Version 10

FitAll

nonlinear regression analysis

User Requested Functions Guide

MTR SOFTWARE

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Contents

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**.

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.

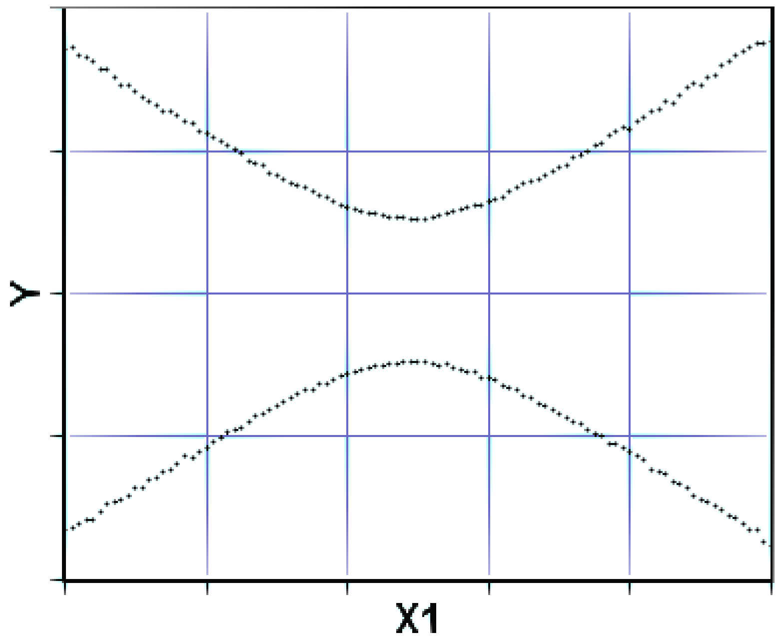
Remarks

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

Also see

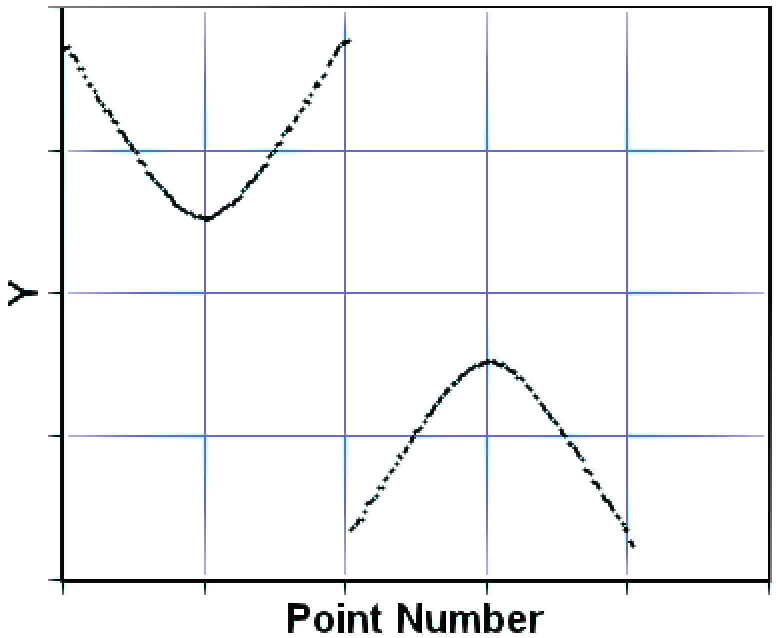
Provides links or references to other related functions.

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

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

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:

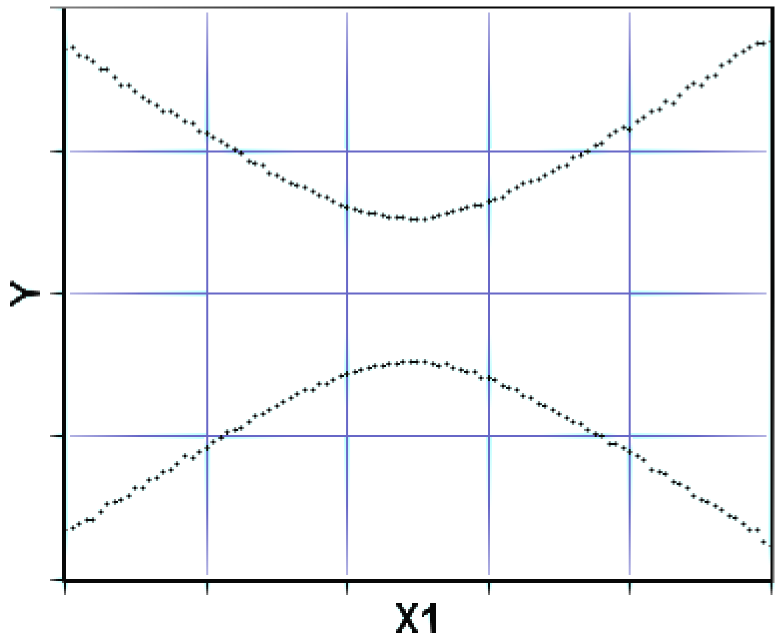
$$\frac{(Y - Yo)^2}{A^2} - \frac{(X - Xo)^2}{B^2} = 1$$

- 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

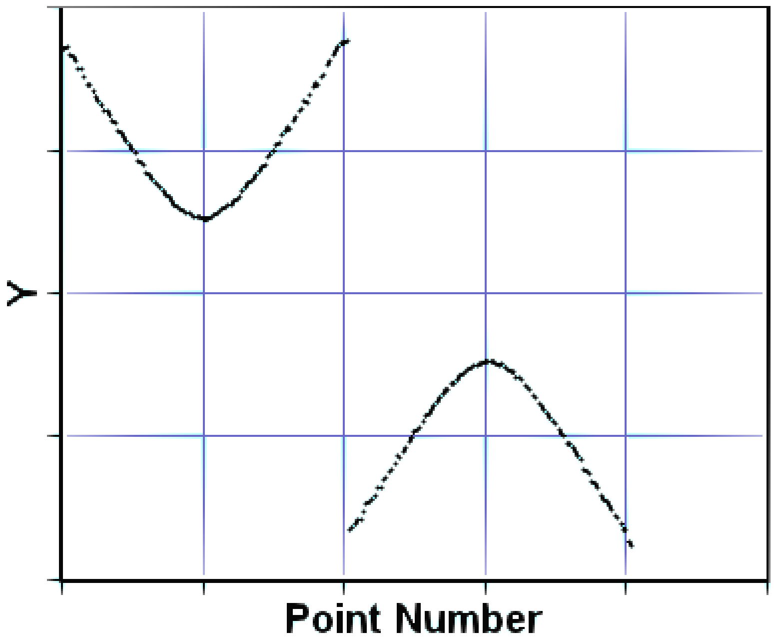
Functions 1528 6, 1529 9, 1530 12, 1537 15, 1538 17, 1539 19, 1540 21, 1547 25, 1548 27, 1549 29 and 1550 31

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

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

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	
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:

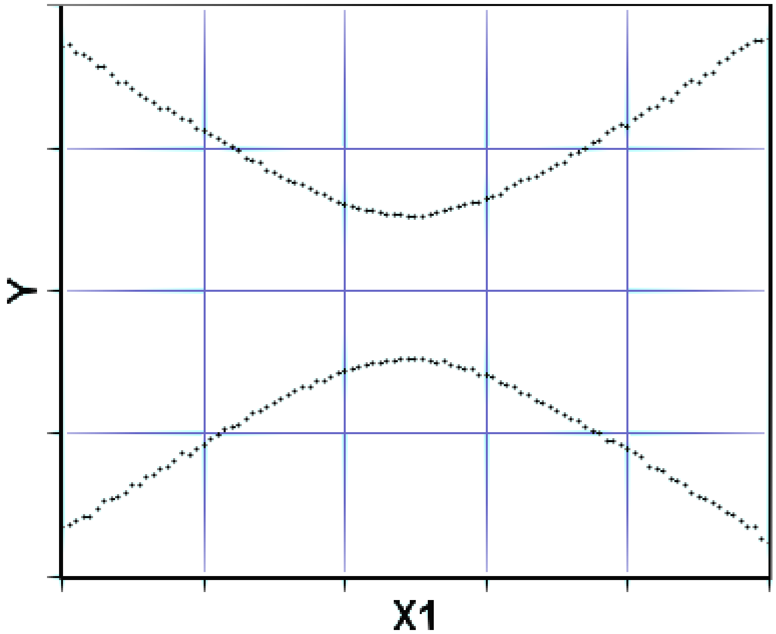
$$\frac{(Y - Yo)^2}{A^2} - \frac{(X - Xo)^2}{B^2} = 1$$

- 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

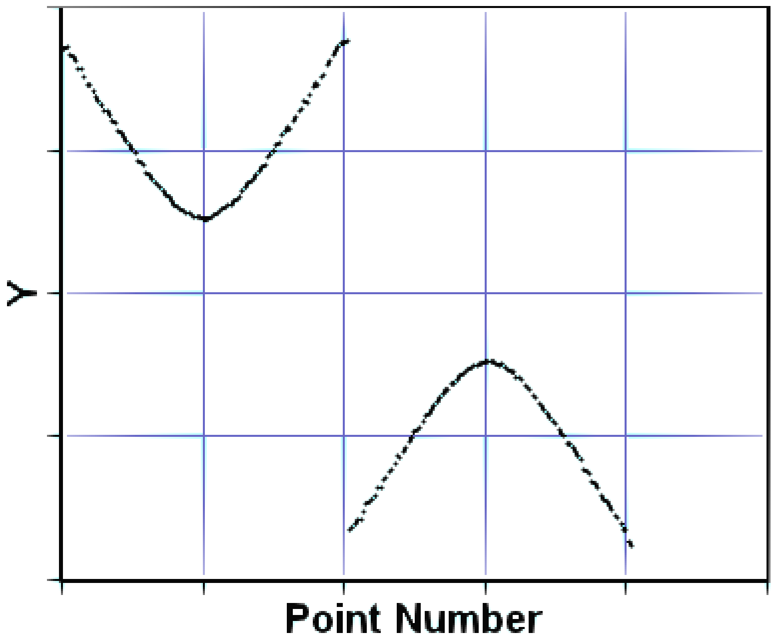
Functions 1527 3, 1529 9, 1530 12, 1537 15, 1538 17, 1539 19, 1540 21, 1547 25, 1548 27, 1549 29 and 1550 31

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

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

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:

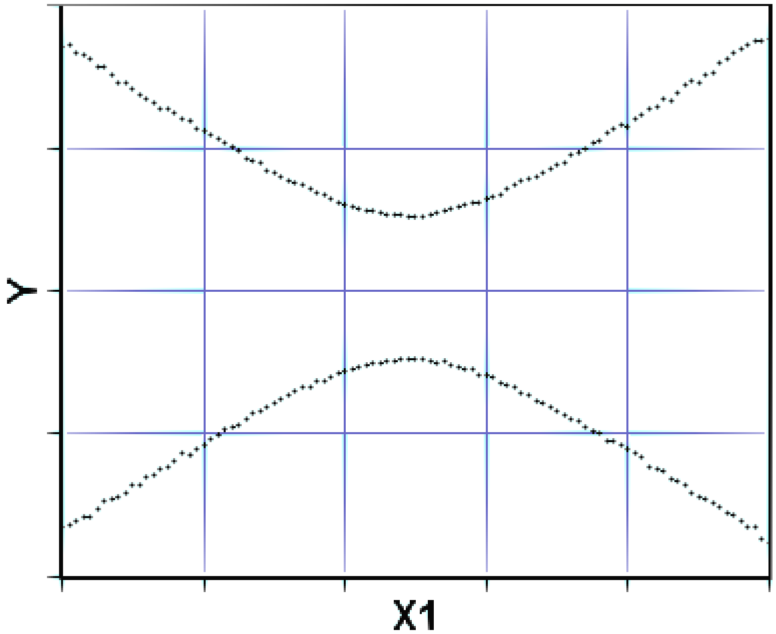
$$\frac{(Y - Yo)^2}{A^2} - \frac{(X - Xo)^2}{B^2} = 1$$

- 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

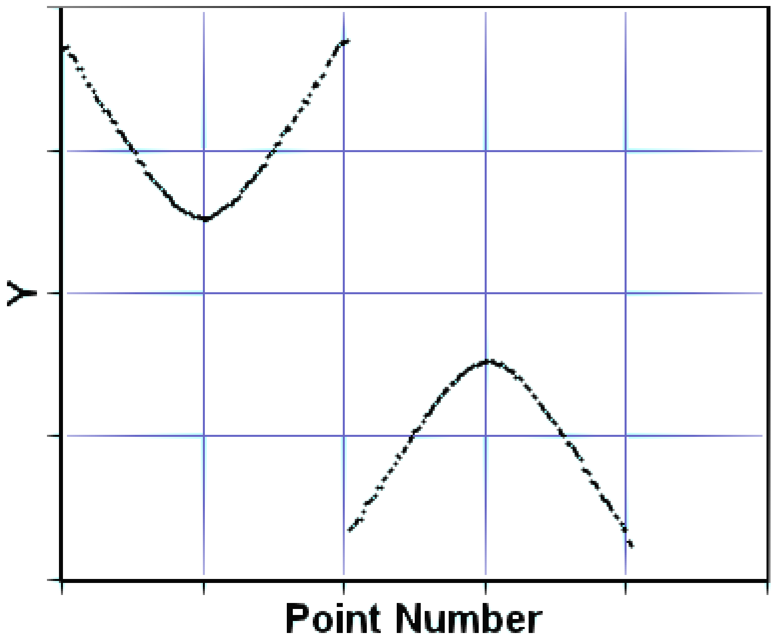
Functions 1527 3, 1528 6, 1530 12, 1537 15, 1538 17, 1539 19, 1540 21, 1547 25, 1548 27, 1549 29 and 1550 31

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

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

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:

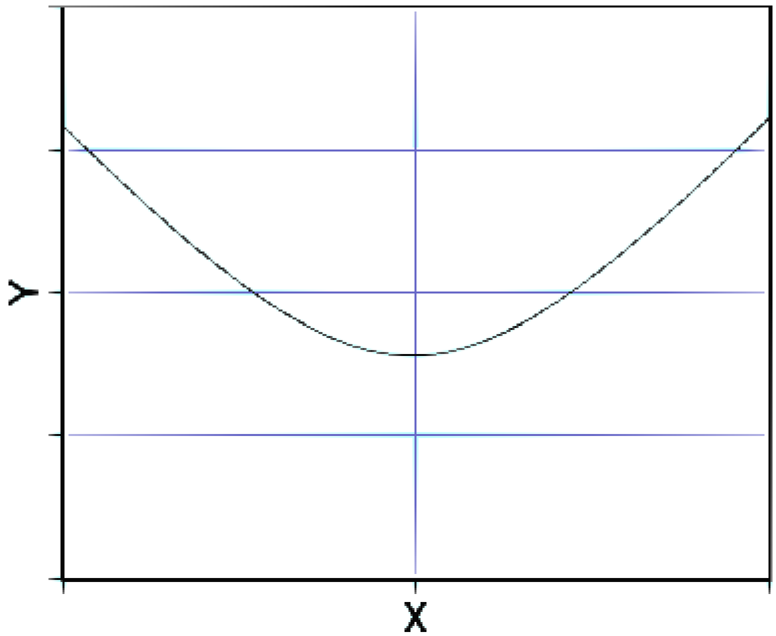
$$\frac{(Y - Yo)^2}{A^2} - \frac{(X - Xo)^2}{B^2} = 1$$

- 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 21.
- If only the South facing branch of the hyperbola is present see Ftn 1550 31.
- 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

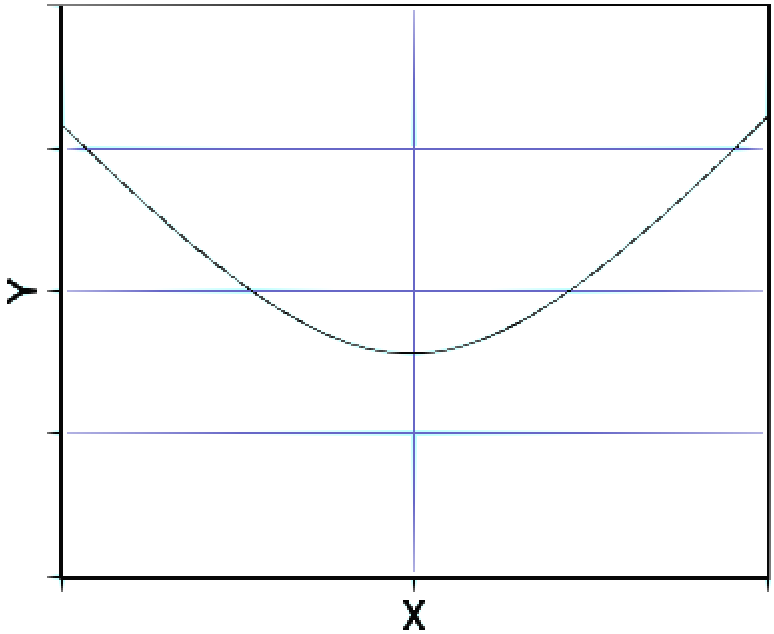
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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

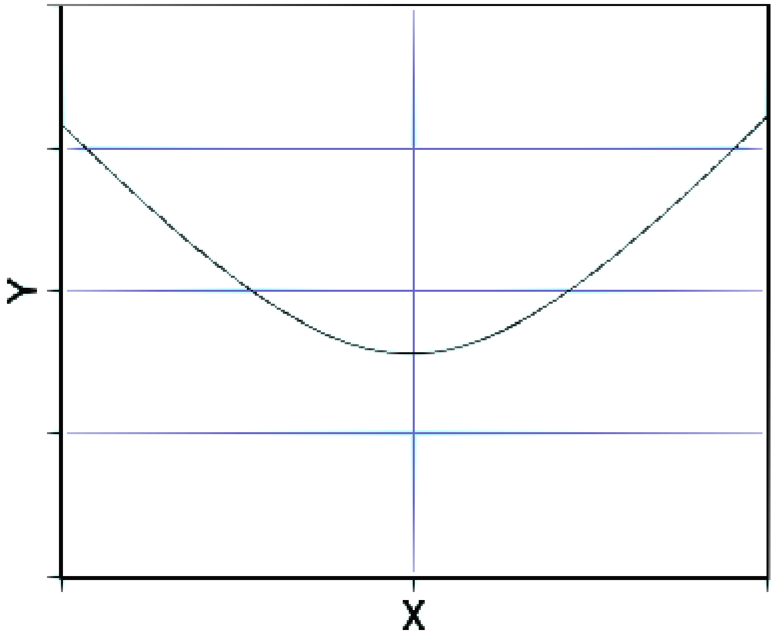
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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

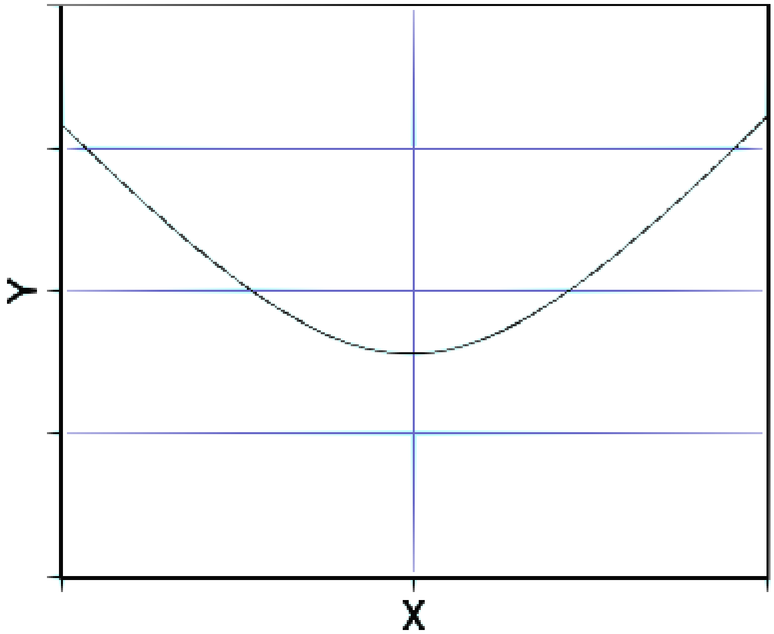
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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*

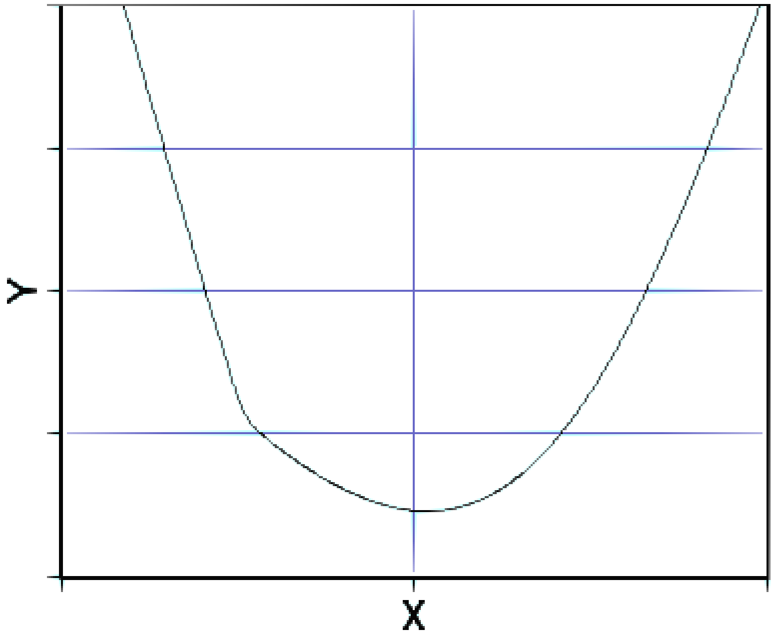
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

• *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:

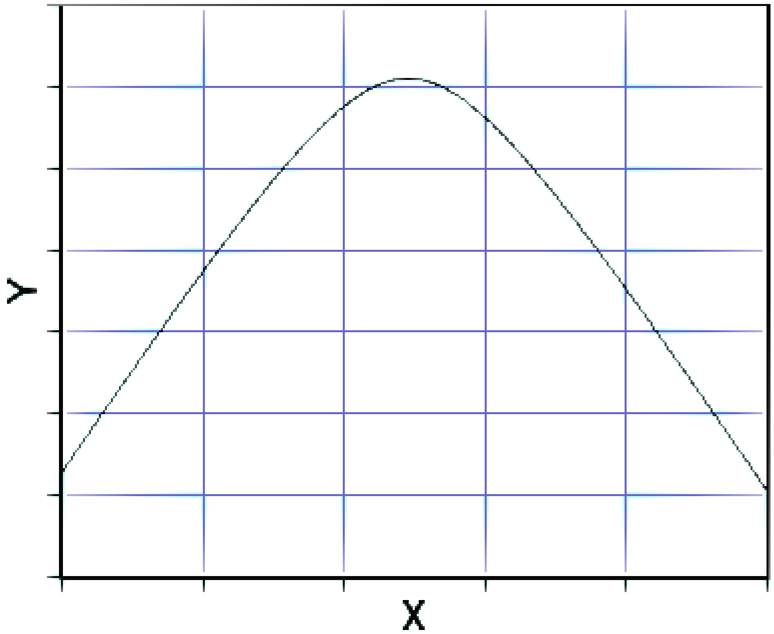
$$\frac{(Y - Yo)^2}{A^2} - \frac{(X - Xo)^2}{B^2} + \frac{(Y - Yo)^2}{A2^2} - \frac{(X - Xo2)^2}{B2^2} = 1$$

- 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

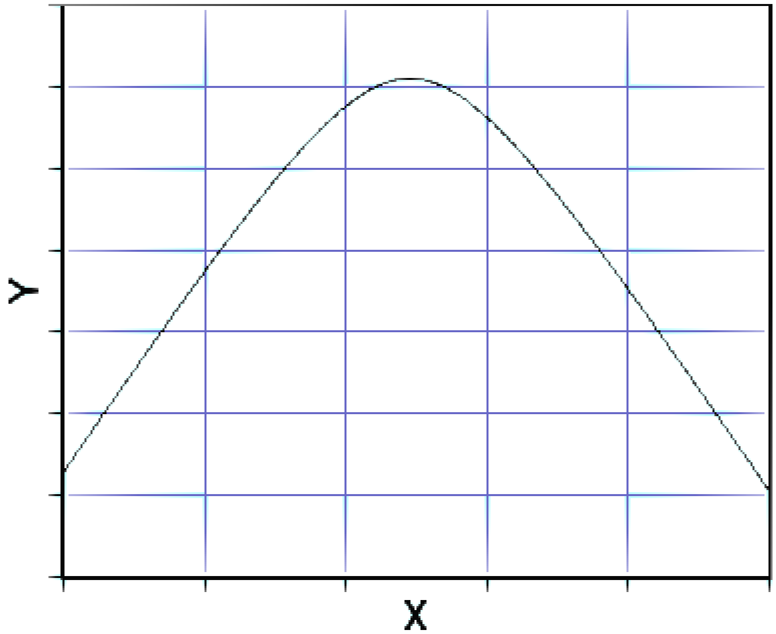
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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

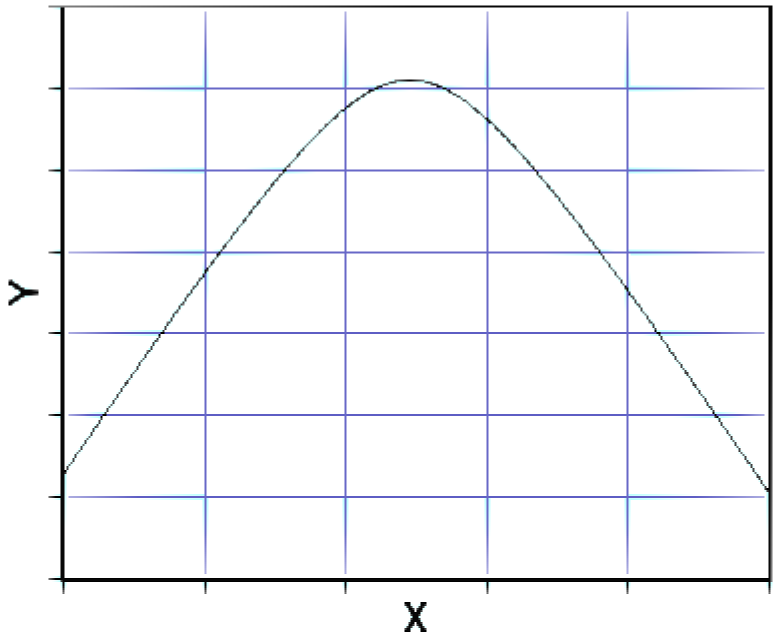
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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

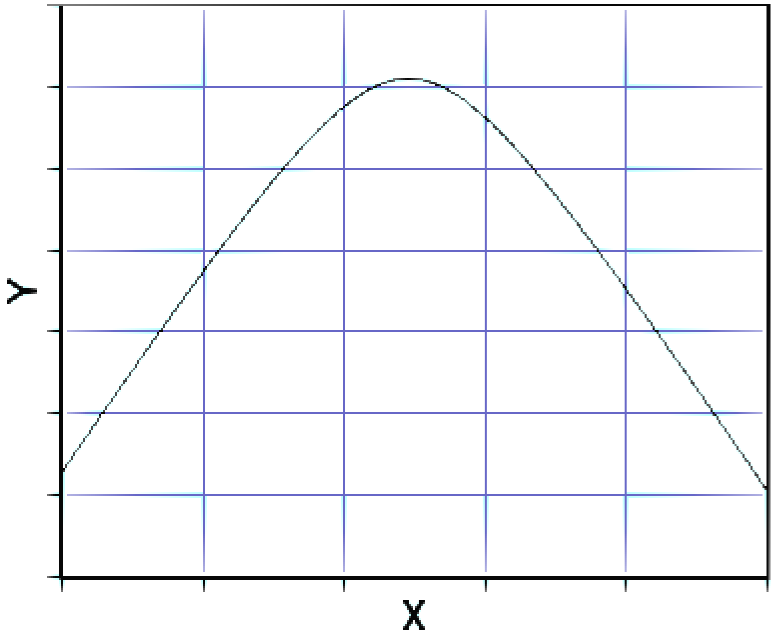
- The above equation is based on the standard formula for a North-South oriented hyperbola, which has the general form:

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

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:

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

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

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 four ways to add your own specialized functions to ***FitAll***.

1. In ***FitAll*** version 10 you can use the new "Scripted Function" feature to add functions that can be defined by a one-line expression and contains one independent variable, X. and up to ten parameters, P.

2. You can contact ***MTR* Software** to get a quotation on the cost of creating a custom ***FitAll* Function Library** for you.

3. 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.

4. You can contact ***MTR* Software** and request that the function be added to one of ***FitAll***'s **Function Libraries**.

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