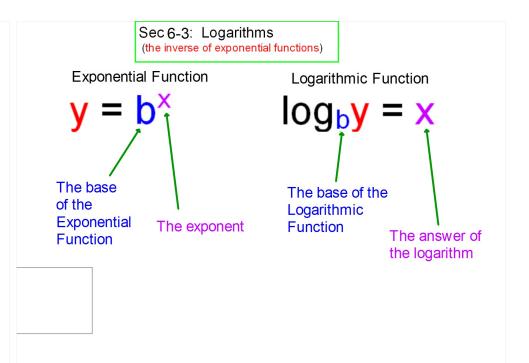
To solve for x in an exponential equation:  $y = b^x$  we use the inverse operation called:

# Logarithm



## Changing from one form to the other:

Exponential Function: Logarith

<u>Logarithmic Function</u>:

y = b<sup>x</sup> "Log, base b, of y equals x"
$$log_b y = x$$
The base is the base

The exponent is the answer

Another way to remember Logarithmic

Form:

Exponential Form:

$$x = y^z$$

becomes

Logarithmic Form:

$$z = Log_y x$$

### **Exponential Equation**

Domain: Range: Any real number y>0 b>0, b**‡**1

### Logarithmic Equation

$$log_b y = x$$

Domain:

x > 0

Range: Any real number

b: b>0, b#1

## Example 1

Try It!

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**1.** Write the logarithmic form of y = 8

#### Example 2

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# Try It!

**2. a.** What is the logarithmic form of  $\frac{1}{3}$  = 343?

**b.** What is the exponential form of  $log_{4}16 = 2?$ 

# Rewrite each into logarithmic form.

1. 
$$8^2 = x$$
  $\log_8 \times = 2$ 

1. 
$$8^{2} = x$$
  $| 09_{8} \times = 2$   
2.  $49 = 450$   $| 09_{8} \times 450_{-} 3$   
3.  $94 = 77$   $| 19_{9} 77 = 10$ 

Rewrite each into exponential form.

1. 
$$LOG_58 = x$$
  $5^{\times} = 8$ 

2. 
$$LOG_3x = 12$$
  $3^{12} = X$ 

2. 
$$LOG_3x = 12$$
  $3^{12} = X$   
3.  $LOG_x15 = 30$   $\chi^{30} = 30$ 

Write in Logarithmic Form:

 $10^{x} = 125$ 

 $LOG_{10}125 \rightarrow "LOG base 10 of 125" \rightarrow LOG125$ 

LOG<sub>10</sub> is called the Common Logarithm and is written without the 10.

The button on the calculator LOG is for Common Logarithms LOG<sub>10</sub>

Solve by first rewriting in logarithmic form.

$$10^{x} = 200$$

 $\log_{10} 200 = X$   $\log_{10} 200 = X$  X = 2.30

Log<sub>e</sub> is called the Natural Logarithm

and is written as In or LN

Solve by first rewriting in logarithmic form.

$$e^{2x} = 10$$

$$\frac{\ln 10 = \frac{1}{2}x}{x} = \frac{\ln 10}{x} = \frac{1}{1}$$

Solve by first rewriting in exponential form.

$$ln(x-1) = 5$$

$$e^{5} = X - 1$$
 $+1$ 
 $+1$ 
 $+1$ 
 $X = e^{5} + 1 = 149.41$ 

Evaluate.

$$8. \log 54 = 1.73$$

# Evaluate each without a calculator:

(hint: think of each as an exponential)

1. 
$$\log_4 1 = 0$$

1. 
$$\log_4 1 = 0$$
 2.  $\log_3 9 = 2$ 

$$4?=1 \rightarrow 4^{\circ}=1$$
  $3?=9 \rightarrow 3^{\circ}=9$ 

3. 
$$\log_4(4) = 1$$

4. 
$$\log_{25}5 = \frac{1}{2}$$

5. 
$$\log_6(6^4) = 4$$

$$25^? = 5$$
 $\sqrt{25} = 5$ 

6. 
$$\log_2(0.5) = -1$$

$$2^{?} = .5$$
 $2^{?} = \frac{1}{2} \rightarrow 2^{?} = \frac{1}{2}$ 

### Example 3

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#### Try It!

3. What is the value of each logarithmic expression?

a. 
$$\log_3(\frac{1}{81}) = -4$$

$$3^{?} = \frac{1}{81} \implies 3^{-4} = \frac{1}{81}$$

b. log7(-7) => un defined

$$7^{?} = -7 \implies \text{there is no power}$$
 $c.\log_5 5^9 = 9$ 
 $f$  7 that equals -7.

$$5^? = 5^9 \implies 5^9 = 5^9$$

Hwk #9 Sec 6-3

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Problems 23, 24, 29, 30, 34, 36, 45, 46, 48