
Version 9

FitAll

nonlinear regression analysis

User Requested Functions Guide

MTR
SOFTWARE

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Introduction

This **FitAll™ User Requested Functions Guide** describes the functions contained in the **User Requested Functions** Library and has an appendix that explains how to get help from **MTR Software**.

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Function Reference

Overview

This section describes each of the functions in *FitAll*'s User Requested Functions Library.

In most cases, a graph of the function is shown. These graphs were created using "typical" parameter and constant values.

The actual appearance of a function depends on the parameter and constant values and may look quite different from the illustrations shown.

Equation

Gives the equation and its variations. The variations are listed in order of increasing complexity.

Constants

Lists the constants, K, that are used in the function. The default values for the constants also are given.

Parameters

Lists the parameters, P, that are used in the function.

Multi-Fits

Describes the Multi-Fit functionality of "Multi-Fit enabled" functions.

Sample Applications

Gives examples of some situations in which the function is known to be used.

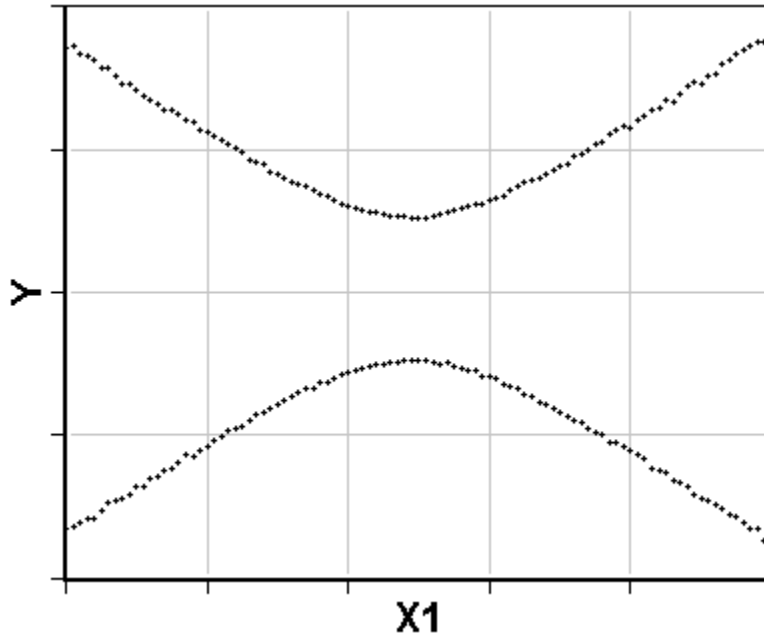
Remarks

Provides general comments and hints, and lists any known limitations or restrictions that should be observed when using the function.

Also see

Provides links or references to other related functions.

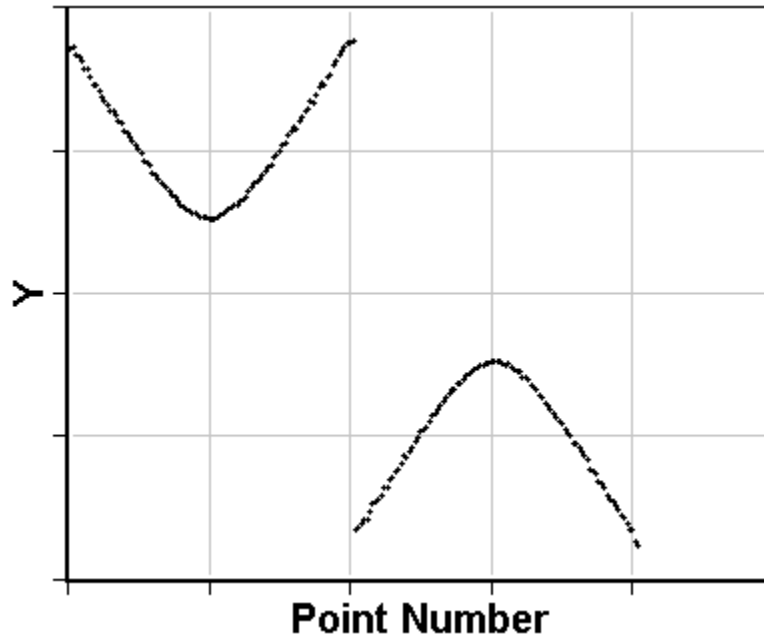
Ftn1527: Hyperbola NS w/ X & Y offsets



NOTE:

This function has two independent variables, X1 and X2 (a selector that indicates whether the Y-value is on the north facing branch or the south facing branch of the hyperbola). The only way to plot a meaningful fit graph in this situation is to plot Y against the "Point Number" rather than the value of the independent variable, X1.

The best way to get a visual indication of the quality of the fit is to view the residuals graph.



Equation

$$Y = \begin{cases} P3 + \frac{P1 * \sqrt{P2^2 + (X1 - P4)^2}}{P2}, & \text{for } X2 = 0 \\ P3 - \frac{P1 * \sqrt{P2^2 + (X1 - P4)^2}}{P2}, & \text{for } X2 \neq 0 \end{cases}$$

in which:

- Y is the measured response.
- X1 is the first independent variable.
- X2 is an independent "selector" variable that determines which form of the equation is evaluated. If X2 is equal to zero Y corresponds to the "north facing" branch of the hyperbola. If X2 is not equal to zero Y corresponds to the "south facing" branch of the hyperbola.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Parameter	Name	Comments
P3	Yo	Y offset.
P4	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

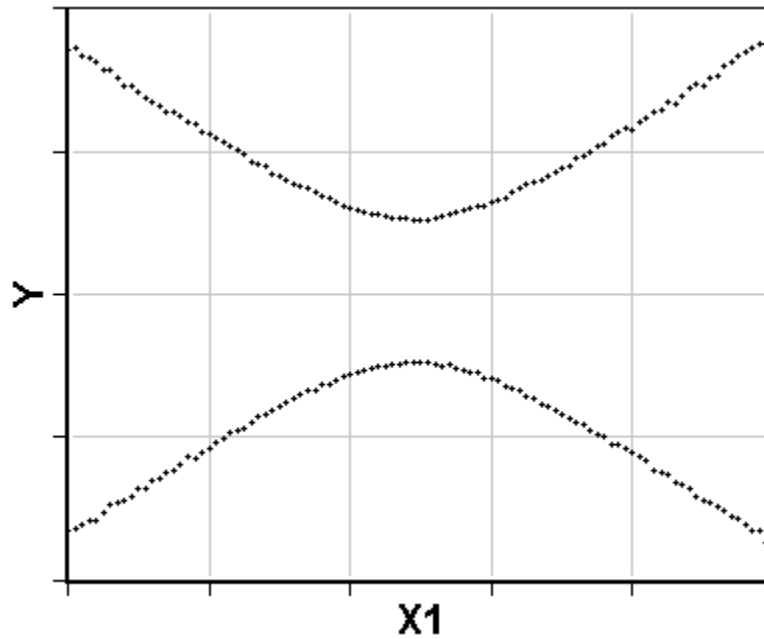
$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- The X2 values can most easily be assigned using the menu selections Edit, column data Fill.
- If only the North facing branch of the hyperbola is present see [Ftn 1537](#)^[15].
- If only the South facing branch of the hyperbola is present see [Ftn 1547](#)^[25].
- If the hyperbola is an East-West oriented hyperbola, exchange the X and Y data columns. The result will be a North-South oriented hyperbola.

Also see

Functions [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

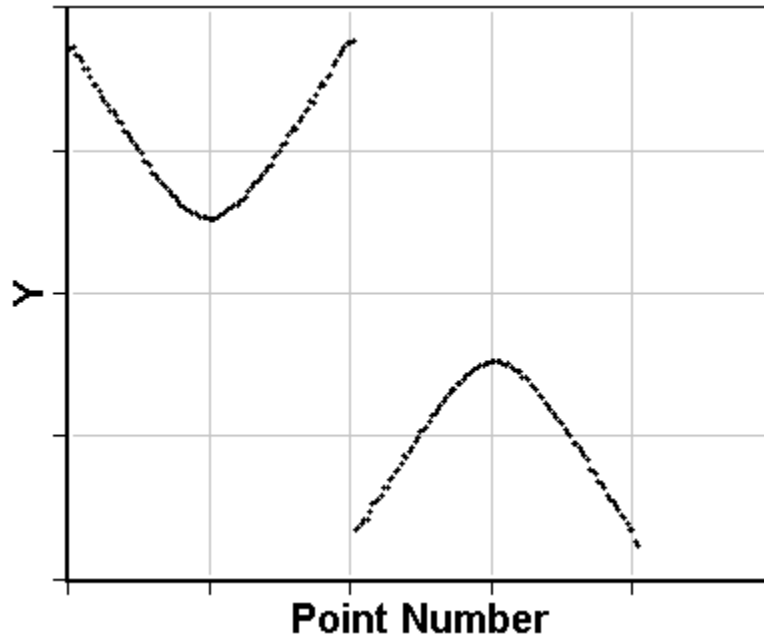
Ftn1528: Hyperbola NS w/ X Offset



NOTE:

This function has two independent variables, X1 and X2 (a selector that indicates whether the Y-value is on the north facing branch or the south facing branch of the hyperbola). The only way to plot a meaningful fit graph in this situation is to plot Y against the "Point Number" rather than the value of the independent variable, X1.

The best way to get a visual indication of the quality of the fit is to view the residuals graph.



Equation

$$Y = \begin{cases} + \frac{P1 * \sqrt{P2^2 + (X1 - P3)^2}}{P2}, & \text{for } X2 = 0 \\ - \frac{P1 * \sqrt{P2^2 + (X1 - P3)^2}}{P2}, & \text{for } X2 \neq 0 \end{cases}$$

in which:

- Y is the measured response.
- X1 is the first independent variable.
- X2 is an independent "selector" variable that determines which form of the equation is evaluated. If X2 is equal to zero Y corresponds to the "north facing" branch of the hyperbola. If X2 is not equal to zero Y corresponds to the "south facing" branch of the hyperbola.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Parameter	Name	Comments
P3	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

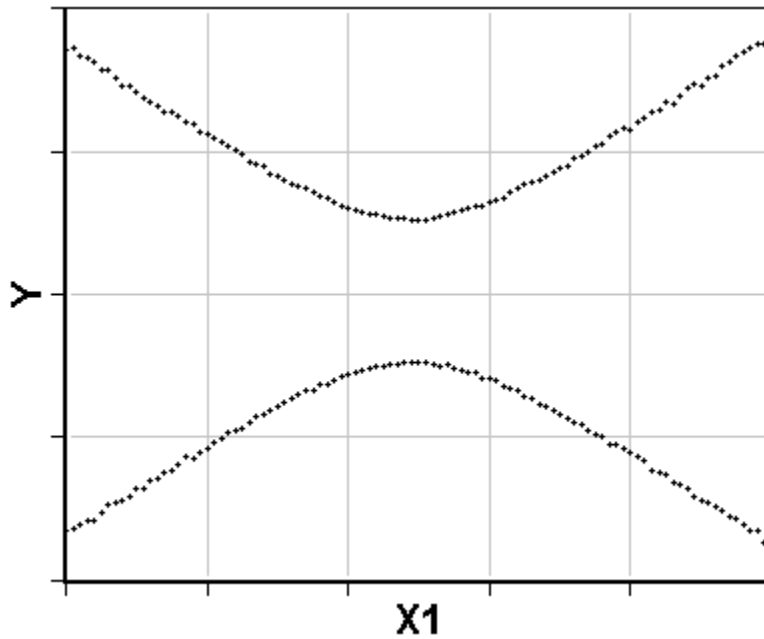
$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- The X2 values can most easily be assigned using the menu selections Edit, column data Fill.
- If only the North facing branch of the hyperbola is present see [Ftn 1538](#)^[17].
- If only the South facing branch of the hyperbola is present see [Ftn 1548](#)^[27].
- If the hyperbola is an East-West oriented hyperbola, exchange the X and Y data columns. The result will be a North-South oriented hyperbola.

Also see

Functions [1527](#)^[3], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

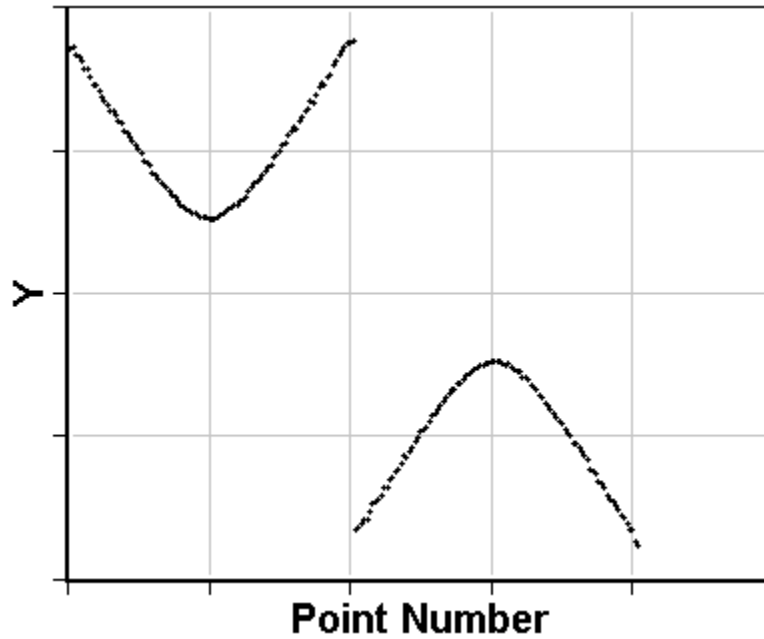
Ftn1529: Hyperbola NS w/ Y Offset



NOTE:

This function has two independent variables, X1 and X2 (a selector that indicates whether the Y-value is on the north facing branch or the south facing branch of the hyperbola). The only way to plot a meaningful fit graph in this situation is to plot Y against the "Point Number" rather than the value of the independent variable, X1.

The best way to get a visual indication of the quality of the fit is to view the residuals graph.



Equation

$$Y = \begin{cases} P3 + \frac{P1 * \sqrt{P2^2 + X1^2}}{P2}, & \text{for } X2 = 0 \\ P3 - \frac{P1 * \sqrt{P2^2 + X1^2}}{P2}, & \text{for } X2 \neq 0 \end{cases}$$

in which:

- Y is the measured response.
- X1 is the first independent variable.
- X2 is an independent "selector" variable that determines which form of the equation is evaluated. If X2 is equal to zero Y corresponds to the "north facing" branch of the hyperbola. If X2 is not equal to zero Y corresponds to the "south facing" branch of the hyperbola.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Parameter	Name	Comments
P3	Yo	Y offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

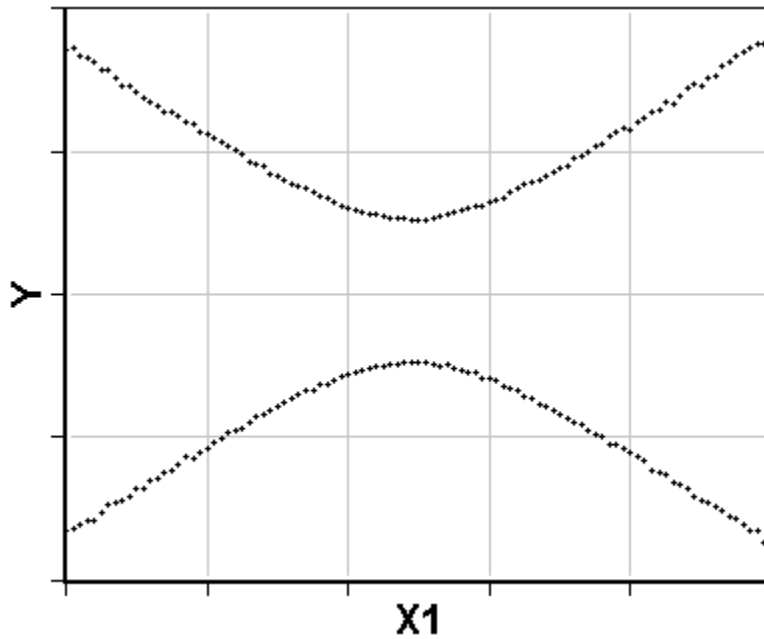
$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- The X2 values can most easily be assigned using the menu selections Edit, column data Fill.
- If only the North facing branch of the hyperbola is present see [Ftn 1539](#)^[19].
- If only the South facing branch of the hyperbola is present see [Ftn 1549](#)^[29].
- If the hyperbola is an East-West oriented hyperbola, exchange the X and Y data columns. The result will be a North-South oriented hyperbola.

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

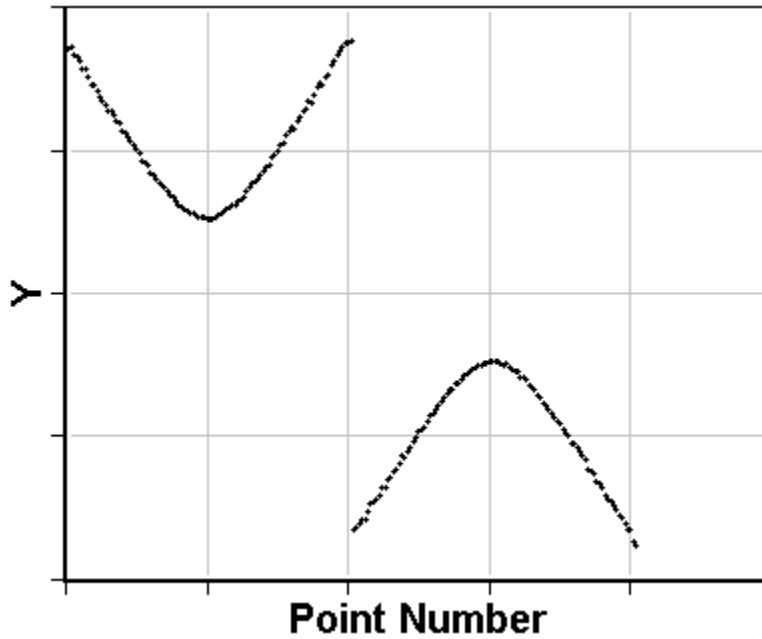
Ftn1530: Hyperbola NS



NOTE:

This function has two independent variables, X1 and X2 (a selector that indicates whether the Y-value is on the north facing branch or the south facing branch of the hyperbola). The only way to plot a meaningful fit graph in this situation is to plot Y against the "Point Number" rather than the value of the independent variable, X1.

The best way to get a visual indication of the quality of the fit is to view the residuals graph.



Equation

$$Y = \begin{cases} + \frac{P1 * \sqrt{P2^2 + X1^2}}{P2}, & \text{for } X2 = 0 \\ - \frac{P1 * \sqrt{P2^2 + X1^2}}{P2}, & \text{for } X2 \neq 0 \end{cases}$$

in which:

- Y is the measured response.
- X1 is the first independent variable.
- X2 is an independent "selector" variable that determines which form of the equation is evaluated. If X2 is equal to zero Y corresponds to the "north facing" branch of the hyperbola. If X2 is not equal to zero Y corresponds to the "south facing" branch of the hyperbola.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

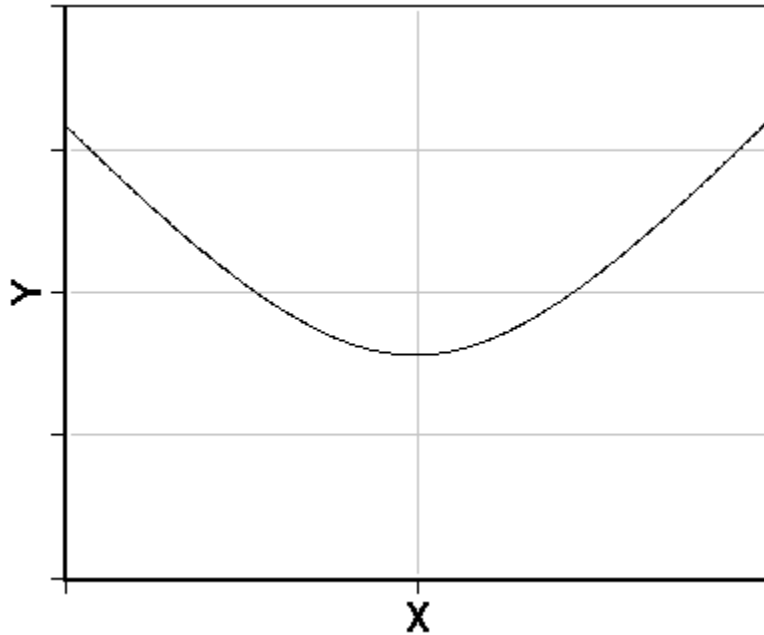
$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- The X2 values can most easily be assigned using the menu selections Edit, column data Fill.
- If only the North facing branch of the hyperbola is present see [Ftn 1540](#)^[2].
- If only the South facing branch of the hyperbola is present see [Ftn 1550](#)^[3].
- If the hyperbola is an East-West oriented hyperbola, exchange the X and Y data columns. The result will be a North-South oriented hyperbola.

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1537: Hyperbola N w/ X & Y Offsets



Equation

$$Y = P3 + \frac{P1 * \sqrt{P2^2 + (X - P4)^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Yo	Y offset.
P4	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

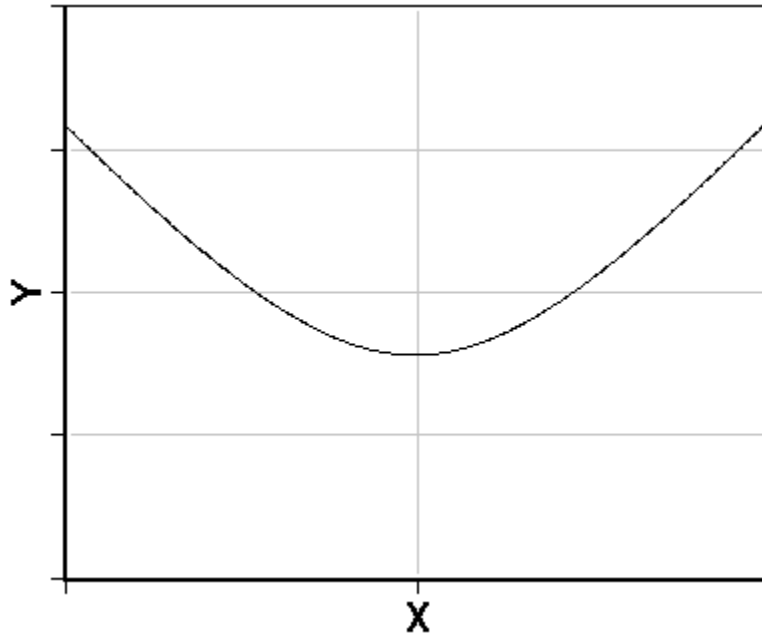
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1538: Hyperbola N w/ X Offset



Equation

$$Y = \frac{P1 * \sqrt{P2^2 + (X - P3)^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

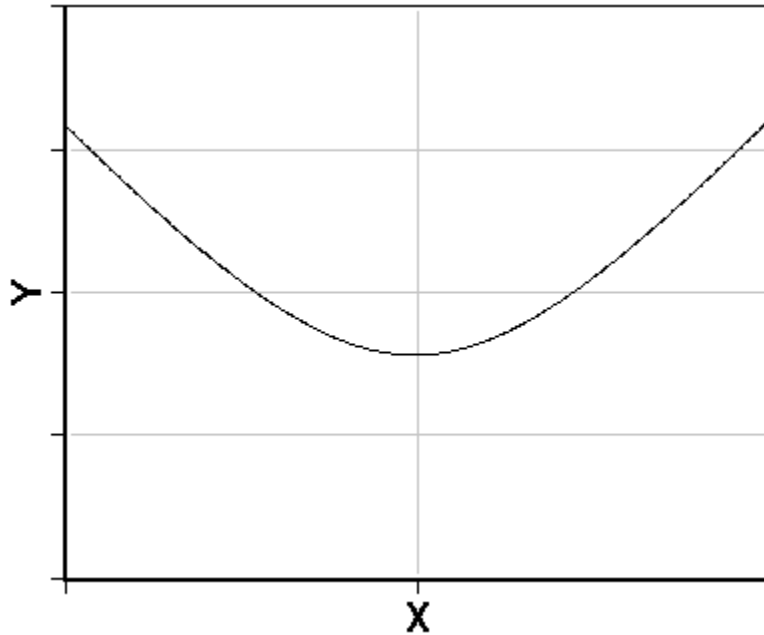
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1539: Hyperbola N w/ Y Offset



Equation

$$Y = P3 + \frac{P1 * \sqrt{P2^2 + X^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Yo	Y offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

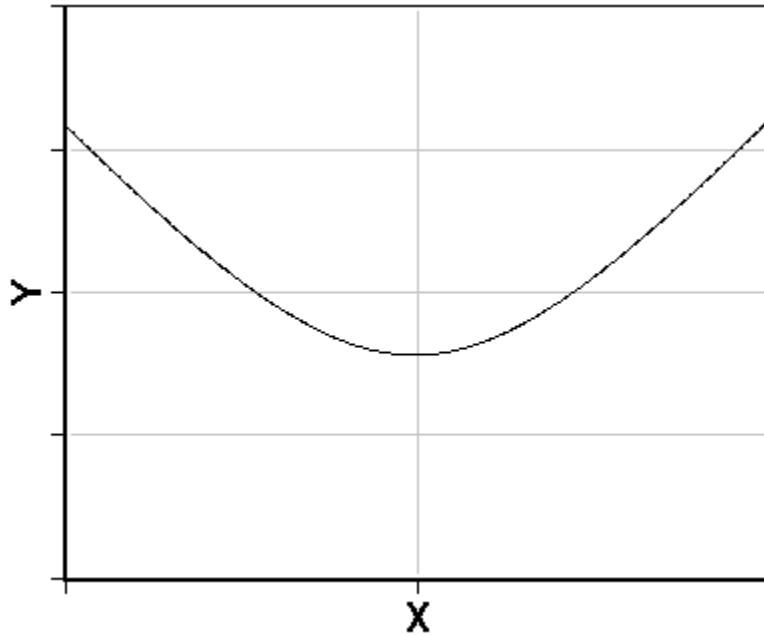
-
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1540: Hyperbola N



Equation

$$Y = \frac{P1 * \sqrt{P2^2 + X^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

• Remarks

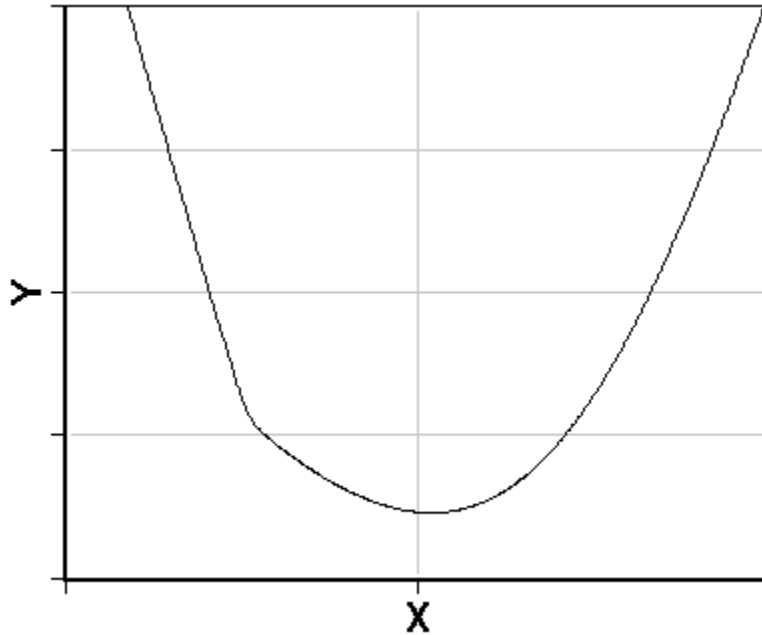
-
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- **Also see**

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1547](#)^[25], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1541: Hyperbolae 2 N w/ Two X and One Y offsets



Equation

$$Y = P3 + \frac{P1 * \sqrt{P2^2 + (X - P4)^2}}{P2} + \frac{P5 * \sqrt{P6^2 + (X - P7)^2}}{P6}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	A for the first hyperbola.
P2	B	B for the first hyperbola.
P3	Yo	Y offset. This is the sum of the Y offsets for the two hyperbolae.
P4	Xo	X offset for the first hyperbola.
P5	A2	A for the second hyperbola.

Parameter	Name	Comments
P6	B2	B for the second hyperbola.
P7	Xo2	X offset for the second hyperbola

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for two North-South oriented hyperbolae, which has the general form:

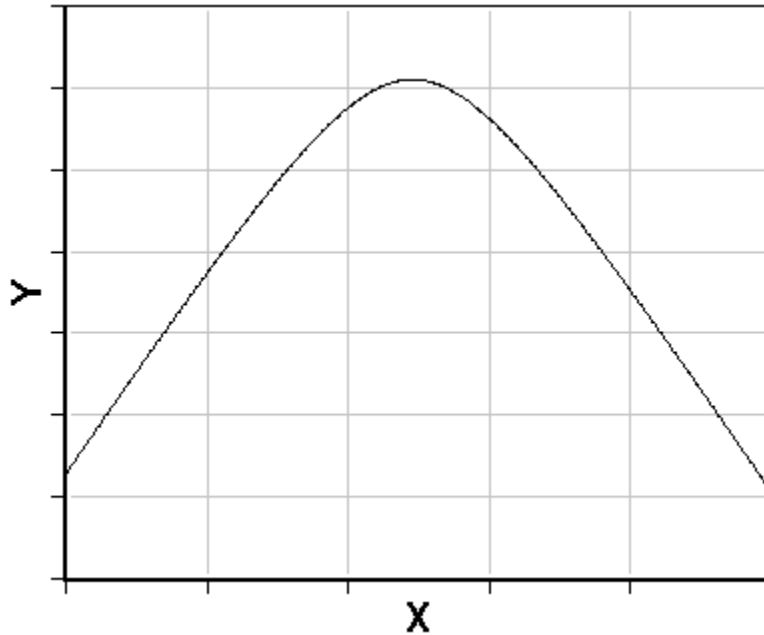
$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} + \frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

- The regression analysis is *very* sensitive to the initial parameter estimates. In most cases, the automatic initial estimates are adequate; however, it is very important that the analysis results be inspected to confirm that they are physically reasonable. If they are not, different initial estimates should be used.

Also see

Functions [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21]

Ftn1547: Hyperbola S w/ X & Y Offsets



Equation

$$Y = P3 - \frac{P1 * \sqrt{P2^2 + (X - P4)^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Yo	Y offset.
P4	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

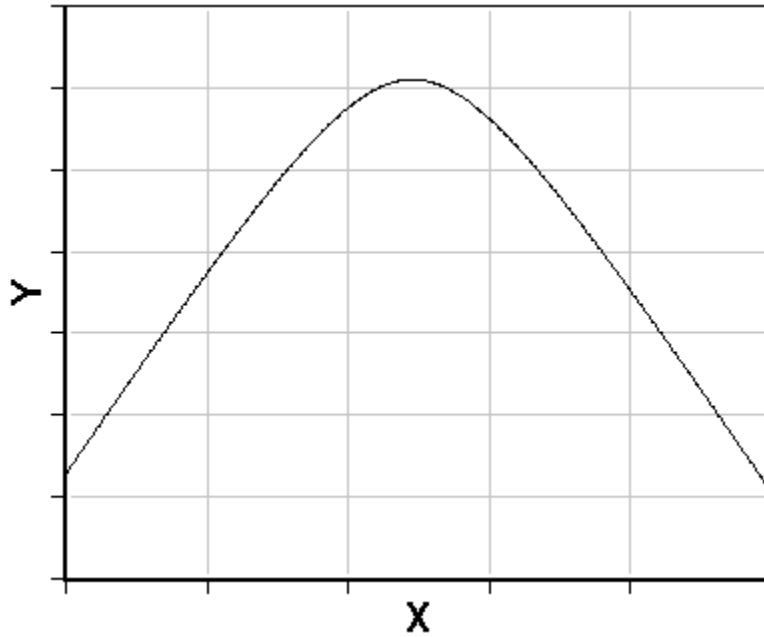
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1548](#)^[27], [1549](#)^[29] and [1550](#)^[31]

Ftn1548: Hyperbola S w/ X Offset



Equation

$$Y = -\frac{P1 * \sqrt{P2^2 + (X - P3)^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Xo	X offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

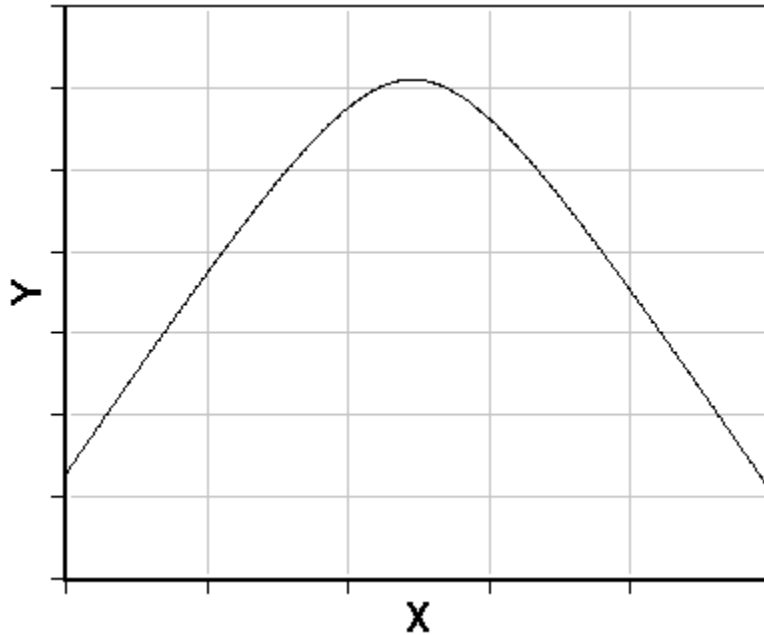
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1549](#)^[29] and [1550](#)^[31]

Ftn1549: Hyperbola S w/ Y Offset



Equation

$$Y = P3 - \frac{P1 * \sqrt{P2^2 + X^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	
P3	Yo	Y offset.

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

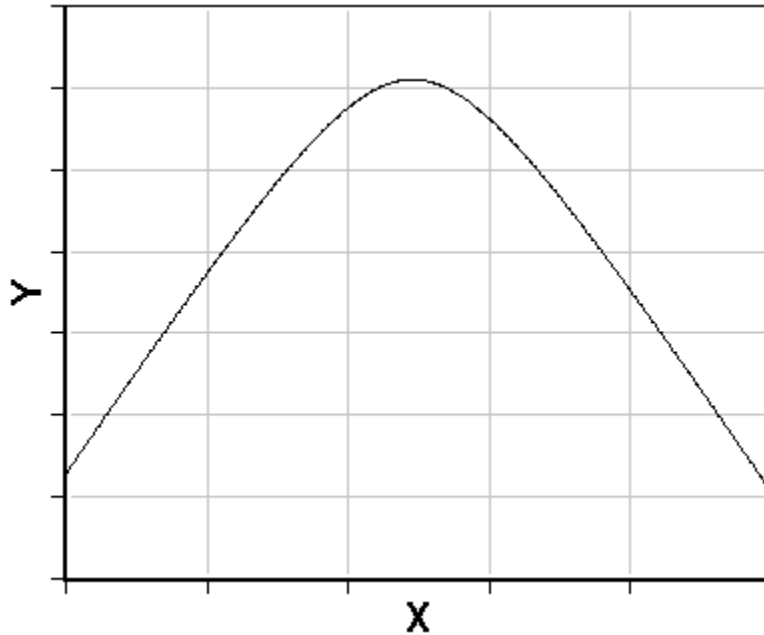
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27] and [1550](#)^[31]

Ftn1550: Hyperbola S



Equation

$$Y = -\frac{P1 * \sqrt{P2^2 + X^2}}{P2}$$

in which:

- Y is the measured response.
- X is the independent variable.

Parameters

Parameter	Name	Comments
P1	A	
P2	B	

Sample Applications

- Investigating Ground Penetrating Radar and the propagation of electromagnetic waves in the subsoil.

Remarks

- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

$$\frac{(Y - Y_0)^2}{A^2} - \frac{(X - X_0)^2}{B^2} = 1$$

Also see

Functions [1527](#)^[3], [1528](#)^[6], [1529](#)^[9], [1530](#)^[12], [1537](#)^[15], [1538](#)^[17], [1539](#)^[19], [1540](#)^[21], [1547](#)^[25], [1548](#)^[27]
and [1549](#)^[29]

Appendix

[Getting Help](#) ³⁴

[Adding Functions to FitAll](#) ³⁵

Getting Help

To get technical or other assistance from MTR Software you can:

Visit MTR Software's website at:

www.fitall.com

Email MTR Software at:

support@fitall.com

Write to MTR Software at:

MTR Software

77 Carlton Street, Suite 808

Toronto ON Canada

M5B 2J7

Telephone MTR Software at:

416-596-1499

Describe your problem or difficulty as completely as you can. We will try to answer your query quickly and completely.

You should also include your email address as well as your daytime, evening and weekend telephone numbers.

Adding Functions to FitAll

There are three ways to add your own specialized functions to *FitAll*.

1. You can contact **MTR Software** to get a quotation on the cost of creating a custom **FitAll Function Library** for you.
2. The **FitAll Programmer's Guide**, which is included with **FitAll Research Edition**, explains:
 - how to modify the supplied source code for the User Defined **FitAll Function Libraries** and
 - how to compile them using Embarcadero / CodeGear / Borland Delphi version 5 to XE2, **FreePascal** version 2.2 or later and **Lazarus** version 1.0 or later. FreePascal and Lazarus are open source Pascal compilers available from www.freepascal.org and www.lazarus.freepascal.org. Lazarus is highly recommended.
3. You can contact **MTR Software** and request that the function be added to one of **FitAll's Function Libraries**.

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Function

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27, 29, 31

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Function Reference 2

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19, 21, 23, 25, 27, 29, 31

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29, 31

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