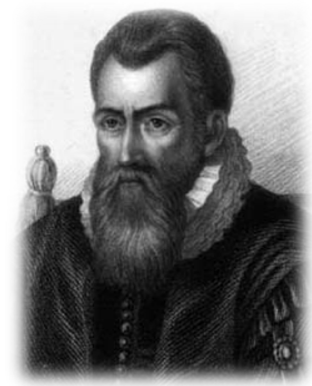
History of Logarithms



Logarithms were invented independently by John Napier, a Scotsman, in 1614 and by Joost Burgi, a Swiss in 1620. The objective of both men was to simplify mathematical calculations. Napier's approach was algebraic, while Burgi's approach was geometric.

Before the invention of logs and the scientific revolution, scientists and astronomers especially used to spend huge amounts of time crunching numbers on paper. By cutting the time they spent doing arithmetic, logarithms effectively gave these mathematicians a longer productive life.

In the preface to the "*Mirifici logarithmorum canonis descriptio*," Napier said he hoped his logarithms would save "calculators" much time and free them from the slippery errors of calculations. 200 years later, French scholar Pierre-Simon Laplace, agreed with this assessment saying that logarithms had:

"...by shortening the labours, doubled the life of the astronomer."

Natural logarithms first arose as more or less accidental variations of Napier's original logarithms. Their real significance was not recognized until later. Initially an extensive table of logarithm values was necessary to perform calculations, today all you need is a simple handheld calculator. In fact, most logarithmic calculations use addition and subtraction and can be easily and rapidly done by hand.

What is a Logarithm?

A logarithm is an exponent. While there are other aspects to a logarithm, it can't be said too often: a logarithm is nothing more than an exponent.

Logarithm: An ________________ representing the power to which a fixed number (__________) must be raised to produce a given number.

Logarithms were invented by John Napier to:

a. …make it necessary for students to buy calculators.
b. …make more work for scientists and astronomers.
c. …make large computations simpler and easier.

Thinking Logarithmically

Think of logarithms as making a conversion from the US imperial system to the metric system. As an exponential function, 100 can be written as 10^2, and as a logarithmic function, it can be rewritten as simply 2.

Today we are going to practice converting between exponential functions and logarithmic functions. Shown below are the two conversion equations written in standard form. The key phrase to remember is "**B**acon **A**nd **E**ggs."

Exponential Functions $y = b^x$ ⟺ Inverses of one another ⟺ Logarithmic Functions $\log_b y = x$

Example 1:
Rewrite from Exponential form to Logarithmic form.

$$3^4 = 81$$

Step 1: Identify the Base number.
B = 3
Step 2: Identify the Exponent.
E = 4
Step 3: Identify the value (Answer) of the exponential term.
A = 81
Step 4: Rewrite using the pattern of BAE or $\log_B A = E$
$\log_3 81 = 4$

Example 2:
Rewrite from Logarithmic form to Exponential form.

$$\mathbf{Log_5 25 = x}$$

Step 1: Identify the Base number.
B = 5
Step 2: Identify the Exponent.
E = x
Step 3: Identify the value (Answer) of the exponential term.
A = 25
Step 4: Rewrite using the reverse pattern of $B^E = A$
$5^x = 25$

HOMEWORK:

Rewrite the following **Exponential Function** as a **Logarithmic Function**:

Exponential	Logarithmic
1. $10^3 = 1000$	
2. $5^2 = 25$	
3. $7^3 = 343$	
4. $2^x = 8$	
5. $y^{-1} = 4$	
6. $x^4 = y$	

Rewrite the following **Logarithmic Function** as an **Exponential Function:**

Logarithmic	Exponential
1. $3 = \log_4 64$	
2. $2 = \log_{10} 100$	
3. $2 = \log_x 36$	
4. $y = \log_3 5$	
5. $18 = \log_y x$	
6. $a = \log_b c$	