

Inverse Hyperbolic Functions

Encyclopedia Article

Inverse Hyperbolic Functions

The following sections of this BookRags Literature Study Guide is offprint from Gale's For Students Series: Presenting Analysis, Context, and Criticism on Commonly Studied Works: Introduction, Author Biography, Plot Summary, Characters, Themes, Style, Historical Context, Critical Overview, Criticism and Critical Essays, Media Adaptations, Topics for Further Study, Compare & Contrast, What Do I Read Next?, For Further Study, and Sources.

(c)1998-2002; (c)2002 by Gale. Gale is an imprint of The Gale Group, Inc., a division of Thomson Learning, Inc. Gale and Design and Thomson Learning are trademarks used herein under license.

The following sections, if they exist, are offprint from Beacham's Encyclopedia of Popular Fiction: "Social Concerns", "Thematic Overview", "Techniques", "Literary Precedents", "Key Questions", "Related Titles", "Adaptations", "Related Web Sites". (c)1994-2005, by Walton Beacham.

The following sections, if they exist, are offprint from Beacham's Guide to Literature for Young Adults: "About the Author", "Overview", "Setting", "Literary Qualities", "Social Sensitivity", "Topics for Discussion", "Ideas for Reports and Papers". (c)1994-2005, by Walton Beacham.

All other sections in this Literature Study Guide are owned and copyrighted by BookRags, Inc.

Contents

Inverse Hyperbolic Functions Encyclopedia Article.....	1
Contents.....	2
Inverse Hyperbolic Functions.....	3



Inverse Hyperbolic Functions

The inverse hyperbolic **functions** are simply the inverse of the different **hyperbolic functions** $\cosh x$, $\coth x$, $\operatorname{csch} x$, $\operatorname{sech} x$, $\sinh x$, and $\tanh x$. The inverse of a function is that function reflected about the line $y = x$ and usually denoted by $f^{-1}(x)$. The inverse hyperbolic functions are denoted as $\sinh^{-1}x$ (or $\operatorname{arcsinh} x$), $\cosh^{-1}x$ (or $\operatorname{arccosh} x$), $\tanh^{-1}x$ (or $\operatorname{arctanh} x$), $\operatorname{csch}^{-1}x$ (or $\operatorname{arccsch} x$), $\operatorname{sech}^{-1}x$ (or $\operatorname{arcsech} x$), and $\operatorname{coth}^{-1}x$ (or $\operatorname{arcoth} x$). Since the hyperbolic functions are based on the exponential function it is not surprising that the inverse hyperbolic functions are based on the natural logarithmic function, \ln .

Like the hyperbolic functions the inverse hyperbolic functions are periodic since they are elliptic functions. Corresponding to the two main hyperbolic functions are the inverses of these functions. They are inverse hyperbolic **sine**, $\sinh^{-1}x$, and inverse hyperbolic **cosine**, $\cosh^{-1}x$ and are defined as: $\sinh^{-1}x = \ln(x + \sqrt{x^2 + 1})$ and $\cosh^{-1}x = \ln(x \pm \sqrt{x^2 - 1})$. The inverse hyperbolic cosine has the \pm sign because it is not a one to one function, that is the **domain** either has to be restricted or the \pm sign has to be used. Inverse hyperbolic tangent is defined as: $\tanh^{-1}x = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right)$. The three other inverse hyperbolic functions, inverse hyperbolic cotangent, inverse hyperbolic secant and inverse hyperbolic cosecant, can be described in terms of inverse hyperbolic tangent, inverse hyperbolic sine and inverse hyperbolic cosine: $\operatorname{coth}^{-1}x = \tanh^{-1} \frac{1}{x}$, $\operatorname{sech}^{-1}x = \cosh^{-1} \frac{1}{x}$, and $\operatorname{csch}^{-1}x = \sinh^{-1} \frac{1}{x}$. Just as the hyperbolic functions have identities the inverse hyperbolic functions have similar identities and negative argument formulas. The negative argument formulas are some of the more useful of these relations.