Logarithms

3.3.1, 3.4.1, 3.4.2, 3.1.3

Recall the *Horizontal Line Test*

Recall the definition of an *inverse function*

- So the inverse of $f(x) = b^x$ is

Which introduces the *definition of a logarithm:*

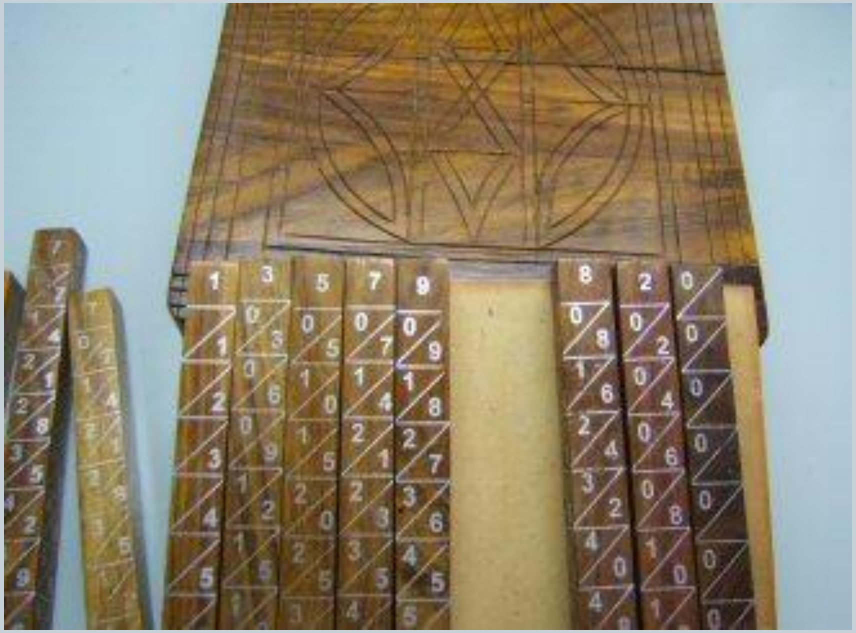
$$y = \log_b x \text{ if and only if } x = b^y$$

So that means…

- The answer to a logarithm is an exponent
- Because this is true, we can evaluate logarithmic expressions using our understanding of exponents

History of logarithms

- Were developed around 1594 by a Scottish mathematician named John Napier
- Originally called "Napier's bones"
- Called them "artificial numbers" at first but changed to logarithms
- Logarithm means "reckoning numbers"



Evaluate the following by converting to exponential form

- $\log_3 81$
- $\log_5 \sqrt{5}$
- $\log_6 1$
- $\log_{2.86} 2.86$

Logarithm Types

- Common logarithms
- Natural logarithms
- “Other” logarithms

Analyze $g(x) = -\log(x+2)$

- Domain:
- Range:
- Symmetry:
- Boundness:
- Increasing/decreasing:
- Extrema:
- Asymptotes:
- End Behavior:

Properties of Logarithms

- Logarithm of 1
- $\log_b 1 = 0$

- $\log_b b^n$

Properties of Logs

- $\log_b b = 1$
- $b^{\log_b n} = n$

Decibel formula

- The decibel scale (dB) is a measure of sound intensity given by the formula

$$\beta = 10 \cdot \log \frac{I}{10^{-12}}$$

Use this formula to determine the decibel level of city traffic.

Properties of Logarithms

- Product Property of Logs

$\log_b xy =$

- Quotient Property of Logs

$$\log_b \frac{x}{y} =$$

Properties of Logs

- Power Rule:
- $\log_b x^p = p \log_b x$

Is the following true or false? Explain.

- $\log \frac{x}{4} = \frac{\log x}{\log 4}$

- $\log_5 x^2 = (\log_5 x)\,(\log_5 x)$

Expand/condense the following

- $\log_2 y^5$
- $2\ln x + 3\ln y$

Change of base formula

- To evaluate the logarithm of any base

$$\log_b x = \frac{\log x}{\log b}$$

Evaluate $\log_8 175$ by using the change of base formula

Graph Translation Thm (Again)

- For any basic function $f(x) = [x]$, the translation
$$f(x) = a[bx - h] + k$$

Represents a vertical stretch or compression of a (which also could represent a reflection over the x-axis, a horizontal stretch/compression of b, a horizontal shift of h units, and a vertical shift of k units