

Common and Natural Logarithms

Common Logarithms

- A common logarithm has a base of 10.
- If there is no base given explicitly, it is common.
- You can easily find common logs of powers of ten.
- You can use your calculator to evaluate common logs.

Natural Logarithms

- A natural logarithm has a base of e .
- We write natural logarithms as \ln .
 - In other words, $\log_e(1) = \ln(1)$
- If $\ln e = x$, $\log_e e = x$ $e^x = e$ $e^x = e^1$ $x = 1$ $\ln e = 1$

The Number e

- The mathematical constant e is the unique real number such that the value of the derivative (the slope of the tangent line) of the function $f(x) = e^x$ at the point $x = 0$ is exactly 1.
- The function e^x so defined is called the exponential function.
- The inverse of the exponential function is the natural logarithm, or logarithm with base e .
- The number e is also commonly defined as the base of the natural logarithm (using an integral to define the latter), as the limit of a certain sequence, or as the sum of a certain series.
- The number e is one of the most important numbers in mathematics, alongside the additive and multiplicative identities 0 and 1, the constant π , and the imaginary number i .
- e is irrational, and as such its value cannot be given exactly as a finite or eventually repeating decimal. The numerical value of e truncated to 20 decimal places is:

Change of Base Formula

- Allows us to convert to a different base.
- If a , b , and n are positive numbers and neither a nor b is 1, then the following equation is true. .

$$\log_a n = \frac{\log_b n}{\log_b a}$$

Examples