Chapter 4 Section 3
MA1032 Data, Functions & Graphs

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The Definition

Definition

If x is a positive number, $\log x$ is the exponent of 10 that gives x.

In other words, if $y = \log x$ then $10^y = x$.

The Graph

Draw a set of axes and use the following questions to guide you in drawing the graph of $y = \log x$.

- How is the equation $x = 10^y$ related to the graph of $y = \log x$?
- If $x = 1$, then what does the equation $x = 10^y$ say y has to be?
- If $x < 1$, the according to the equation $x = 10^y$, what has to happen to y?
- If $x > 1$, then according to the equation $x = 10^y$, what has to happen to y?
- If x is close to zero, then 10^y has to be close to zero too. What does y have to do in order to make 10^y close to zero?
- If $x < 0$, then according the the equation $x = 10^y$, what has to happen to y?

Asymptotes

Let $y = f(x)$ be a function and let a be a finite number.

Definition

The graph of f has a horizontal asymptote of $y = a$ if $f(x) \to a$ as $x \to \infty$ or $x \to -\infty$ or both.

Definition

The graph of f has a vertical asymptote of $x = a$ if $f(x) \to \infty$ or $f(x) \to -\infty$ as $x \to a$.

Notice how the definitions of $\log x$ and $\ln x$ are related. How does this translate to their graphs?

Sound Intensity

- Measured in watts/cm^2
- $I_0 = 10^{-16}$
- Order of intensity
- $\log(I/I_0)$
- Decibels

Exercise #34

1. Let D_1 and D_2 represent the decibel ratings of sounds of intensity I_1 and I_2, respectively. Using log properties, find a simplified formula for the difference between the two ratings, $D_2 - D_1$, in terms of the two intensities, I_1 and I_2.

2. If a sound's intensity doubles, how many decibels louder does the sound become?

pH

$$pH = -\log[H^+]$$

Exercise #13

Find the hydrogen ion concentration, $[H^+]$, for Lye which has a pH of 13.

Summary

- Definition of common logarithmic function
- Domain and Range
- Graphs
- Applications (sound & pH)