## Graphing Exponential and Logarithmic Functions

Exponential Function - An exponential function is any function that can be written in the form of $f(x)=a^{x}$, where $x$ is a real number, $a>0$ and $a \neq 1$. The number $a$ is called the base of the exponential function.

Example: Graph the following exponential function by using a table to find at least three ordered pairs.

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

Solution: a) Let $x=0,1$, and 2 and plug into the function to solve for $f(x)$
A ) $f(0)=2^{0}=\mathbf{1}$
B) $f(1)=2^{1}=2$
C) $f(2)=2^{2}=4$

| $x$ | $y$ |
| :---: | :---: |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |



Example: Graph the following exponential function by using a table to find at least three ordered pairs.
2) $f(x)=-2^{x}$

Solution: a) The graph from Example 1 reflected over the $x$-axis.
A ) $f(0)=-2^{0}=-2^{0}=-1$
B) $f(1)=-2^{1}=-2$
C) $f(2)=-2^{2}=-4$

| $\mathbf{x}$ | $\mathbf{y}$ |
| :---: | :---: |
| 0 | -1 |
| 1 | -2 |
| 2 | -4 |



Logarithmic Function - Any function in the form of $\mathrm{y}=\log _{\mathrm{a}} \mathrm{x}$ which is the exponent y such that $a^{y}=x$.

The number a is called the base of the logarithm and a can be any positive constant other than 1.

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Example: Graph the following logarithmic function by using a table to find at least three ordered pairs.
3) $f(x)=\log _{2} x$

Solution: a) Remember that $\mathrm{y}=\mathrm{f}(\mathrm{x})$ and in this case $2^{y}=x$
b) Let $\mathrm{y}=0,1$, and 2 and plug into the function to solve for x
A ) $x=2^{0}=1$
B) $x=2^{1}=2$
C) $x=2^{2}=4$

| $\mathbf{x}$ | $\mathbf{y}$ |
| :---: | :---: |
| 1 | 0 |
| 2 | 1 |
| 4 | 2 |



Example: Graph the following logarithmic function by using a table to find at least three ordered pairs.
4) $f(x)=-\log _{2} x$

Solution: a) This is the graph of Example 3 has been reflected over the $x$-axis.
b) Remember that $\mathrm{y}=\mathrm{f}(\mathrm{x})$ and in this case $2^{-y}=x$

Let $\mathrm{y}=0,-1$, and -2 and plug into the function to solve for x
A) $x=2^{0}=\mathbf{1}$
B) $x=2^{-(-1)}=2^{1}=\mathbf{2}$
C) $x=2^{-(-2)}=2^{2}=4$

| $\mathbf{x}$ | $\mathbf{y}$ |
| :---: | :---: |
| 1 | 0 |
| 2 | -1 |
| 4 | -2 |


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## Practice Problems:

Graph the following exponential and logarithmic functions by using a table to make at least three ordered pairs:

## Solution:

1) $f(x)=4^{x}$

2) $f(x)=-3^{x}$

3) $f(x)=\log _{4} x$

4) $f(x)=-\log _{3} x$

