Ln X Graph

Natural logarithm

{dx}{x}}} d v = d x ? v = x {\displaystyle dv=dx\Rightarrow v=x} then: ? ln ? x d x = x ln ? x ? ? x x d x = x ln ? x ? ? 1 d x = x ln ? x ? x + C {\displaystyle

The natural logarithm of a number is its logarithm to the base of the mathematical constant e, which is an irrational and transcendental number approximately equal to 2.718281828459. The natural logarithm of x is generally written as ln x, loge x, or sometimes, if the base e is implicit, simply log x. Parentheses are sometimes added for clarity, giving ln(x), loge(x), or log(x). This is done particularly when the argument to the logarithm is not a single symbol, so as to prevent ambiguity.

The natural logarithm of x is the power to which e would have to be raised to equal x. For example, ln 7.5 is 2.0149..., because e2.0149... = 7.5. The natural logarithm of e itself, ln e, is 1, because e1 = e, while the natural logarithm of 1 is 0, since e0 = 1.

The natural logarithm can be defined for any positive real number a as the area under the curve y = 1/x from 1 to a (with the area being negative when 0 < a < 1). The simplicity of this definition, which is matched in many other formulas involving the natural logarithm, leads to the term "natural". The definition of the natural logarithm can then be extended to give logarithm values for negative numbers and for all non-zero complex numbers, although this leads to a multi-valued function: see complex logarithm for more.

The natural logarithm function, if considered as a real-valued function of a positive real variable, is the inverse function of the exponential function, leading to the identities:

e

ln

?

x

=

x

if

x

?

R

+

ln

?

e

x

=

x

if

x

?

R

$$\displaystyle {\begin{aligned}e^{\ln x}&=x\qquad {\text{ if }}x\in \mathbb {R} _{+}\\\ln e^{x}&=x\qquad {\text{ if }}x\in \mathbb {R} \end{aligned}}$$

Like all logarithms, the natural logarithm maps multiplication of positive numbers into addition:

ln

?

(

x

?

y

)

=

ln

?

x

+

ln

?

y

.

$$\displaystyle \ln(x\cdot y)=\ln x+\ln y~.$$

Logarithms can be defined for any positive base other than 1, not only e. However, logarithms in other bases differ only by a constant multiplier from the natural logarithm, and can be defined in terms of the latter, log

b

?

x

=

ln

?

x

/

ln

?

b

=

ln

?

x

?

log

b

?

e

{\displaystyle \log _{b}x=\ln x/\ln b=\ln x\cdot \log _{b}e}

.

Logarithms are useful for solving equations in which the unknown appears as the exponent of some other quantity. For example, logarithms are used to solve for the half-life, decay constant, or unknown time in exponential decay problems. They are important in many branches of mathematics and scientific disciplines, and are used to solve problems involving compound interest.

Ladder graph

mathematical field of graph theory, the ladder graph Ln is a planar, undirected graph with 2n vertices and 3n ? 2 edges. The ladder graph can be obtained as

In the mathematical field of graph theory, the ladder graph Ln is a planar, undirected graph with 2n vertices and 3n ? 2 edges.

The ladder graph can be obtained as the Cartesian product of two path graphs, one of which has only one edge: Ln,1 = Pn × P2.

Exponential function

\log } ?, converts products to sums: ? ln ? (x ? y) = ln ? x + ln ? y {\displaystyle \ln(x\cdot y)=\ln x+\ln y} ?. The exponential function is occasionally

In mathematics, the exponential function is the unique real function which maps zero to one and has a derivative everywhere equal to its value. The exponential of a variable ?

x

{\displaystyle x}

? is denoted ?

exp

?

x

{\displaystyle \exp x}

? or ?

e

x

{\displaystyle e^{x}}

?, with the two notations used interchangeably. It is called exponential because its argument can be seen as an exponent to which a constant number e ? 2.718, the base, is raised. There are several other definitions of the exponential function, which are all equivalent although being of very different nature.

The exponential function converts sums to products: it maps the additive identity 0 to the multiplicative identity 1, and the exponential of a sum is equal to the product of separate exponentials, ?

exp

?

(

x

+

y

)

=

exp

?

x

?

exp

?

y

{\displaystyle \exp(x+y)=\exp x\cdot \exp y}

?. Its inverse function, the natural logarithm, ?

ln

{\displaystyle \ln }

? or ?

log

{\displaystyle \log }

?, converts products to sums: ?

ln

?

(

x

?

y

)

=

ln

?

x

+

ln

?

y

{\displaystyle \ln(x\cdot y)=\ln x+\ln y}

?.

The exponential function is occasionally called the natural exponential function, matching the name natural logarithm, for distinguishing it from some other functions that are also commonly called exponential functions. These functions include the functions of the form ?

f

(

x

)

=

b

x

{\displaystyle f(x)=b^{x}}

?, which is exponentiation with a fixed base ?

b

{\displaystyle b}

?. More generally, and especially in applications, functions of the general form ?

f

(

x

)

=

a

b

x

{\displaystyle f(x)=ab^{x}}

? are also called exponential functions. They grow or decay exponentially in that the rate that ?

f

(

x

)

{\displaystyle f(x)}

? changes when ?

x

{\displaystyle x}

? is increased is proportional to the current value of ?

f

(

x

)

{\displaystyle f(x)}

?.

The exponential function can be generalized to accept complex numbers as arguments. This reveals relations between multiplication of complex numbers, rotations in the complex plane, and trigonometry. Euler's formula ?

exp

?

i

?

=

cos

?

?

+

i

sin

?

?

{\displaystyle \exp i\theta =\cos \theta +i\sin \theta }

? expresses and summarizes these relations.

The exponential function can be even further generalized to accept other types of arguments, such as matrices and elements of Lie algebras.

Conductance (graph theory)

state x ? ? {\displaystyle x\in \Omega } , 1 4 ? ? ? x (?) ? 2 ? 2 (ln ? ? (x) ? 1 + ln ? ? ? 1) {\displaystyle {\frac {1}{4\Phi }}\leq \tau _{x}(\delta

In theoretical computer science, graph theory, and mathematics, the conductance is a parameter of a Markov chain that is closely tied to its mixing time, that is, how rapidly the chain converges to its stationary distribution, should it exist. Equivalently, the conductance can be viewed as a parameter of a directed graph, in which case it can be used to analyze how quickly random walks in the graph converge.

The conductance of a graph is closely related to the Cheeger constant of the graph, which is also known as the edge expansion or the isoperimetic number. However, due to subtly different definitions, the conductance and the edge expansion do not generally coincide if the graphs are not regular. On the other hand, the notion of electrical conductance that appears in electrical networks is unrelated to the conductance of a graph.

Stirling's approximation

) ? 1 2 ln ? n ? ? 1 n ln ? x d x = n ln ? n ? n + 1 , {\displaystyle \ln(n!)-{\tfrac {1}{2}}\ln n\approx \int _{1}^{n}\ln x\,{\rm {d}}x=n\ln n-n+1,}

In mathematics, Stirling's approximation (or Stirling's formula) is an asymptotic approximation for factorials. It is a good approximation, leading to accurate results even for small values of

n

{\displaystyle n}

. It is named after James Stirling, though a related but less precise result was first stated by Abraham de Moivre.

One way of stating the approximation involves the logarithm of the factorial:

ln

?

(

n

!

)

=

n

ln

?

n

?

n

+

O

(

ln

?

n

)

,

{\displaystyle \ln(n!)=n\ln n-n+O(\ln n),}

where the big O notation means that, for all sufficiently large values of

n

{\displaystyle n}

, the difference between

ln

?

(

n

!

)

{\displaystyle \ln(n!)}

and

n

ln

?

n

?

n

{\displaystyle n\ln n-n}

will be at most proportional to the logarithm of

n

{\displaystyle n}

. In computer science applications such as the worst-case lower bound for comparison sorting, it is convenient to instead use the binary logarithm, giving the equivalent form

log

2

?

(

n

!

)

=

n

log

2

?

n

?

n

log

2

?

e

+

O

(

log

2

?

n

)

.

{\displaystyle \log _{2}(n!)=n\log _{2}n-n\log _{2}e+O(\log _{2}n).}

The error term in either base can be expressed more precisely as

1

2

log

?

(

2

?

n

)

+

O

(

1

n

)

{\displaystyle {\tfrac {1}{2}}\log(2\pi n)+O({\tfrac {1}{n}})}

, corresponding to an approximate formula for the factorial itself,

n

!

?

2

?

n

(

n

e

)

n

.

{\displaystyle n!\sim {\sqrt {2\pi n}}\left({\frac {n}{e}}\right)^{n}.}

Here the sign

?

{\displaystyle \sim }

means that the two quantities are asymptotic, that is, their ratio tends to 1 as

n

{\displaystyle n}

tends to infinity.

Random geometric graph

In graph theory, a random geometric graph (RGG) is the mathematically simplest spatial network, namely an undirected graph constructed by randomly placing

In graph theory, a random geometric graph (RGG) is the mathematically simplest spatial network, namely an undirected graph constructed by randomly placing N nodes in some metric space (according to a specified probability distribution) and connecting two nodes by a link if and only if their distance is in a given range, e.g. smaller than a certain neighborhood radius, r.

Random geometric graphs resemble real human social networks in a number of ways. For instance, they spontaneously demonstrate community structure - clusters of nodes with high modularity. Other random graph generation algorithms, such as those generated using the Erd?s–Rényi model or Barabási–Albert (BA) model do not create this type of structure. Additionally, random geometric graphs display degree assortativity according to their spatial dimension: "popular" nodes (those with many links) are particularly likely to be linked to other popular nodes.

Percolation theory on the random geometric graph (the study of its global connectivity) is sometimes called the Gilbert disk model after the work of Edgar Gilbert, who introduced these graphs and percolation in them in a 1961 paper. A real-world application of RGGs is the modeling of ad hoc networks. Furthermore they are used to perform benchmarks for graph algorithms.

Asymptote

asymptote of ƒ(x) when x tends to +?. The function ƒ(x) = ln x has m = lim x ? + ? f (x) / x = lim x ? + ? ln ? x x = 0 {\displaystyle m=\lim _{x\rightarrow

In analytic geometry, an asymptote ( ) of a curve is a straight line such that the distance between the curve and the line approaches zero as one or both of the x or y coordinates tends to infinity. In projective geometry and related contexts, an asymptote of a curve is a line which is tangent to the curve at a point at infinity.

The word "asymptote" derives from the Greek ?????????? (asumpt?tos), which means "not falling together", from ? priv. "not" + ??? "together" + ????-?? "fallen". The term was introduced by Apollonius of Perga in his work on conic sections, but in contrast to its modern meaning, he used it to mean any line that does not intersect the given curve.

There are three kinds of asymptotes: horizontal, vertical and oblique. For curves given by the graph of a function y = ƒ(x), horizontal asymptotes are horizontal lines that the graph of the function approaches as x tends to +? or ??. Vertical asymptotes are vertical lines near which the function grows without bound. An oblique asymptote has a slope that is non-zero but finite, such that the graph of the function approaches it as x tends to +? or ??.

More generally, one curve is a curvilinear asymptote of another (as opposed to a linear asymptote) if the distance between the two curves tends to zero as they tend to infinity, although the term asymptote by itself is usually reserved for linear asymptotes.

Asymptotes convey information about the behavior of curves in the large, and determining the asymptotes of a function is an important step in sketching its graph. The study of asymptotes of functions, construed in a broad sense, forms a part of the subject of asymptotic analysis.

Logit

function ? (x) = 1 / (1 + e ? x) {\displaystyle \sigma (x)=1/(1+e^{-x})} , so the logit is defined as logit ? p = ? ? 1 (p) = ln ? p 1 ? p for

In statistics, the logit (LOH-jit) function is the quantile function associated with the standard logistic distribution. It has many uses in data analysis and machine learning, especially in data transformations.

Mathematically, the logit is the inverse of the standard logistic function

?

(

x

)

=

1

/

(

1

+

e

?

x

)

{\displaystyle \sigma (x)=1/(1+e^{-x})}

, so the logit is defined as

logit

?

p

=

?

?

1

(

p

)

=

ln

?

p

1

?

p

for

p

?

(

0

,

1

)

.

{\displaystyle \operatorname {logit} p=\sigma ^{-1}(p)=\ln {\frac {p}{1-p}}\quad {\text{for}}\quad p\in (0,1).}

Because of this, the logit is also called the log-odds since it is equal to the logarithm of the odds

p

1

?

p

{\displaystyle {\frac {p}{1-p}}}

where p is a probability. Thus, the logit is a type of function that maps probability values from

(

0

,

1

)

{\displaystyle (0,1)}

to real numbers in

(

?

?

,

+

?

)

{\displaystyle (-\infty ,+\infty)}

, akin to the probit function.

Exponential family random graph models

T = (? ln ? 2 , ln ? 3) T {\displaystyle \theta =(\theta _{1},\theta _{2})^{T}=(-\ln 2,\ln 3)^{T}} , so that the probability of every graph y ? Y {\displaystyle

Exponential family random graph models (ERGMs) are a set of statistical models used to study the structure and patterns within networks, such as those in social, organizational, or scientific contexts.They analyze how connections (edges) form between individuals or entities (nodes) by modeling the likelihood of network features, like clustering or centrality, across diverse examples including knowledge networks, organizational networks, colleague networks, social media networks, networks of scientific collaboration, and more. Part of the exponential family of distributions, ERGMs help researchers understand and predict network behavior in fields ranging from sociology to data science.

Inverse trigonometric functions

For real x ? 1: ? arcsec ? (x) d x = x arcsec ? (x) ? ln ? (x + x 2 ? 1) + C ? arccsc ? (x) d x = x arccsc ? (x) + ln ? (x + x 2 ? 1) + C

In mathematics, the inverse trigonometric functions (occasionally also called antitrigonometric, cyclometric, or arcus functions) are the inverse functions of the trigonometric functions, under suitably restricted domains. Specifically, they are the inverses of the sine, cosine, tangent, cotangent, secant, and cosecant functions, and are used to obtain an angle from any of the angle's trigonometric ratios. Inverse trigonometric functions are widely used in engineering, navigation, physics, and geometry.