Bing

Logarithm tables are built by using various methods to calculate the logarithm values of different numbers and then arranging them in a tabular format for easy reference. Some of the methods used to calculate logarithm values are:

- Power series: This method uses the Taylor series expansion of the natural logarithm function ln(x) around x = 1 and then applies the change of base formula to get the logarithm values for other bases. For example, ln(x) = (x-1) - (x-1)^2/2 + (x-1)^3/3 - ... and log\_a(x) = ln(x)/ln(a).

- Arithmetic-geometric mean: This method uses the arithmetic-geometric mean (AGM) of two numbers to approximate their logarithm ratio. For example, log\_a(b) ≈ π/2 \* AGM(1, a/b)/AGM(1, a).

- Feynman's algorithm: This method uses a recursive algorithm based on the identity log\_a(b) = 2 \* log\_a(sqrt(b)) and the approximation log\_a(1+x) ≈ x for small x. For example, log\_10(2) = 2 \* log\_10(sqrt(2)) ≈ 2 \* (sqrt(2)-1).

Calculators use different algorithms to calculate logarithms depending on their hardware and software specifications. Some of the common algorithms are:

- CORDIC: This algorithm uses a series of elementary operations such as addition, subtraction, bit-shifting and table lookup to compute various functions including logarithms. It is suitable for calculators with limited memory and processing power.

- Newton-Raphson: This algorithm uses an iterative method to find the root of a function by using its derivative. It can be used to find the logarithm of a number by finding the root of the function f(x) = a^x - b, where a is the base and b is the number whose logarithm is sought.

- Binary search: This algorithm uses a divide-and-conquer strategy to find the logarithm of a number by repeatedly halving an interval that contains the logarithm value and checking which half contains it. It can be used to find the logarithm of a number by finding the exponent that makes the base equal to the number.

The common logarithmic table represents the log with only base 10 because it is convenient for calculations involving powers of 10, such as scientific notation and metric units. Other bases can be obtained from the common logarithmic table by using the change of base formula: log\_a(x) = log\_10(x)/log\_10(a).

I hope this helps you understand how logarithm tables are built and how calculators are calculating the logs. Do you have any questions?