**Exponential Functions: Growth and Decay**

The first thing we need to do before we begin is look at the formula for an exponential function. What does it look like?

 where “a” is the starting value, “b” is the base and “x” is the exponent.

Put a big circle or box around that equation. IT IS VERY IMPORTANT!!!

Tables of Values:

Let’s look at a very standard exponential function: 

If we were to create a table with domain and range values it would look like this:

|  |  |
| --- | --- |
| **x** | **y** |
| 0 | 1 |
| 1 | 3 |
| 2 | 9 |
| 3 | 27 |
| 4 | 81 |

Something very important happens with this table of values, specifically the y-values. Fill in the blanks below to see what this is.

   

What did you notice? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Notice how that 3 comes up in our original equation? Look back at it if you don’t. This will happen with **all** exponential functions. They will either increase or decrease by a consistent rate.

Practice Problem: Given the following table, write an exponential function.

|  |  |
| --- | --- |
| x | y |
| 0 | 1 |
| 1 | ½ |
| 2 | ¼ |
| 3 | 1/8 |

Answer: 

Sometimes we will have exponential growth and other times exponential decay.

Read on to the next page to learn the difference between these two.

**Exponential Growth:**

When you see the graph of an exponential growth function, the graph will rise as the x-values increase. (Exactly what you would expect.) As far as our parent function goes, “b” (which stood for the base) will be greater than one (b>1).

Examples: , , 

Notice with that 3rd example the starting value (the “a”) is 5 instead of 1.

**Exponential Decay:**

When we have the graph of an exponential decay function, the graph will fall as the x-values increase. (Again, exactly what you would expect.) When we look at the parent function now, “b” will be between 0 and 1 (0<b<1).

Examples: , , 

Again with that 3rd example, the starting value is 2. This would affect what the graph of this function looks like.

Applications:

One of the ways we use exponential functions in everyday life and problems is modeled through the following equation: 

“A(t)” = final amount

“a” = initial amount

“r” = rate

“t” = time

When the equation is (1+r) we will have exponential growth.

When the equation is (1-r) we will have exponential decay.

Practice Problem: You put $2500 in the bank at 4% annual interest. How much will you have after 50 years?

Answer: $17,766.71

**Assignment: Worksheet + pg 493 #2-10, 15, 17, 21**