b and any integer values of m and n,
$$b^m \cdot b^n = b^{m+n}$$

1.) $3^4 \cdot 2^2 =$ _____   2.) $5^2 \cdot 3^4 =$ _____

Power Properties of Exponents

For any nonzero values of a and b and any integer values for m and n,
$$(b^m)^n = b^{mn}$$
$$(ab)^n = a^n b^n$$

1.) $(4^5)^2 =$ _____

2.) $(x^3)^4 =$ _____

3.) $(xy)^3 =$ _____

Homework:

Evaluate each expression.		
1.) $50 \cdot x^5$ for $x = 0.5$	2.) $50,000 \cdot m^3$ for $m = 1.1$	3.) $0.0125 \cdot c^4$ for $c = 2$

Match the table with the function that models the data.

Table I

x	y
1	3
2	6
3	9
4	12

Table II

x	y
1	3
2	9
3	27
4	81

Table III

x	y
1	1
2	8
3	27
4	64

Functions:
A. $y = 3x$
B. $y = x^3$
C. $y = 3^x$

USE YOUR TEXTBOOK PAGE 385-386 FOR THE FOLLOWING PROBLEMS.

1.a.	1.b.	1.c.	1.d.
2.a.	2.b.	2.c.	2.d.

3.a.	3.b.	3.c.	3.d.
4.a.	4.b.	4.c.	4.d.

5.