8.1 Exploring the Logarithmic Function

The **logarithmic function** $y = \log_b x$ is the *inverse* of the exponential function $y = b^x$.

Note:

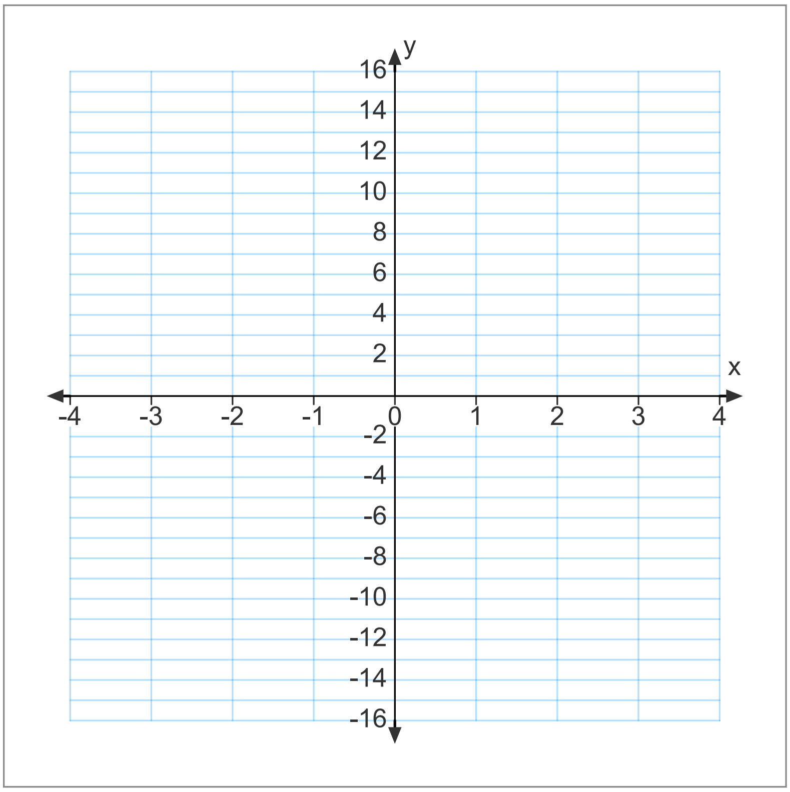
- Both relations above are functions;
- The x-axis is the HA for the exponential function
  The y-axis is the VA for the logarithmic (log) function
- The y-intercept of the exponential function is 1, while
  the x-intercept of the log function is 1
- The range of the exponential function is $\{y \in \mathbf{R} / y > 0\}$,
  so the domain of the log function is $\{x \in \mathbf{R} / x > 0\}$.
- The domain of the exponential function is $\{x \in \mathbf{R}\}$,
  so the range of the log function is $\{y \in \mathbf{R}\}$.
- The base, b, where $b > 0$, and $b \neq 1$.

Ex. 1:

Complete a table of values for $y = 2^x$ using integer values for x.
Confirm the properties described above, after graphing its inverse.

$y = 2^x$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



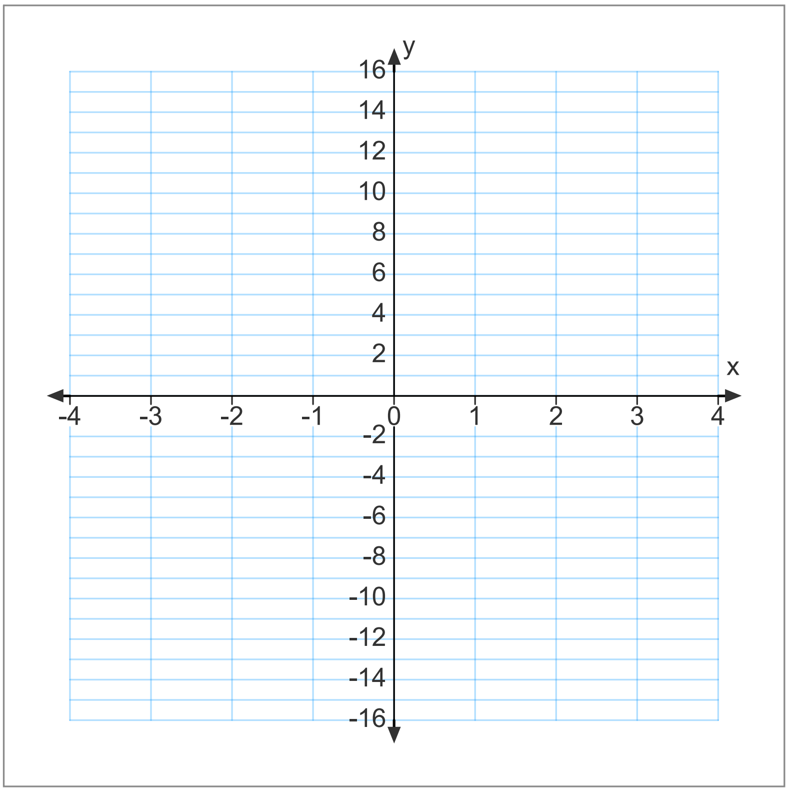
Ex. 2:

Complete a table of values for $y = \left(\frac{1}{2}\right)^x$ using integer values for x.

Confirm the properties described on the first page after graphing the inverse.

$$y = \left(\frac{1}{2}\right)^x$$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



Note: Given $y = b^x$,

When $b > 1$

When $0 < b < 1$

It makes sense that if the log function is the inverse of the exponential function, then ...

Ex. 3: Without using a calculator, evaluate:

a) $\log_5 25$ b) $\log_{55} 1$ c) $\log_2\left(\frac{1}{4}\right)$ d) $\log_{10} 1000$

"I understand that a logarithmic function is the inverse of an exponential function.
Also, I know their associated properties.
Finally, I can evaluate simple logarithms without a calculator."

Entertainment: p.451 #1ac, 2i and ii for 1a and 1c, 3ac, 4 to 9*, 10, 11
*Note: for #9c the answer is 3.