Interpolation Functions

Excel ® Add-in

Interpolation.xla release 2.0 April 6th 2016

Linear Interpolation:

INTERPO	Linear interpolation.
INTERPO2	Double linear interpolation and extrapolation.
INTERPO2N	Double linear interpolation.

Cubic Interpolation:

CERCHA	Cubic spline interpolation.
CERCHAC	Spline coefficients.
CERCHACOEF	Spline coefficients (ref. axis origin).
CERCHAP	Slope in well-known data.
CERCHAPI	Initial slope at the first spline.
CERCHAPF	Final slope at the last spline.
CERCHACI	Initial second derivative of the first spline.
CERCHACF	Final second derivative of the last spline.
CERCHARA	Curvature radii at well-known data.
CERCHARAXY	Centre of curvature coordinates.
CERCHACU	Second derivatives at well-known data.
CERCHACUR	Curvature at points.
CERCHAREA	Area under the spline.
CERCHAMX	Statical moment respect X axis.
CERCHAMY	Statical moment respect Y axis.
CERCHAM2X	Second moment (inertia) respect X axis.
CERCHAM2Y	Second moment (inertia) respect Y axis.
CERCHAP2	Product of inertia.
CERCHAXG	Centre of gravity Xg.
CERCHAYG	Centre of gravity Yg.
CERCHALON	Lenght of chord of spline.

New functions:

CERCHAK	Akima spline (stable to the outliers).
CERCHAKCO	Akima spline coeffcients.
CERCHAKD	Akima spline first and second derivatives.
CERCHAKIN	Akime spline integration.
CERCHAS	Cubic spline interpolation (Alglib algorithm).
CERCHASCO	Spline coefficients.
CERCHASD	First and second derivatives.
CERCHASIN	Spline integration.
CERCHAH	Hermite spline interpolation.
CERCHAHCO	Hermite spline coefficients.
CERCHA2D	Hermite spline second derivative.
CERCHAHIN	Hermite spline integration.

Install instructions

New functions have been created using Alglib Algorithms (http://www.alglib.net/)

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INTERPO

INTERPO(X;Range_x;Range_y)

X: Data for interpolation.

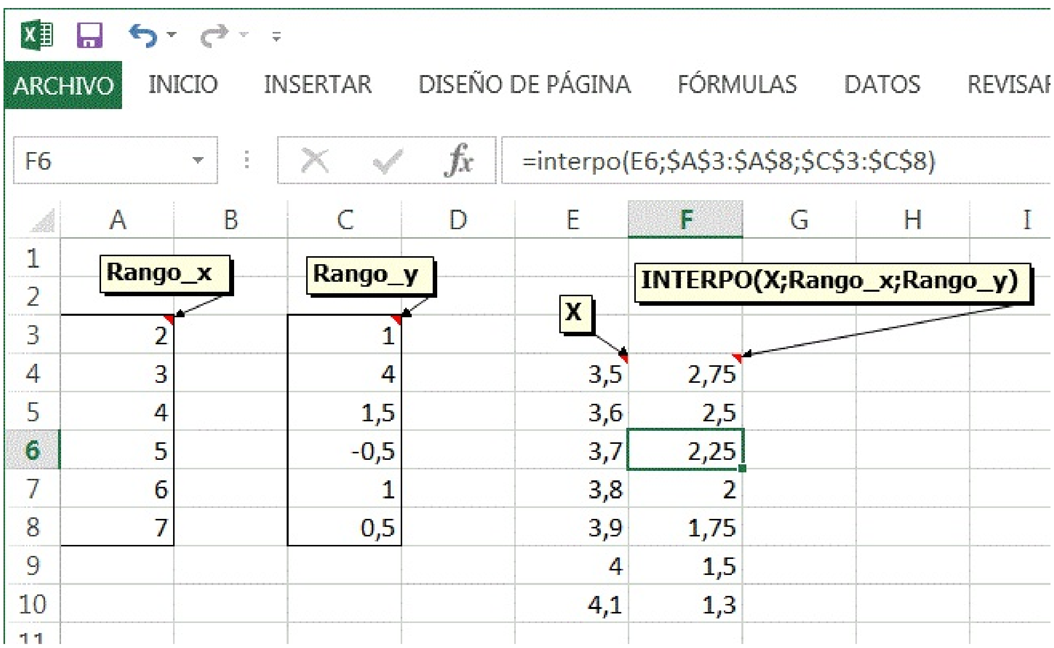
Range_x: Range of 1 column with all **X** given data (independent variable).

Range_y: Range of 1 column with all **Y** given data (dependent variable).

Function for linear interpolation or extrapolation in columns sorted in ascending sense (see the following picture), and in descendent, but single sense (monotonic). This function works considering next ones (greater and smaller) to the value of the argument. Excel has functions for interpolate in tables of values, but considering all of them and making a regression. The interpolation type of this function is the typical interpolation of the old logarithms table.

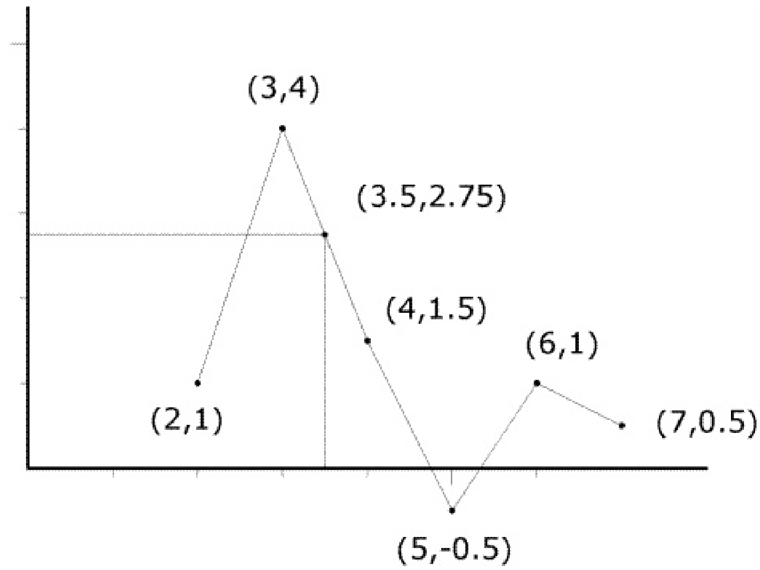
Ranges of " x " and " y " can be of different sizes although, in that case, range of " y " must be greater, but this can bring erroneous results depending on the zone where the lack of data is.

Range_x must be monotonic, that is to say, it must be increasing or diminishing continuously and not having two equal values.



As you can see in the above picture, If you want to copy the formula for other interpolations, it must be written with signs of absolute reference for **Range_x** and **Range_y**.

In order to obtain this, once in the formula assistant RefEdit, press F4 key.



The algorithm is an adaptation of the function published on the Internet by Peter Hewett (1995).

See also: INTERPO2 & INTERPO2N

Other functions

INTERPO2

INTERPO2(X;Y;Range)

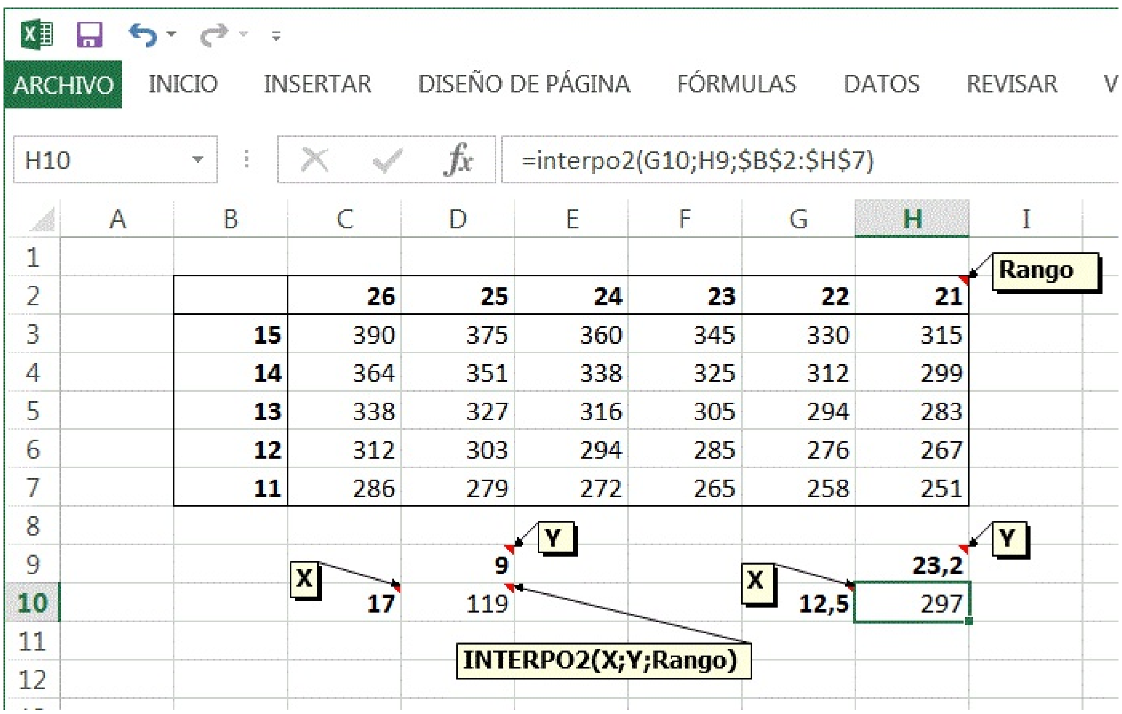
X: value to interpolate in the first column (the left one).

Y: value to interpolate in the upper row

Range: Range with all the data, including the arguments.

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Function for linear interpolation and extrapolation with double entrance in first row and first column. First row and column must be sorted in ascending or descending order (see following picture). The function will calculate using only the values near the arguments.



	A	B	C	D	E	F	G	H
1								
2			26	25	24	23	22	21
3		15	390	375	360	345	330	315
4		14	364	351	338	325	312	299
5		13	338	327	316	305	294	283
6		12	312	303	294	285	276	267
7		11	286	279	272	265	258	251
8								
9				9				23,2
10			17	119			12,5	297
11								
12								

In the above picture you can see an extrapolation and an interpolation.

See also: INTERPO & INTERP2N

Other functions

INTERPO2N

INTERPO2N(X;Y;Range)

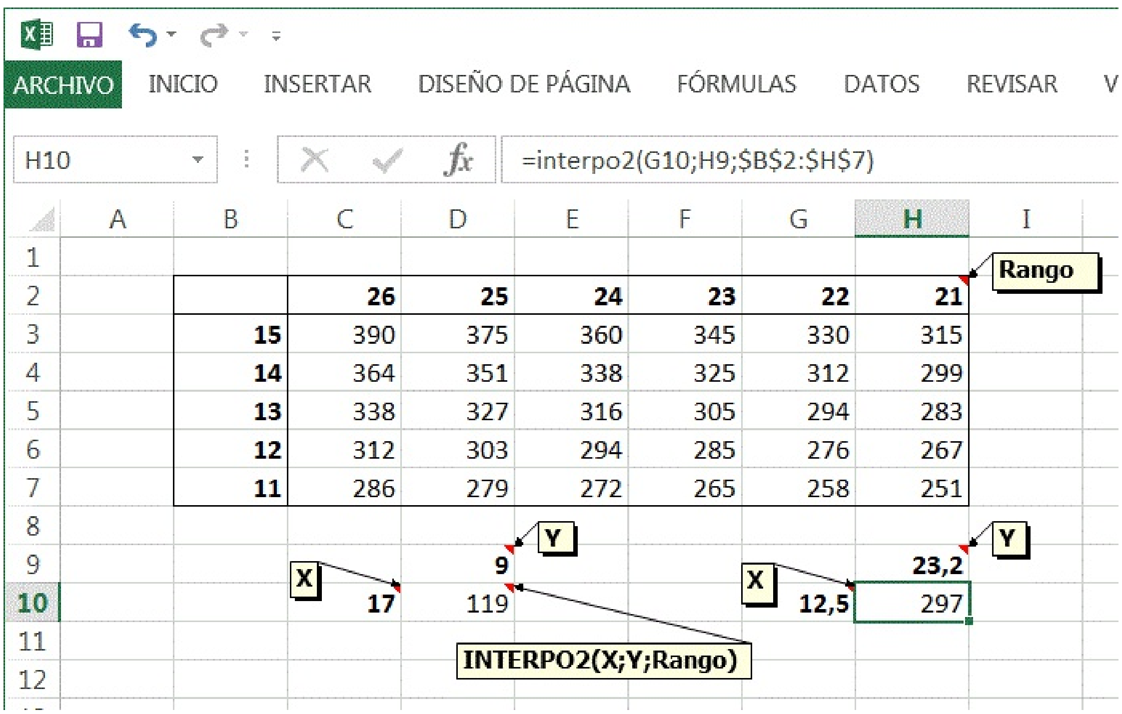
X: value to interpolate in the first column (the left one).

Y: value to interpolate in the upper row

Range: Range with all the data, including the arguments.

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Function for linear interpolation by double entrance in first row and first column. The row and the column must be sorted in ascending or descending way (see following picture). The function will calculate the result using only the values near the arguments. This function does not extrapolate.



See [INTERPO2]

[Other functions]

CERCHA

CERCHA(X ; Range_xy ; "Keys" ; V1;V2)

Required arguments: **X**; **Range_xy**

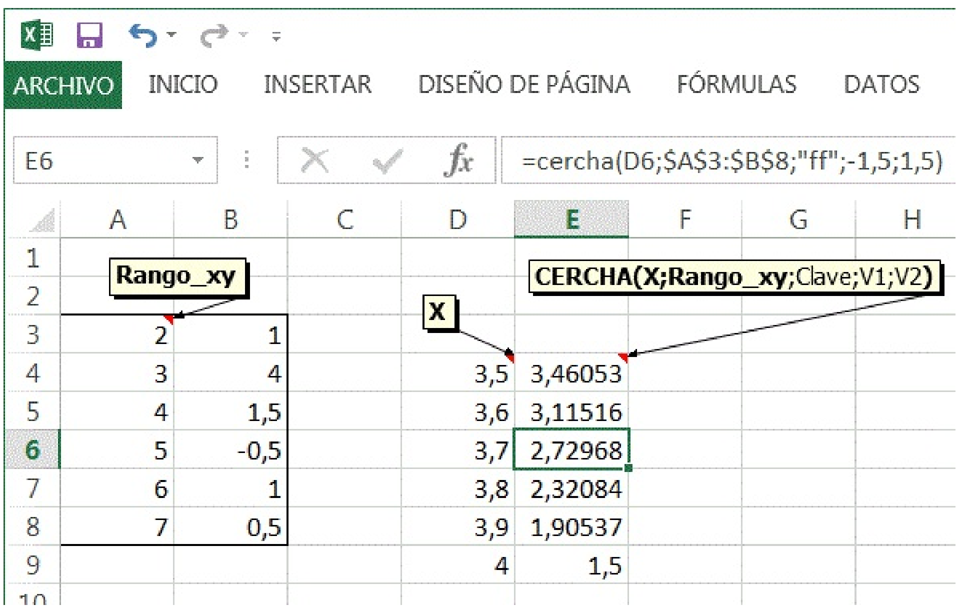
Optional arguments: "**Keys**";**V1**;**V2**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function is used for interpolation or extrapolation using splines. Splines are cubic polynomial functions, that adapt by pieces to the points where it is necessary to interpolate, in such a way that among pairs of contiguous points there are different polynomials (with exceptions). First derivative (slope) and second derivative at the ends of the polynomials match with the next one and the values at the start of first and the end of the last splines can be made up on the basis of the type of spline that is needed, that is to say, settle down "end-point constraints".

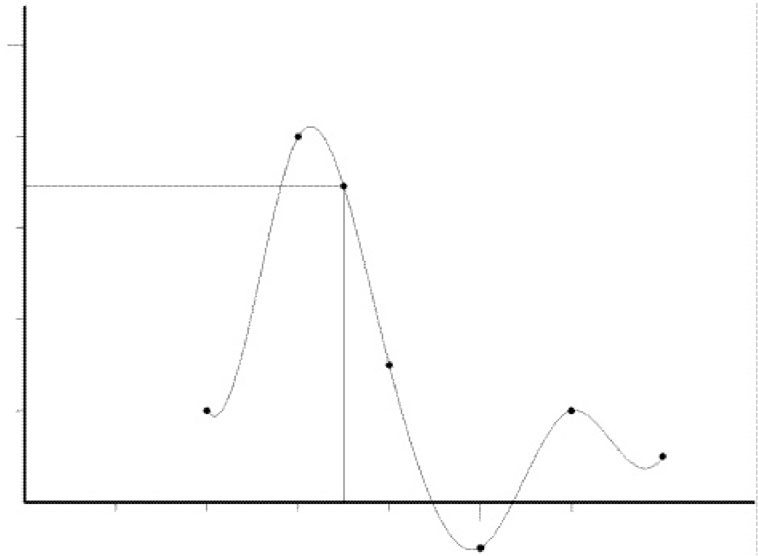
Important: Data must be ordered in ascending and the end-point constraints will be applied, first (1st **key** and **V1**) for the smaller value of **Range_xy** (1 column) and (2nd **key** and **V2**) for the greater value of **Range_xy** (1st column).

Use of function CERCHA:



	A	B	C	D	E	F	G	H
1								
2								
3	2	1						
4	3	4		3,5	3,46053			
5	4	1,5		3,6	3,11516			
6	5	-0,5		3,7	2,72968			
7	6	1		3,8	2,32084			
8	7	0,5		3,9	1,90537			
9				4	1,5			

Resulting curve and interpolation for a single point:



See also: CERCHAK, CERCHAS & CERCHAH

Other functions

CERCHAC

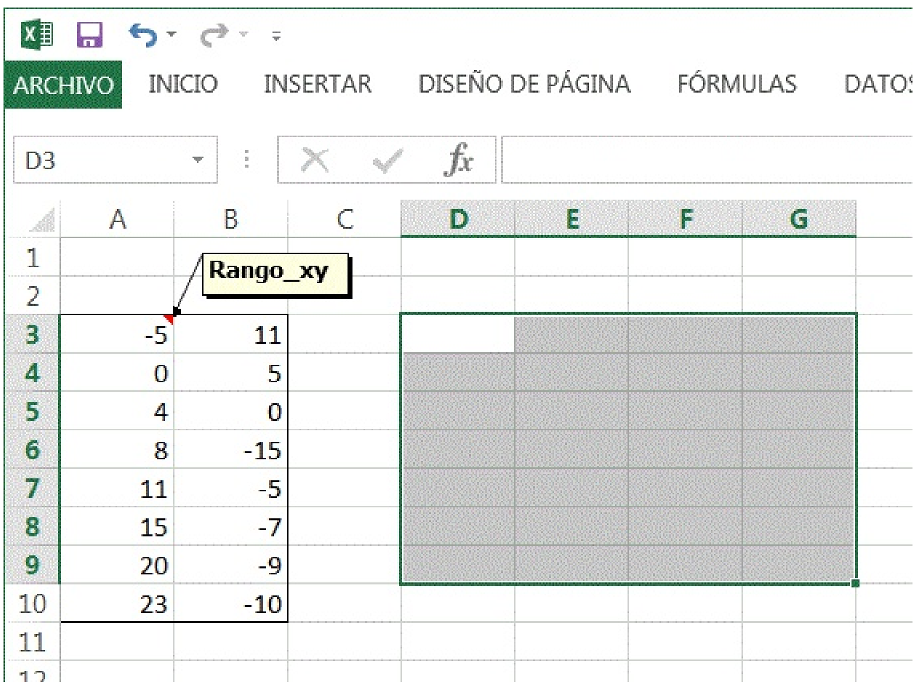
CERCHAC(Range_xy ; "Keys" ; V1;V2)

Required arguments: Range_xy
Optional arguments: "Keys";V1;V2
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

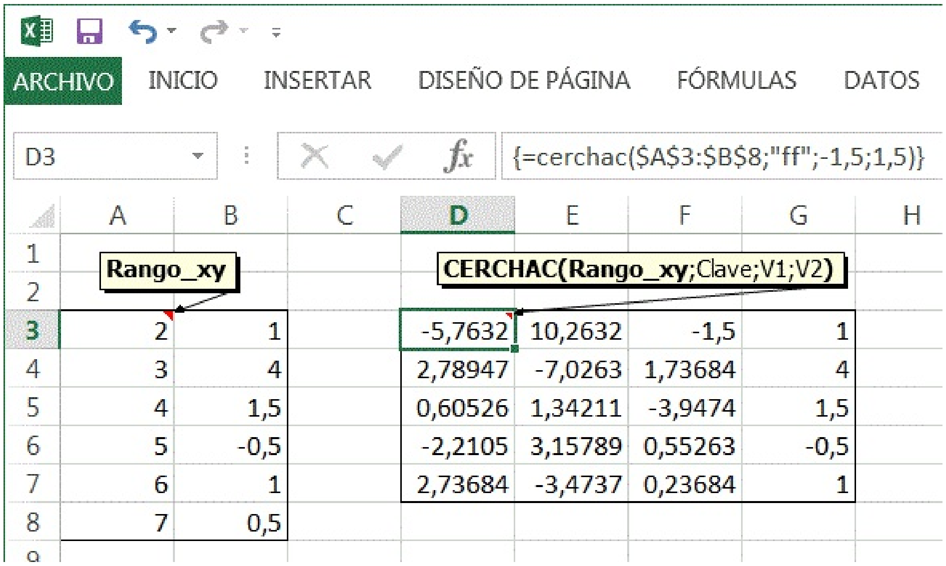
This function serves to obtain the coefficients of the polynomials (splines). Having a series of points (given data), with this function you can find the polynomial coefficients of the spline. The number of splines is one less than the number of points (see example).

It is a **matrix function**, reason why it is necessary to select a range before the formula is introduced. In this range will appear the coefficients. The range to select must have 3 or 4 columns (better 4) and an equal number of rows than the number of polynomials needed.

Example: First select the range of 4 columns and several rows



Once introduced the arguments with the assistant of functions, you have to press **Ctrl + Shift + Enter** and….



ARCHIVO INICIO INSERTAR DISEÑO DE PÁGINA FÓRMULAS DATOS

D3 {=cerchac($A$3:$B$8;"ff";-1,5;1,5)}

	A	B	C	D	E	F	G	H
1	Rango_xy			CERCHAC(Rango_xy;Clave;V1;V2)				
2								
3	2	1		-5,7632	10,2632	-1,5	1	
4	3	4		2,78947	-7,0263	1,73684	4	
5	4	1,5		0,60526	1,34211	-3,9474	1,5	
6	5	-0,5		-2,2105	3,15789	0,55263	-0,5	
7	6	1		2,73684	-3,4737	0,23684	1	
8	7	0,5						

As you can see, the last column matches with the given values of **Y**. The first polynomial of interpolation (first spline) is:

$$y(x) = -5,763 (x - 2)^3 + 10,263 (x - 2)^2 - 1,5 (x - 2) + 1$$

and the second polynomial will be:

$$y(x) = 2,789 (x - 3)^3 - 7,026 (x - 3)^2 + 1,737 (x - 3) + 4$$

See
CERCHACOEF to obtain polynomials referred to the coordinate origin. See also:
CERCHAKCO, CERCHASCO & CERCHAHCO

Other functions

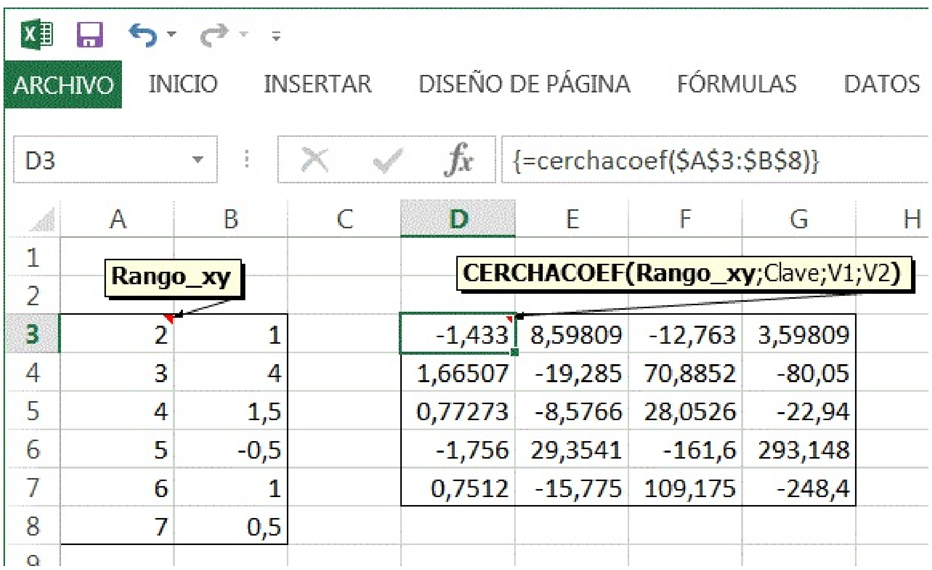
CERCHACOEF

CERCHACOEF(Range_xy ; "Keys" ; V1;V2)

Required arguments: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function serves to obtain the coefficients of the polynomials (splines), but with respect to the origin of coordinates and not with respect to the abscissa where the spline begins.

It is a **matrix function**, reason why it is necessary that before the formula is introduced a range must be selected where the calculated coefficients are going to be showed. The range to select must have 3 or 4 columns (better 4) and an equal number of rows to the number of polynomials are needed. Then pressing **Ctrl + Shift + Enter**:



	A	B	C	D	E	F	G	H
1								
2								
3	2	1		-1,433	8,59809	-12,763	3,59809	
4	3	4		1,66507	-19,285	70,8852	-80,05	
5	4	1,5		0,77273	-8,5766	28,0526	-22,94	
6	5	-0,5		-1,756	29,3541	-161,6	293,148	
7	6	1		0,7512	-15,775	109,175	-248,4	
8	7	0,5						

The first polynomial is:

y(x) = -1,433 x^3 + 8,598 x^2 - 12,763 x + 3,598

See also: CERCHAC, CERCHAKCO, CERCHASCO & CERCHAHCO

Other functions

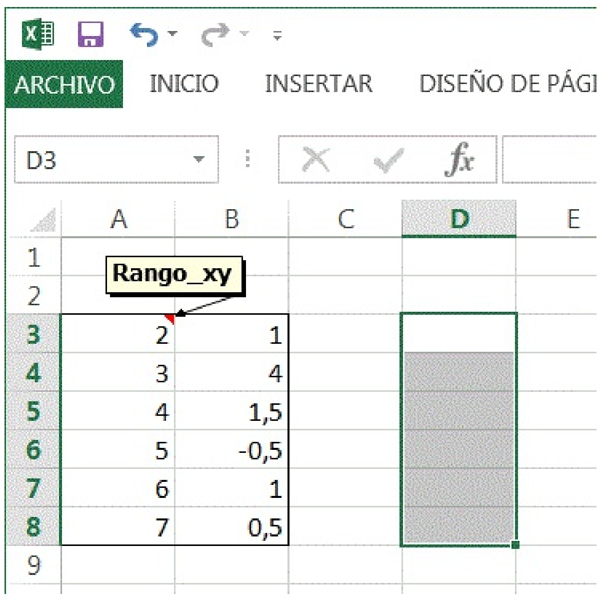
CERCHAP ___

CERCHAP(Range_xy ; "Keys" ; V1;V2)

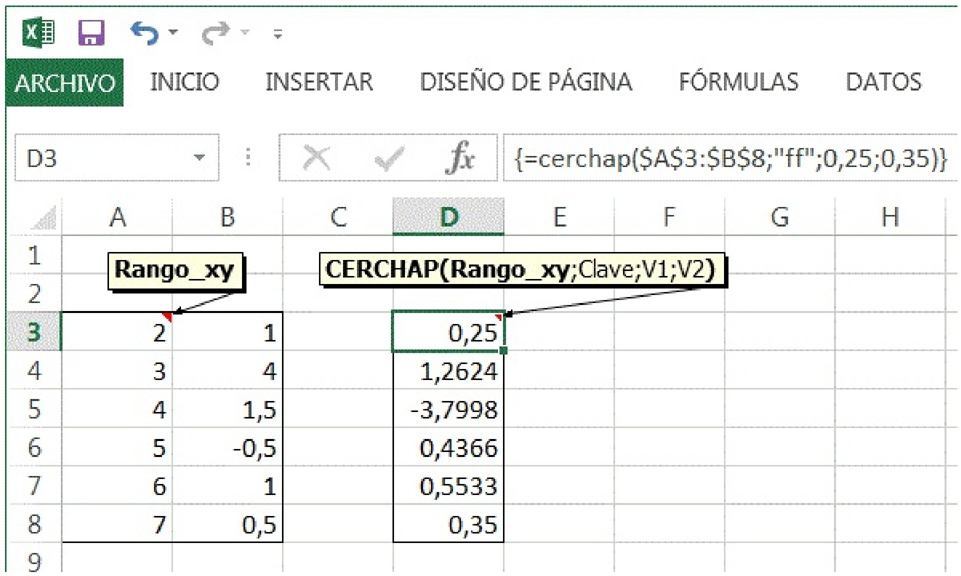
Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

Calculation of slopes (1st derivative) at the given (well-known) points.
It is a **matrix function**. It is necessary to select previously a range of a column and several rows depending on the number of slopes needed, counted from the first point. Values (given points) must be sorted in ascending.

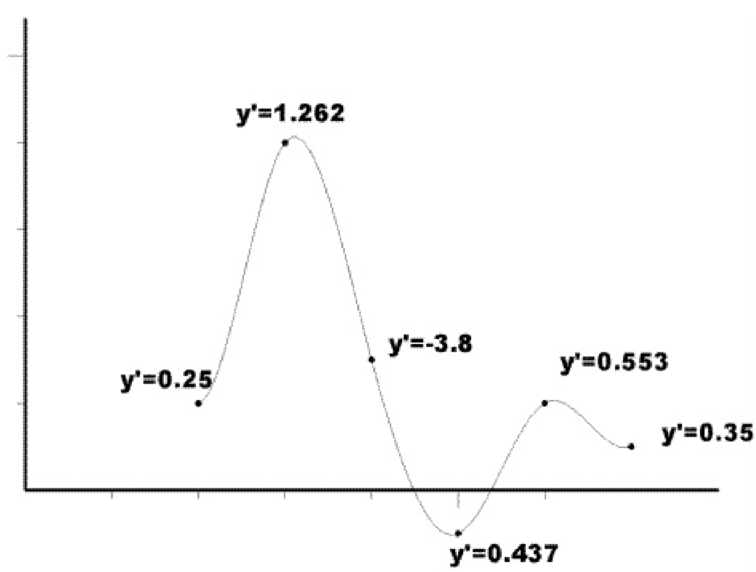
Example of use of function CERCHAP



Pressing: **Ctrl + Shift + Enter**....



Values



See also: CERCHAPI, CERCHAPF, CERCHAKD & CERCHASD

Other functions

CERCHAPI

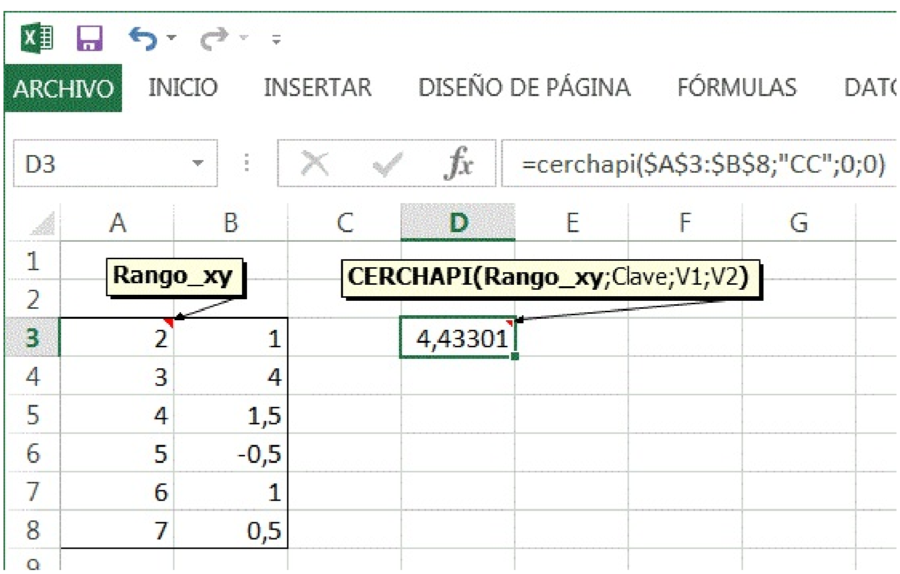
CERCHAPI(Range_xy ; "Keys" ; V1;V2)

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Determination of the slope (1st derivative) at the initial point of first spline.

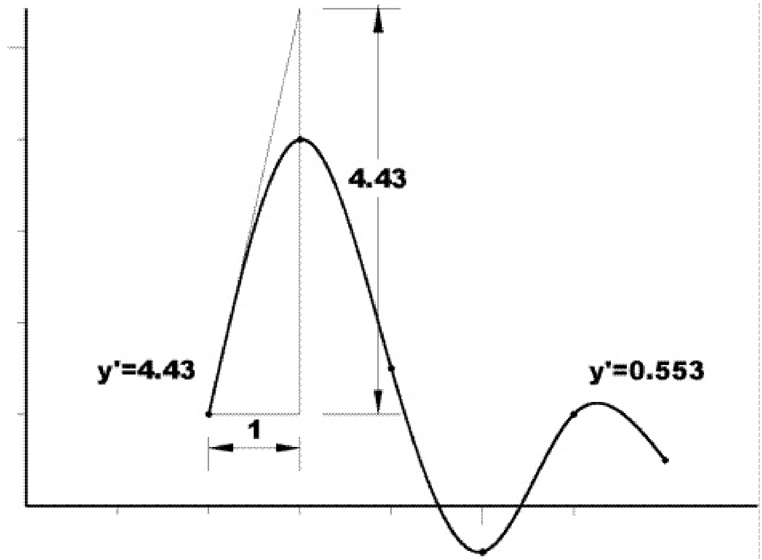
Suggestion: Matlab ® (function csape) uses, by default, to the slopes of the interpolation splines, which would have a spline with only the first four given points (for the initial slope) and the last four (for the final). For a similar calculation, this function can be used previously selecting a **Range_xy** with those 4 points and typing end-point constraints "ee" (Lagrange's conditions). It will assign only a cubic one for these 4 points and later using the function CERCHAPF with the 4 last given points, in an similar way, in order to obtain the final slope. Finally, with calculated slopes, the function to be used is CERCHA with the constraints "ff" and the values calculated for **V1** and **V2**.

In the following example, curvature (2nd derivative) equal to zero for the beginning and end is assigned, and the function calculates the slope at origin:



Value of the slope. Same result is obtained with the following formula:
=CERCHAPI(A3:B8)

Because "natural" end-constraints are by default (zero curvature).



See also: CERCHAP, CERCHAKD & CERCHASD

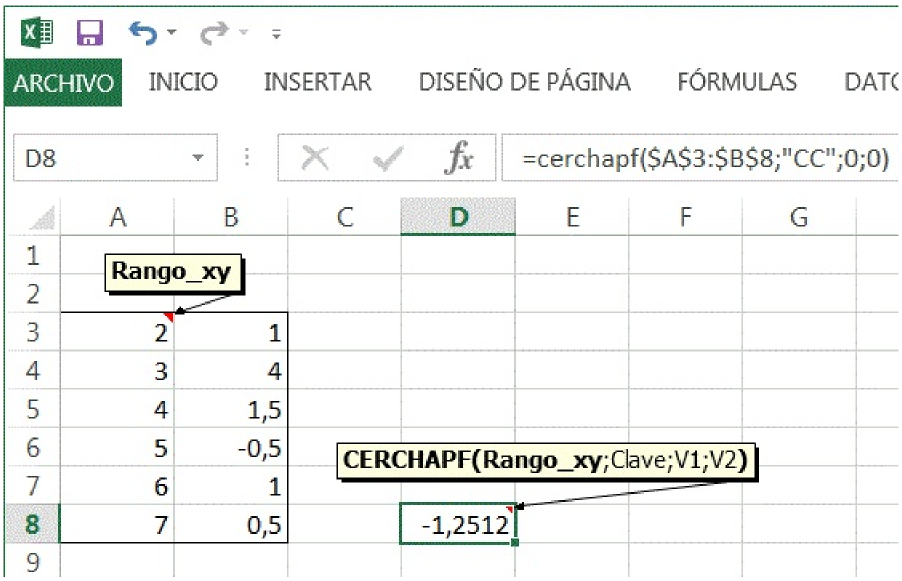
Other functions

CERCHAPF

CERCHAPF(Range_xy ; "Keys" ; V1;V2)

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function is used to determine the final slope at the last point of the last spline.



See also: CERCHAP, CERCHAPI, CERCHAKD & CERCHASD

Other functions

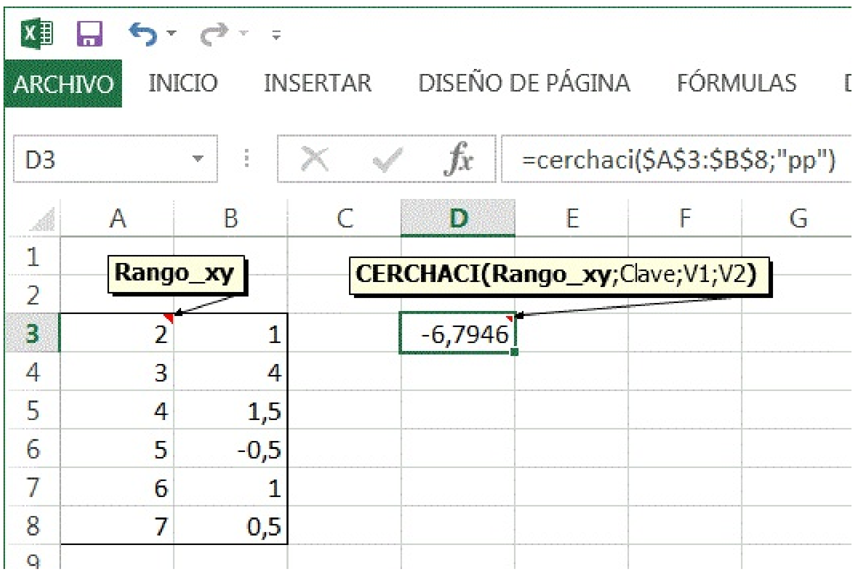
CERCHACI ____

CERCHACI(Range_xy ; "Keys" ; V1;V2)

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

To determine the initial curvature (2nd derivative) at the first point of the first spline.

In the following example, the end-point constraints are "pp", then the first and the last spline will be parabolas



	A	B
3	2	1
4	3	4
5	4	1,5
6	5	-0,5
7	6	1
8	7	0,5

See also: CERCHACF, CERCHAKD, CERCHASD & CERCHAH2D

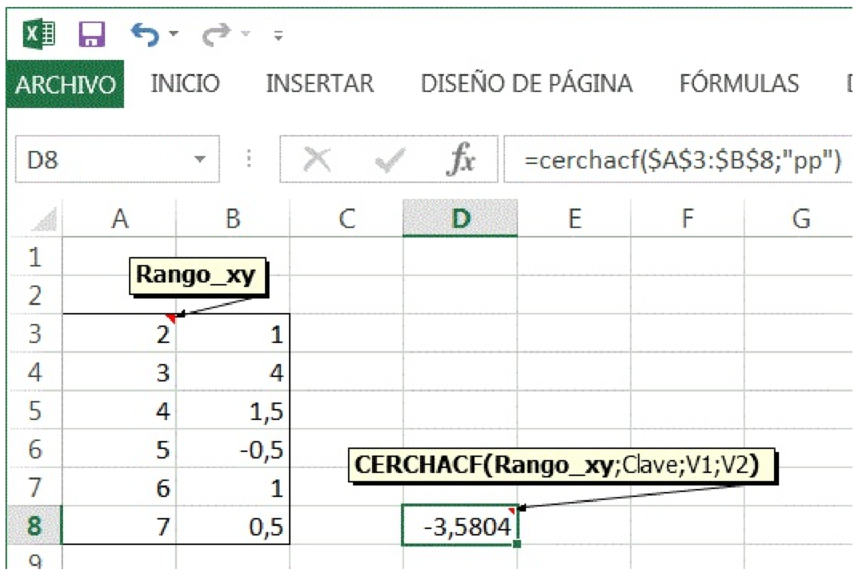
Other functions

CERCHACF

CERCHACF(Range_xy ; "Keys" ; V1;V2)

Required arguments: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

In order to determine the final curvature (2nd derivative) at the last point of the last spline.



	A	B
3	2	1
4	3	4
5	4	1,5
6	5	-0,5
7	6	1
8	7	0,5

See CERCHACI, CERCHAKCO, CERCHASCO & CERCHAHCO.

Other functions

CERCHARA ____

CERCHARA(Range_xy ; "Keys" ; V1;V2)

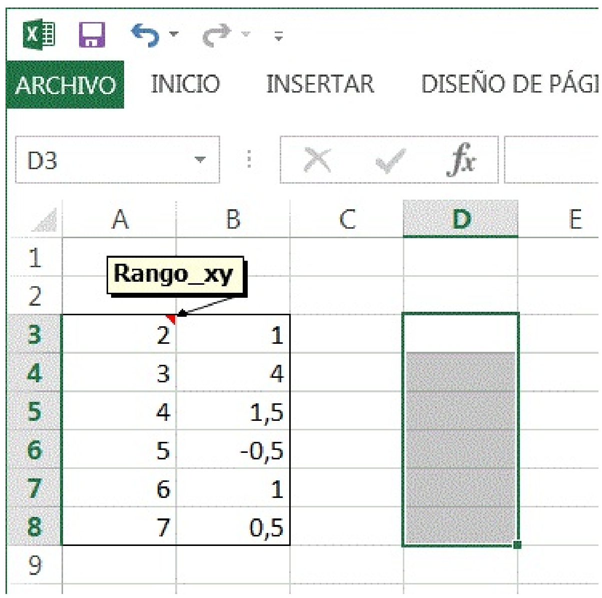
____

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

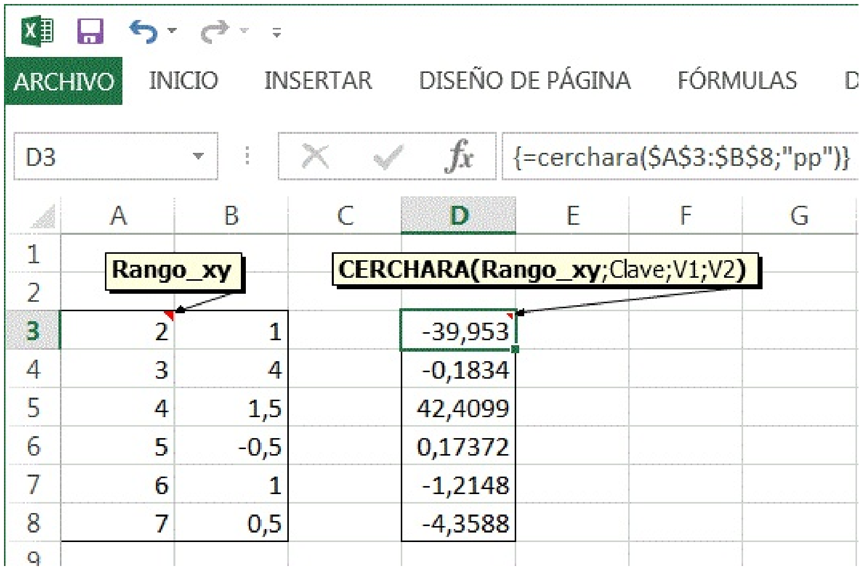
To determine the radius of curvature of the segments in the given points.

It is a matrix function, reason why a range should be selected before the formula is introduced, where the curvature radius will be showed. The range to select must have 1 column and an equal number of rows that the number of radii needed.

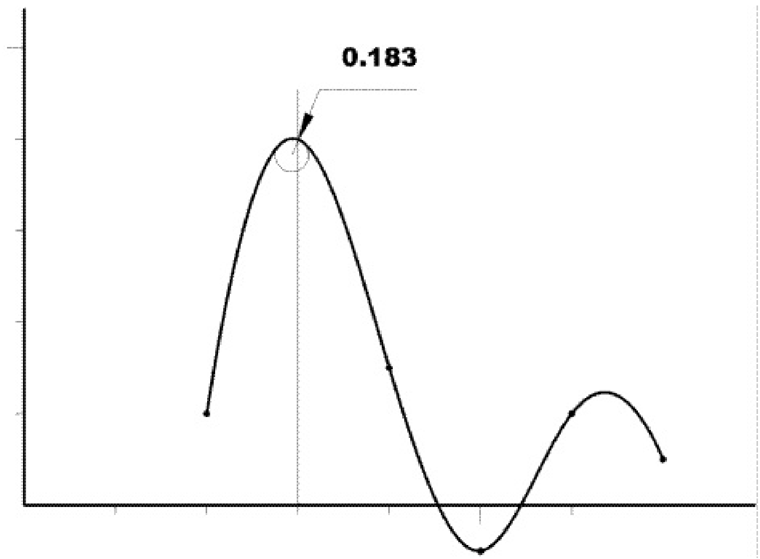
Example: First select a range of 1 column and several rows:



Once the arguments are introduced, with the assistant of functions press:
Ctrl + Shift + Enter and….



In the following figure it is the radius of curvature at the second point



See CERCHARAXY to know the coordinates of the centers of curvature.

Other functions

CERCHARAXY ___

CERCHARAXY(Range_xy ; "Keys" ; V1;V2)

Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

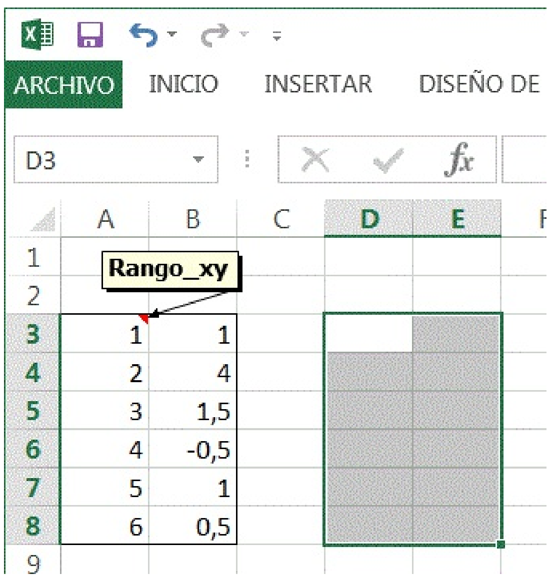
Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**

Important: the positions and the separators must be respected ("; " or "," according to configuration Excel or Windows).

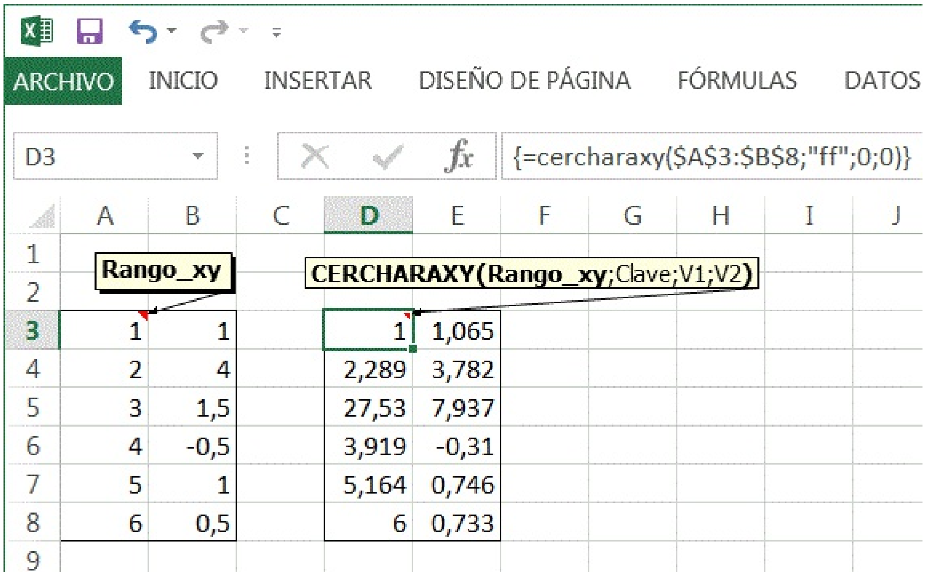
To determine the coordinates of the centers of curvature of the segment, in the given points. It is a **matrix function**.

A range of same size that **Range_xy** is selected:



Is a matrix function, reason why once introduced the arguments with the assistant of functions it is pressed

Ctrl + Shift + Enter and….



See CERCHARA to know the radius of curvature of the segments in the given points.

Other functions

CERCHACU ____

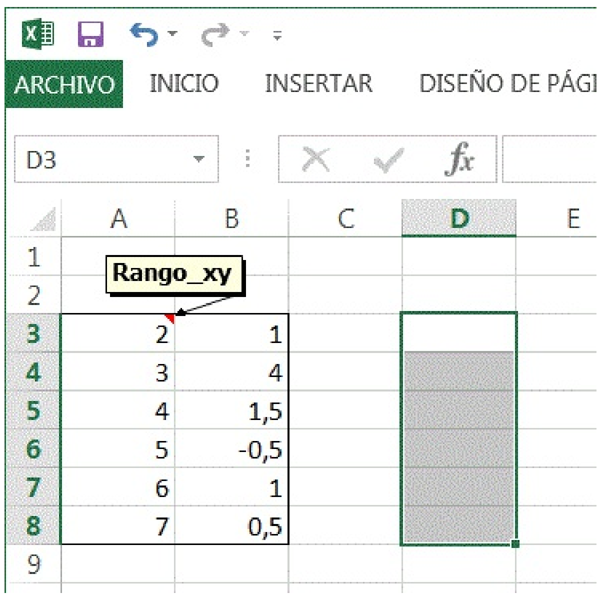
CERCHACU(Range_xy ; "Keys" ; V1;V2)

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

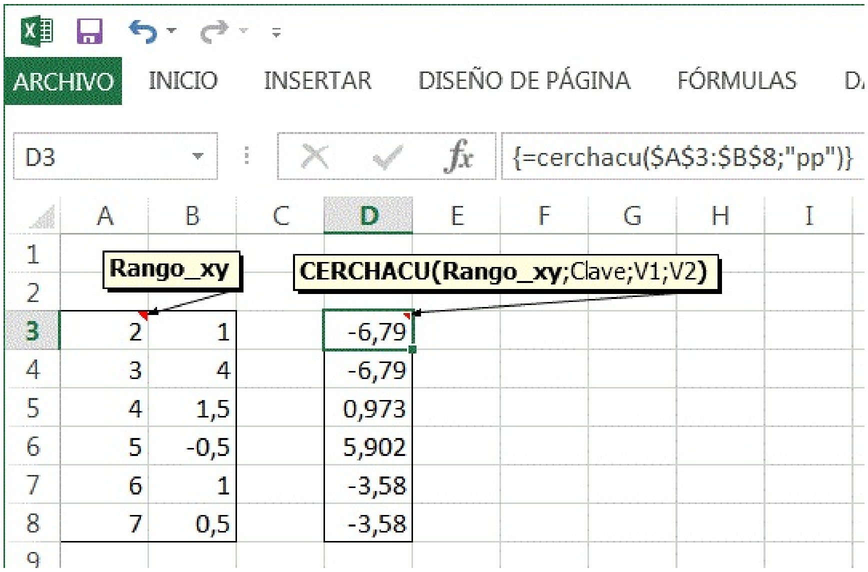
To determine second derivative at the given points.

It is a **matrix function**. It is necessary to select a range of a column and several rows as the results expected, counted from the first point. The values (given points) must be sorted in ascending.

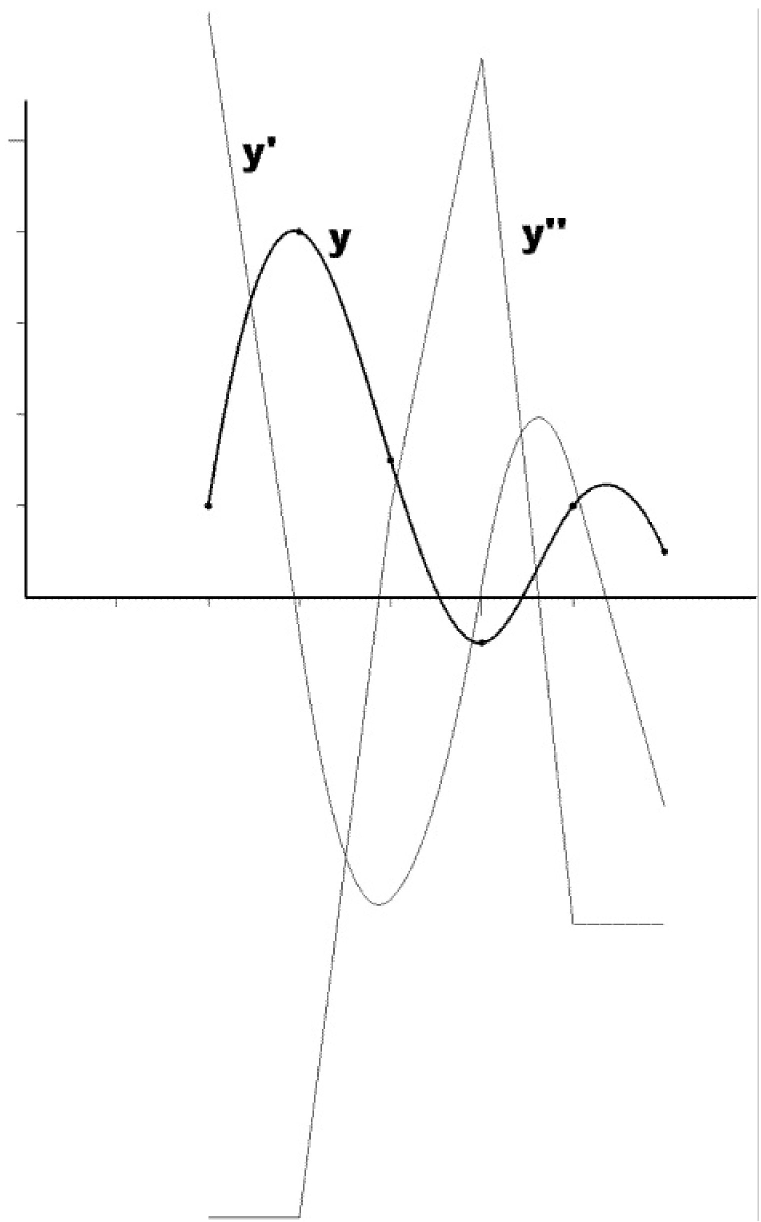
Example of use:



Pressing **Ctrl + Shift + Enter**



Representation of values



y

is the interpolated function , **y'** is the representation of first derivative in all points of the function, and **y''** is the representation of 2nd derivative. Parabolic completions have been used, which mean, that the first and last spline are parabolas (2nd degree equations) reason why 2nd derivative in those sections are constants. In the rest of sections, 2nd derivative is a first degree equation.

See also: CERCHAKD, CERCHASD, CERCHASH2D

Other functions

CERCHACUR

CERCHACUR(Range_xy ; "Keys" ; V1;V2)

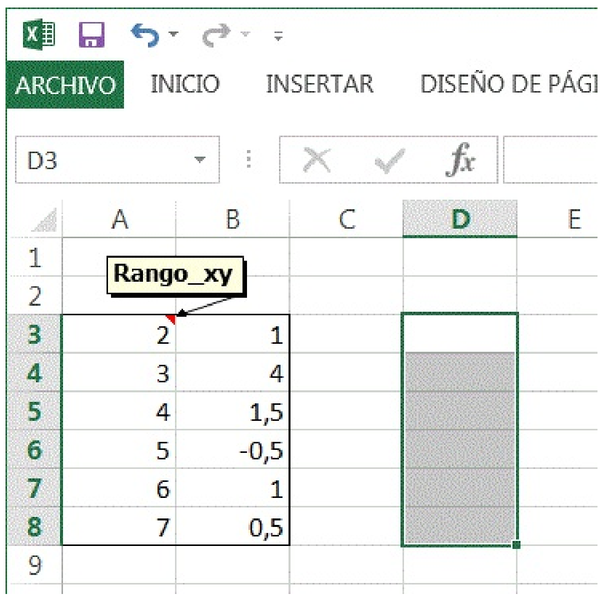
Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

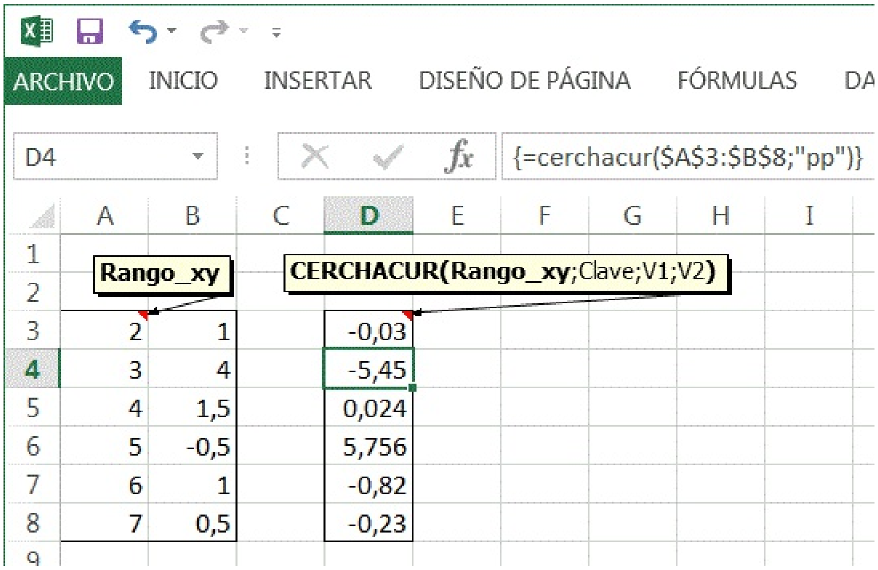
To determine the curvatures (inverse of the curvature radius) of the segments in the given (well-known) points. For 2nd derivative see function cerchacu CERCHACU

It is a **matrix function**, reason why a range should be selected before the introduction of the formula, where the curvature radius will be showed. The range to select must have 1 column and the equal number of rows to number of radii needed.

Example of use:



Once the arguments are introduced with the assistant of functions, press:
Ctrl + Shift + Enter and….



See also: CERCHACU

Other functions

CERCHAREA

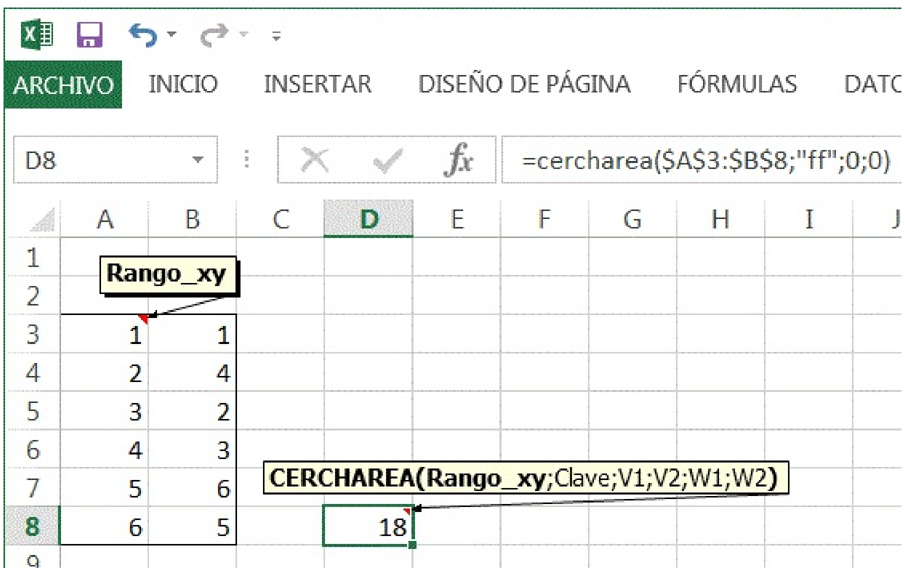
CERCHAREA(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

Required argument: **Range_xy**
Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**
Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

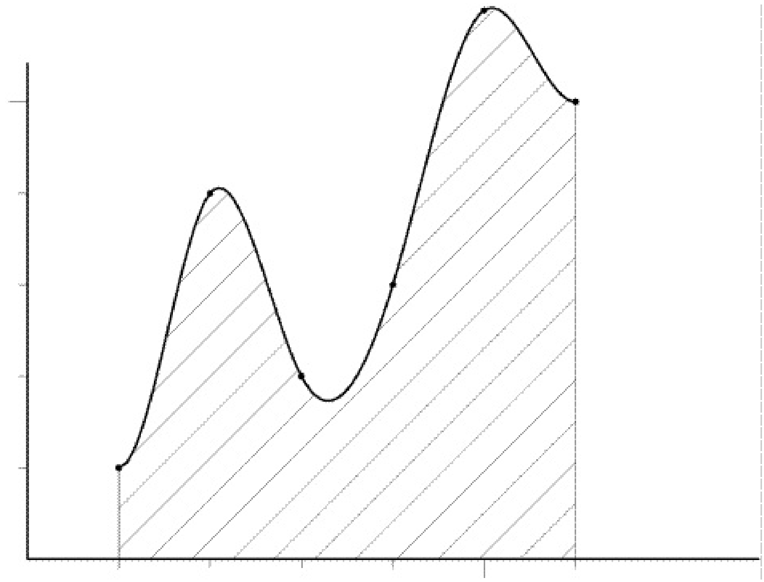
This function serves to obtain the area under the splines until the axis of the Xs, from the point (**W1**) to the point (**W2**). In case of lack of **W1** and **W2** , **W1** will be equal to the first value of **X** in the selected range, and **W2** the last value of the selected range.

It is necessary to consider that if the splines cut the axis of the Xs, zones of areas with negative value will be generated.

Example of use of function CERCHAREA

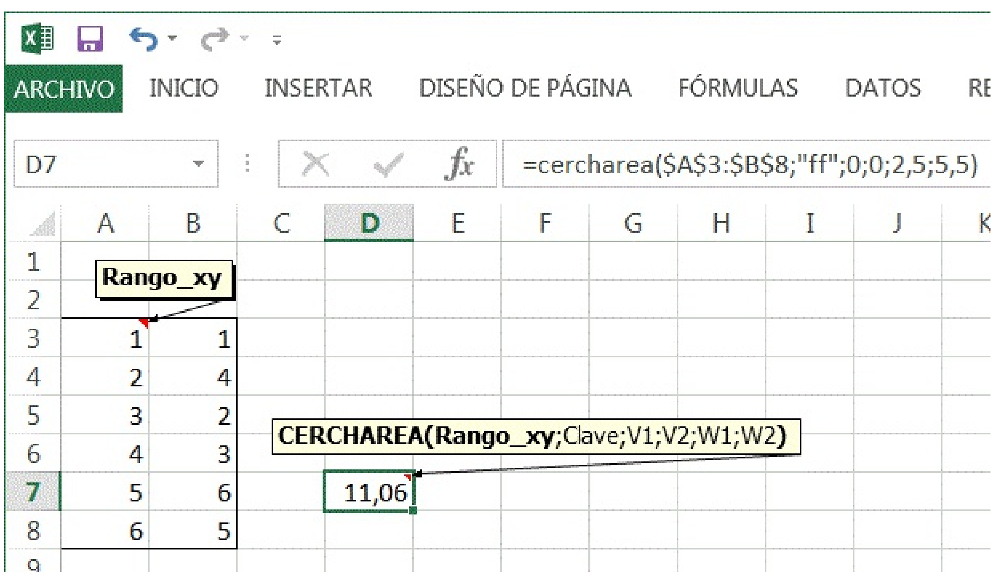


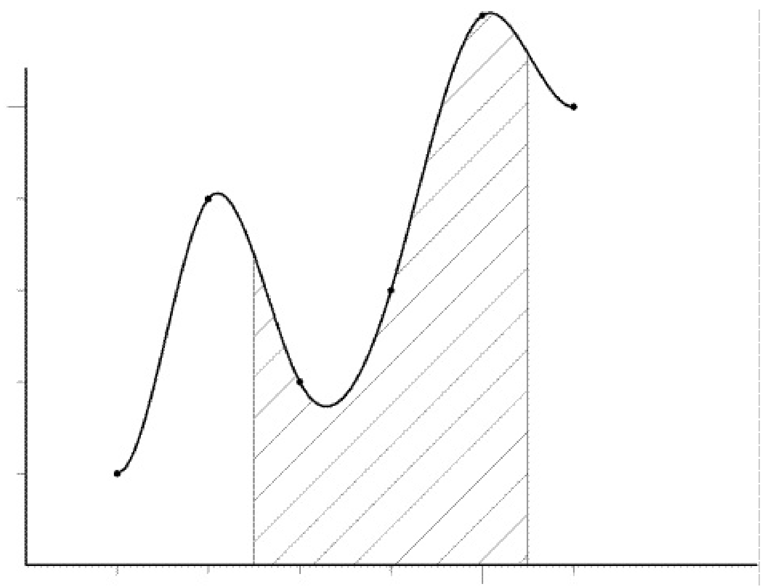
That corresponds with the hatched area in the next picture.



Both zeros of the formula are the slopes at the origin of the first spline and at the end of the last spline. The parameters **ab** have been left in blank, but two points can be defined, so the area begins and finishes in them. For example:

For the formula: CERCHAREA(A3:B8;"ff";0;0;2,5;5,5)



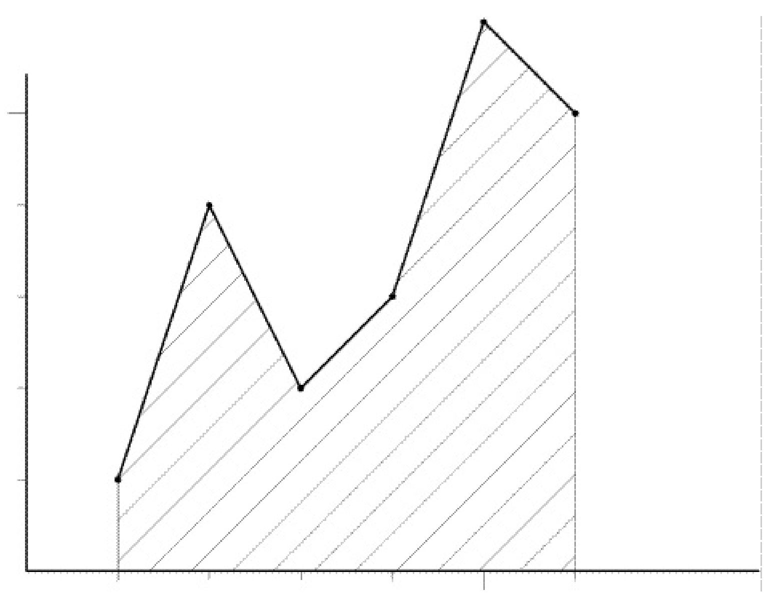


Extrapolation values could have been typed, but an appropriate type of end-point constraint (at one or at two ends) should be selected in that case. For extrapolation: "ee" keys are the better way.

If values for **ab** are not indicated, it's understood that they will be the first and the last one of the points of Range_xy.

Example of the calculation of the area linking such points with straight lines:

CERCHAREA(A3:B8;"pg")



Peculiarly, the result is the same that in CERCHAREA(A3:B8;"ff";0;0)

See also: CERCHAKIN, CERCHASIN & CERCHAHIN

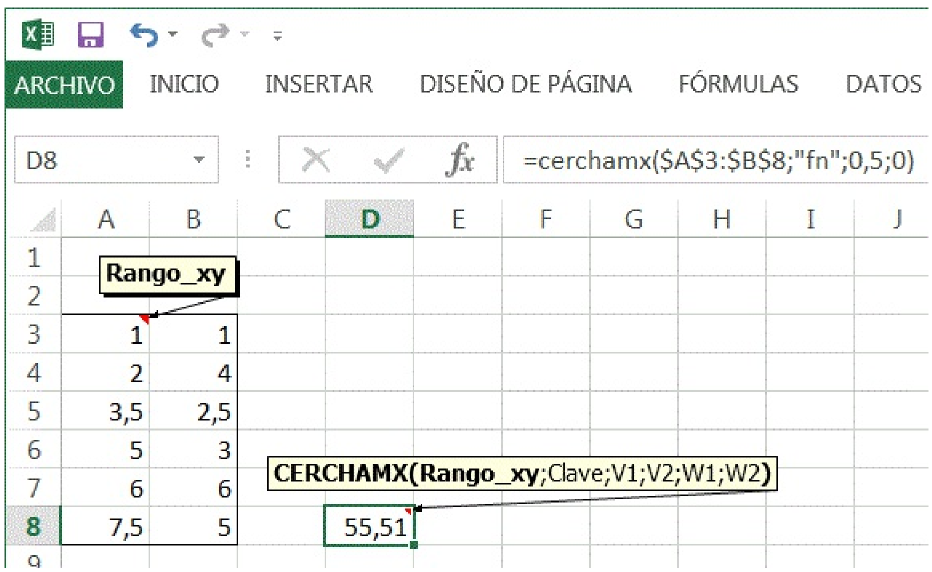
Other functions

CERCHAMX ___

CERCHAMX(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).
Required arguments: Range_xy
Optional arguments: "Keys";V1;V2;W1;W2

This function serves to calculate the static moment of the area under the spline with respect to the axis of the Xs.



See also: CERCHAMY

Other functions

CERCHAMY ____

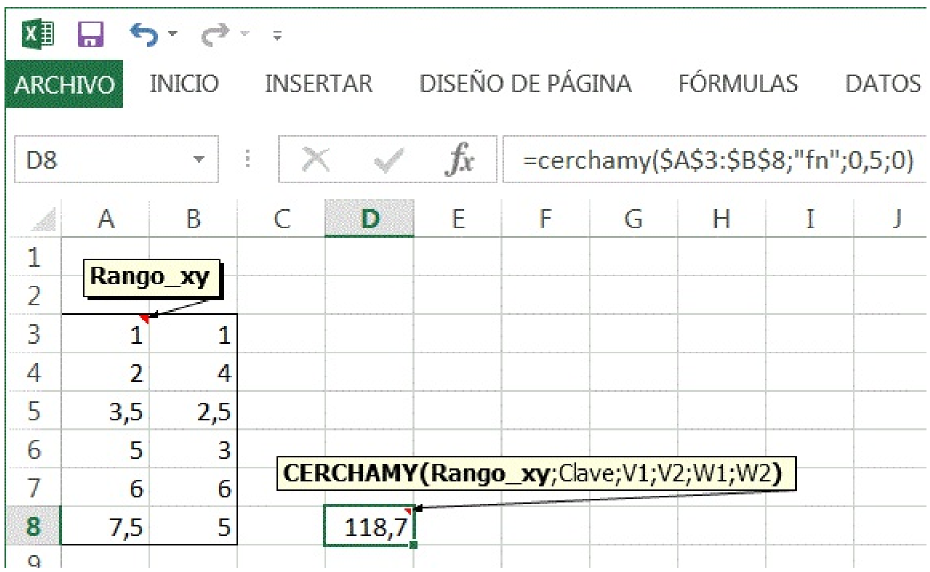
CERCHAMY(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the static moment of the area under the spline with respect to the axis of Y.



See also: CERCHAMX

Other functions

CERCHAM2X

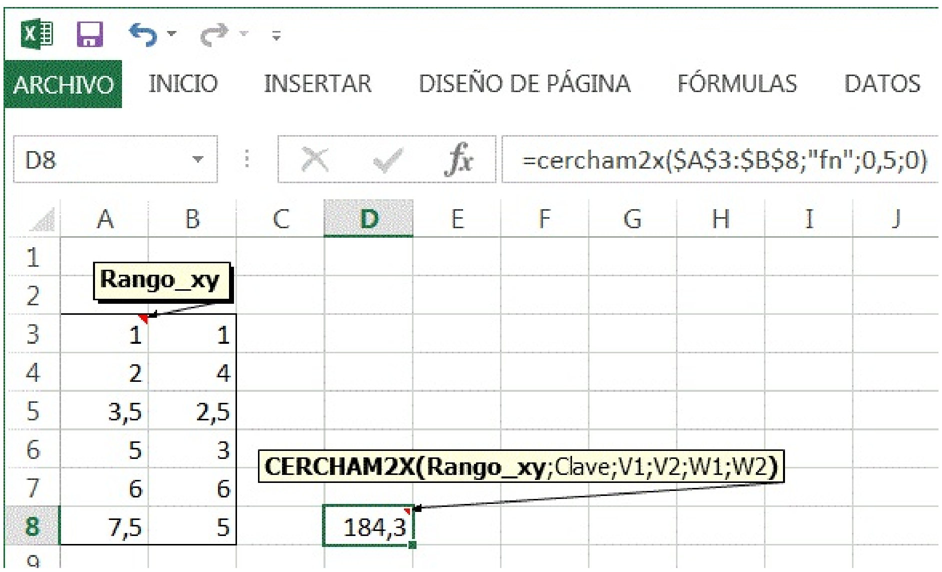
CERCHAM2X(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the second moment (inertia) of the area under the spline with respect to the axis of the Xs.



See also: CERCHAM2Y

Other functions

CERCHAM2Y ____

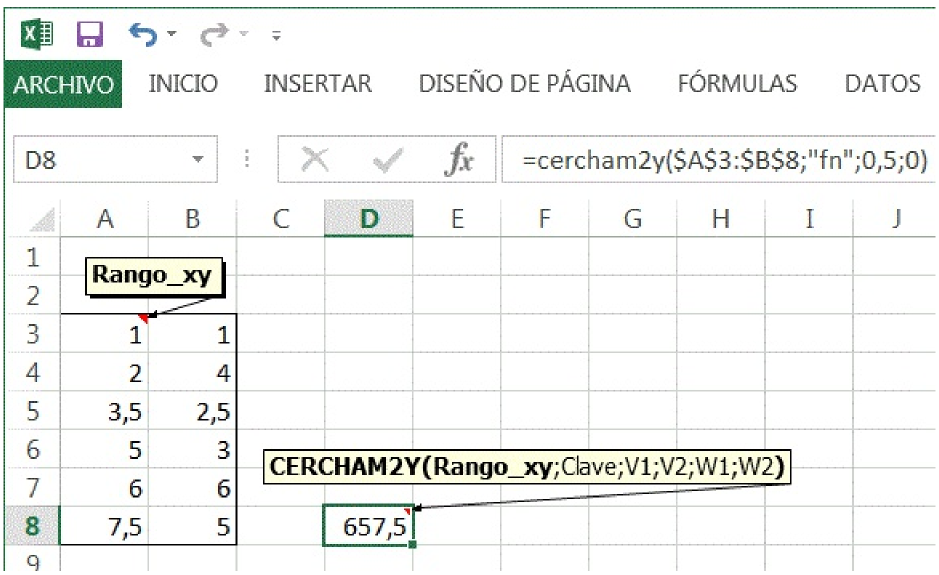
CERCHAM2Y(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the second moment (inertia) of the area under the spline with respect to the axis of Ys.



See also: CERCHAM2X

Other functions

CERCHAP2 ____

CERCHAP2(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

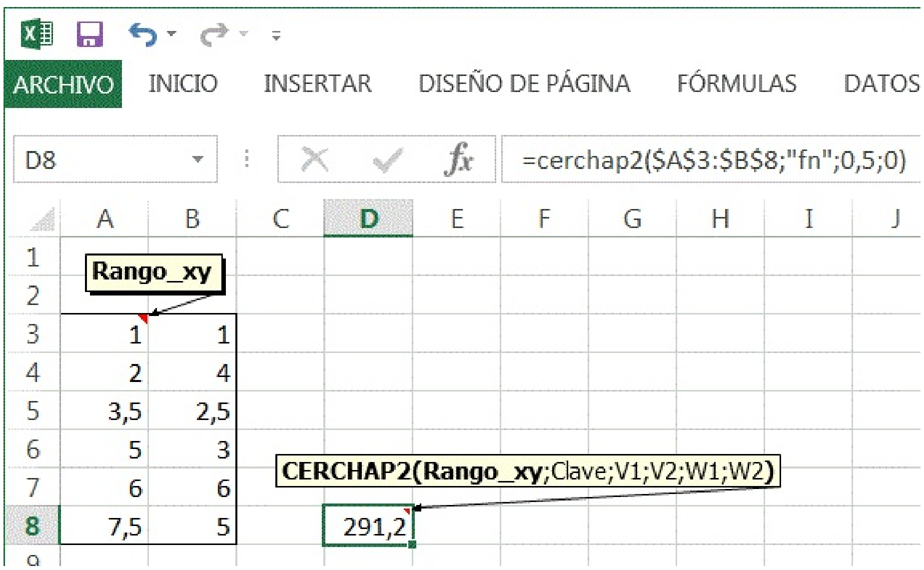
____

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the product of inertia of the area under the spline with respect to the axis of the Xs and of Ys.



See also: CERCHAM2X & CERCHAM2Y

Other functions

CERCHAXG ____

CERCHAXG(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

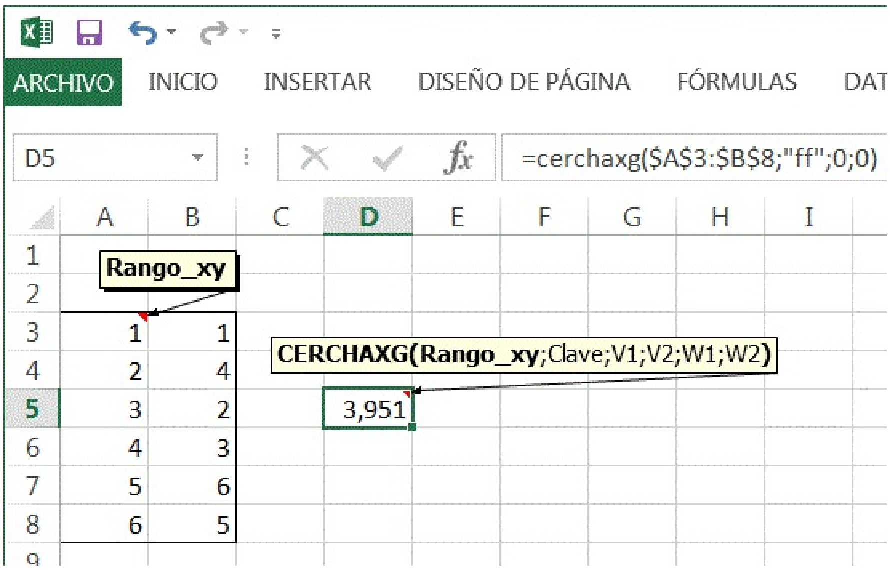
____

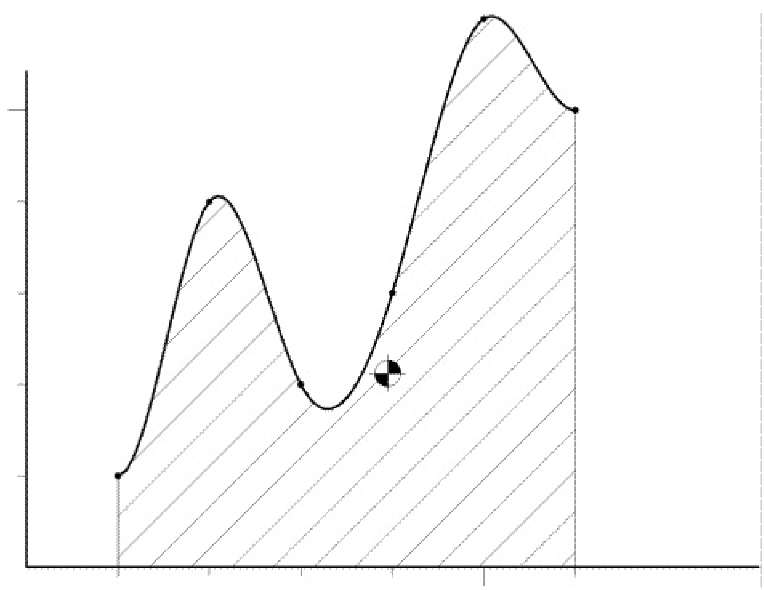
Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the longitudinal coordinate of the gravity center of the area formed under the spline.





See also: CERCHAYG

Other functions

CERCHAYG ____

CERCHAYG(Range_xy ; "Keys" ; V1;V2 ; W1;W2)

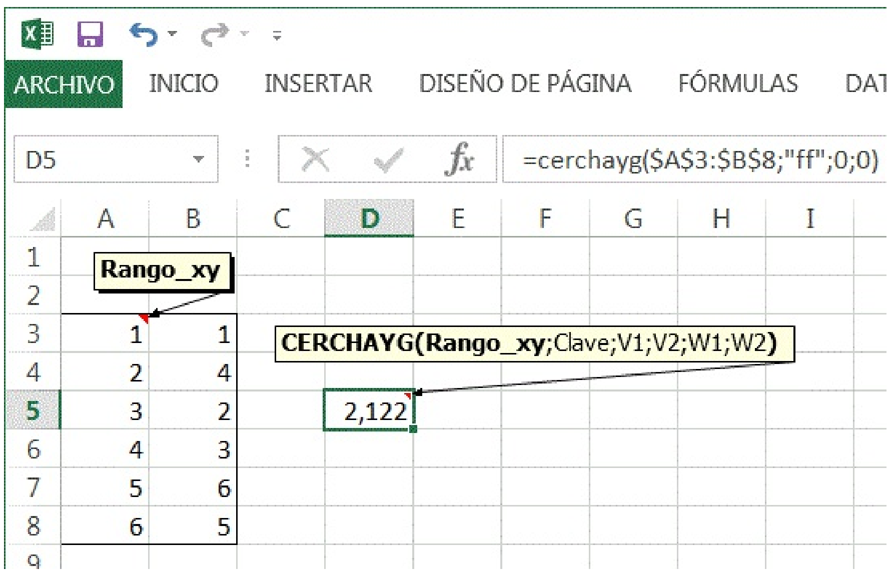
____

Important: the positions and the separators must be respected ("; " or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**

This function serves to calculate the vertical coordinate of the gravity center of the area formed under the spline.



	A	B
3	1	1
4	2	4
5	3	2
6	4	3
7	5	6
8	6	5

See also: CERCHAXG

Other functions

CERCHALON

CERCHALON(Range_xy ; "Keys" ; V1;V2 ; W1;W2 ; Prec)

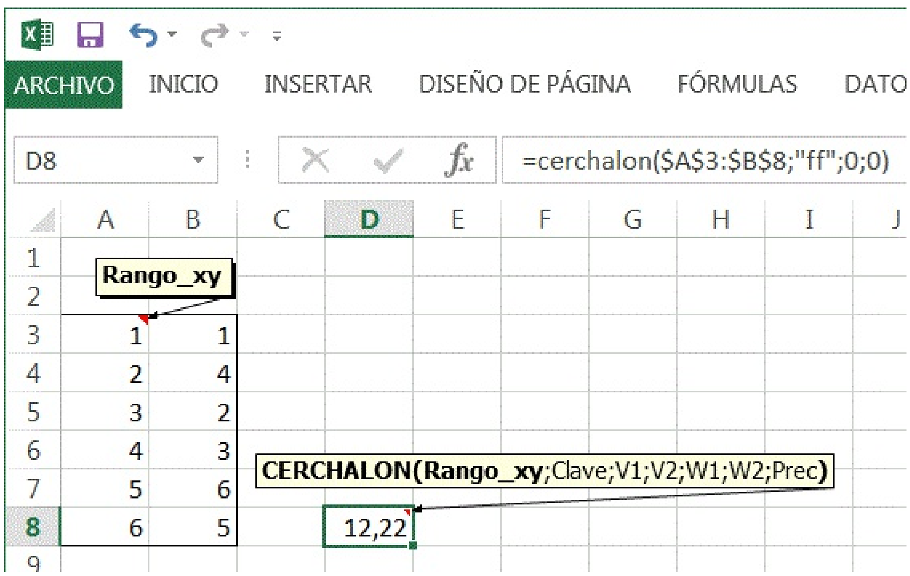
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Required argument: **Range_xy**

Optional arguments: "**Keys**";**V1**;**V2**;**W1**;**W2**;**Prec**

This function serves to calculate the length of the chord of the splines. It could result in a very slow function depending on whether the assistant of formulas of Excel is used, instead of directly introducing the formula in the bar of formulas.

Example of use of formula CERCHALON:



Other functions

CERCHAS

CERCHAS(X ; Range_xy ; Frontiz ; Viz ; Frontde ; Vde)

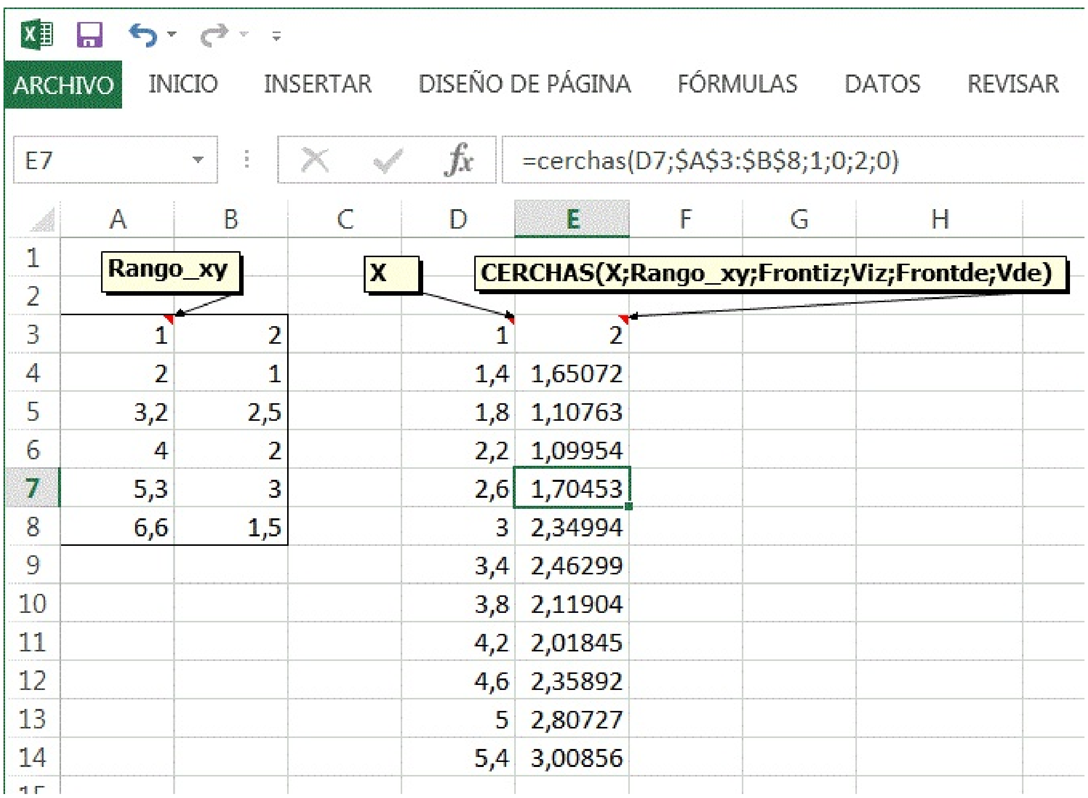
Required arguments: **X; Range_xy ; Frontiz ; Viz ; Frontde ; Vde**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Function to interpolate and extrapolate in cubic splines with end constraints but in a different way than with function Cercha. End constraints can generate periodic, parabolic, clamped (forced) and natural splines. To obtain extrapolated (Not-a-Knot) spline, function CERCHA must be used.

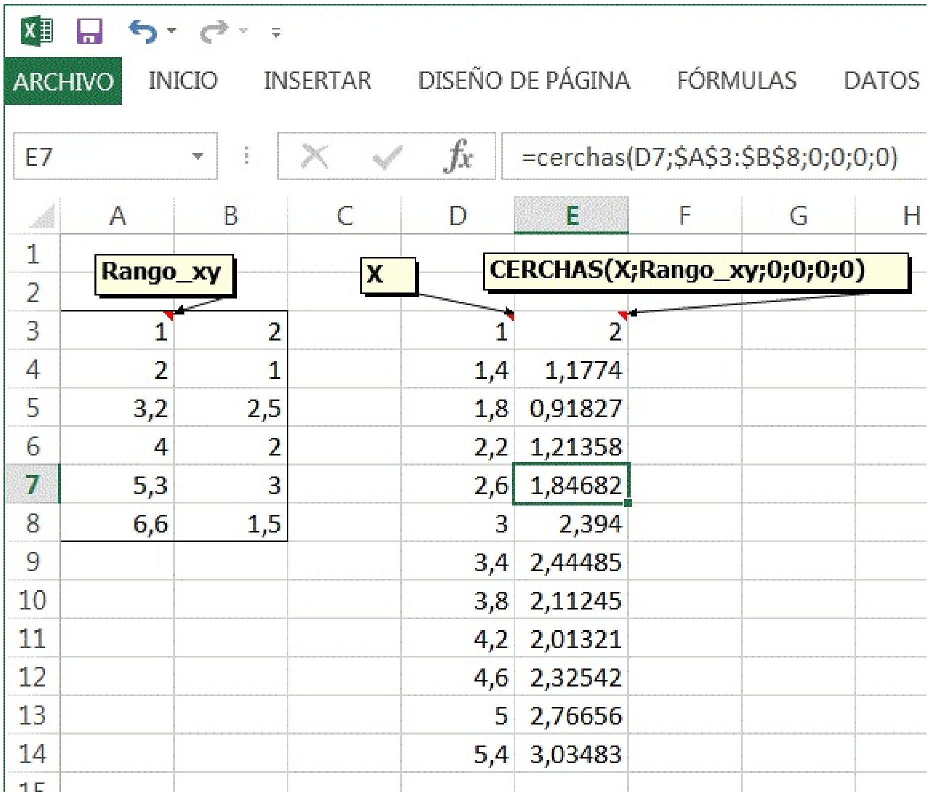
No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHAS:



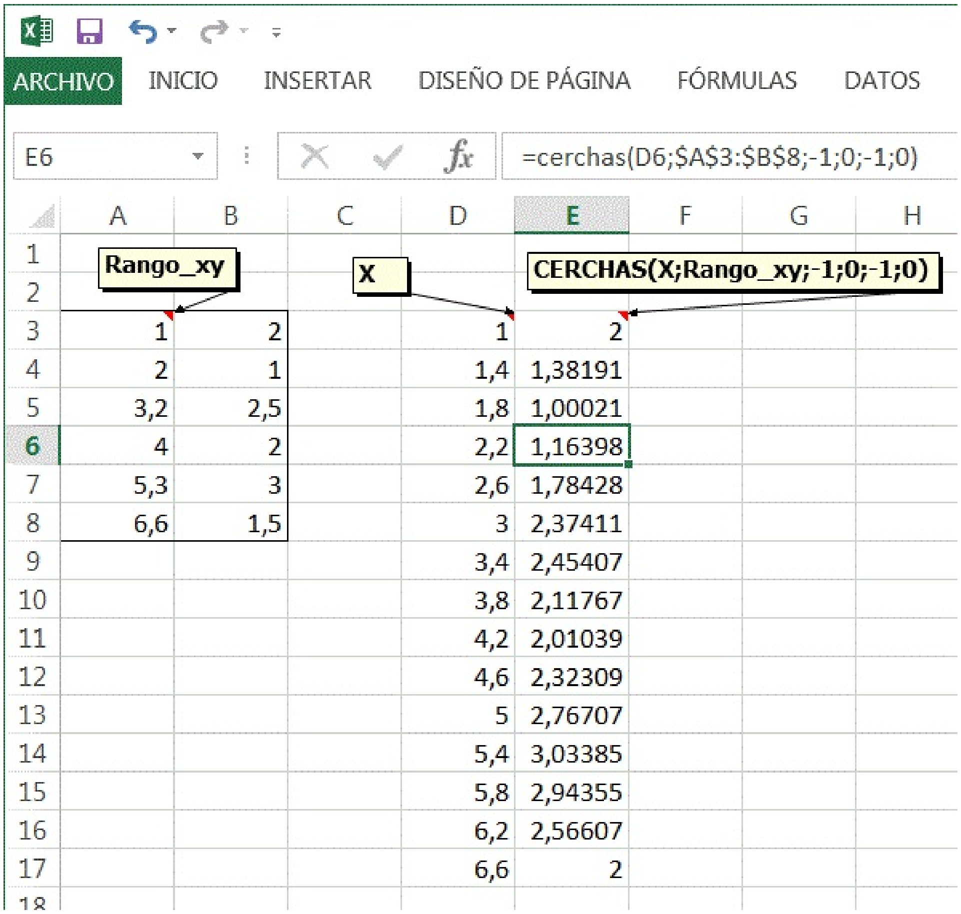
Introduced formula can be seen in the formula bar. In this case a clamped constraint at first point an natural at the last one have been determined. Clamped with 0 slope (horizontal). Natural indicates that the curvature at the end equals 0 (straight line).

Another example (parabolic spline):



	A	B	C	D	E
3	1	2		1	2
4	2	1		1,4	1,1774
5	3,2	2,5		1,8	0,91827
6	4	2		2,2	1,21358
7	5,3	3		2,6	1,84682
8	6,6	1,5		3	2,394
9				3,4	2,44485
10				3,8	2,11245
11				4,2	2,01321
12				4,6	2,32542
13				5	2,76656
14				5,4	3,03483

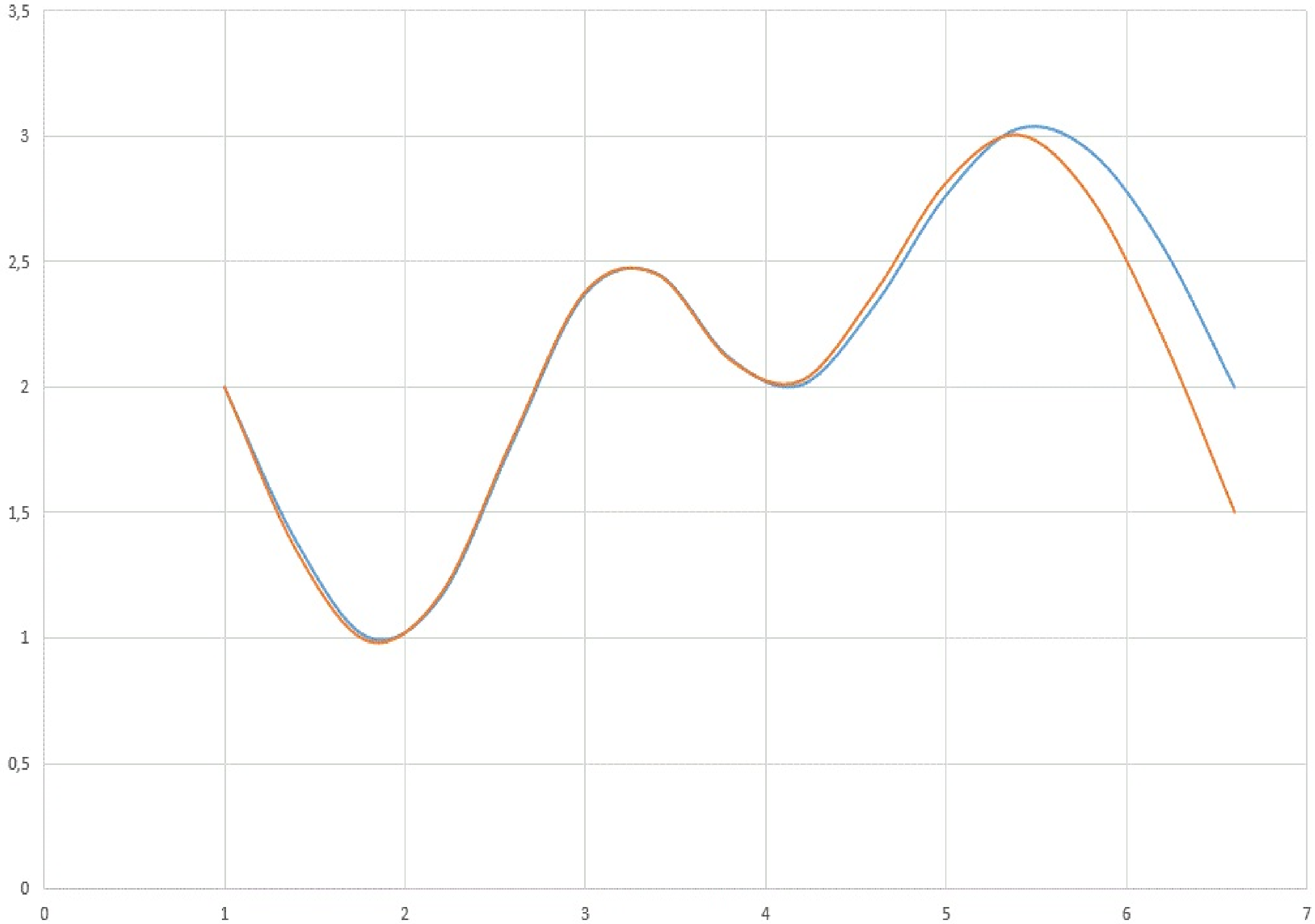
Periodic spline:



	A	B	C	D	E
1					
2					
3	1	2		1	2
4	2	1		1,4	1,38191
5	3,2	2,5		1,8	1,00021
6	4	2		2,2	1,16398
7	5,3	3		2,6	1,78428
8	6,6	1,5		3	2,37411
9				3,4	2,45407
10				3,8	2,11767
11				4,2	2,01039
12				4,6	2,32309
13				5	2,76707
14				5,4	3,03385
15				5,8	2,94355
16				6,2	2,56607
17				6,6	2

It is very important notice that in this type of spline (periodic) the last value of **Y** in **Range_xy** is changed to be equal to the first one. If you do not want this behavior you have to use function CERCHA with keys XX as end constraints.

Next picture shows the differences between this two functions when periodic type is demanded. Blue spline is the one from CERCHAS and red one is from CERCHA.



See also: CERCHA, CERCHAH y CERCHAK

Other functions

CERCHASCO ____

CERCHASCO(Range_xy ; Frontiz ; Viz ; Frontde ; Vde ; Orig)

____

Required arguments: **Range_xy ; Frontiz ; Viz ; Frontde ; Vde**

Optional argument: **Orig**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

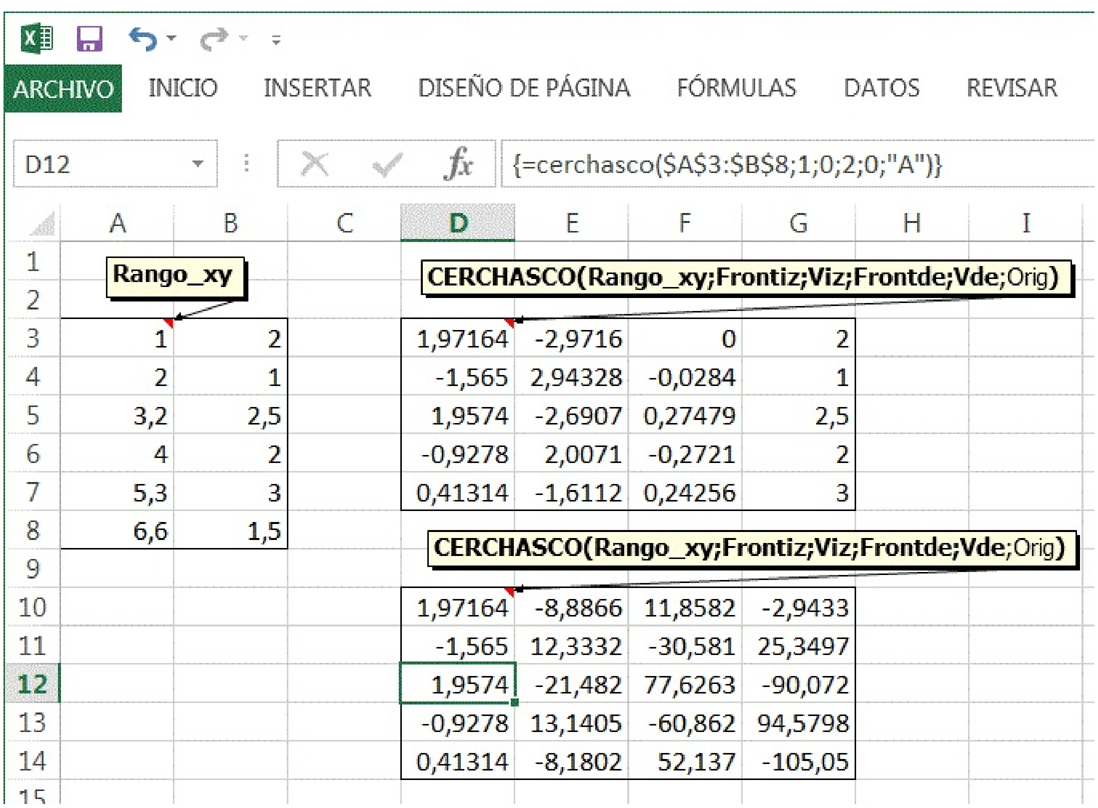
This is a matrix function and then, once the data has been introduced in the Function Wizard or in the formula bar, key sequence: **Ctrl+Shift+Enter** must be pressed. With this function spline polynomial coefficients are obtained.

It is a **matrix function**. That is why **Ctrl+Shift+Enter** must be pressed after typing the formula. With this function spline coefficients are obtained.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHASCO:

Initially, a range of 4 columns and of a number of rows equal to the number of rows in **Range_xy** minus one has to be selected. Then, pressing**: Ctrl+Shift+Enter**, hence:



	A	B	C	D	E	F	G
3	1	2		1,97164	-2,9716	0	2
4	2	1		-1,565	2,94328	-0,0284	1
5	3,2	2,5		1,9574	-2,6907	0,27479	2,5
6	4	2		-0,9278	2,0071	-0,2721	2
7	5,3	3		0,41314	-1,6112	0,24256	3
8	6,6	1,5					
10				1,97164	-8,8866	11,8582	-2,9433
11				-1,565	12,3332	-30,581	25,3497
12				1,9574	-21,482	77,6263	-90,072
13				-0,9278	13,1405	-60,862	94,5798
14				0,41314	-8,1802	52,137	-105,05

In the above picture the first group of results does not have the optional argument **Orig** then, the resulting polynomials are referred to their ordinate (Y value). The last group of coefficients are referred to coordinate origin, point (0,0) because letter A has been introduced in the formula. **Orig** is a letter (a or A) so that, it is necessary to quoted this letter but only in the case of use of the formula bar. If Function Wizard is been used the quoted is automatically typed but in the formula bar (near the symbol fx) it is necessary to quote the letter.

The first polynomial is: For x >= 1 and x <= 2

y (x) = 1,9716 (x - 1)^3 - 2,9716 (x - 1)^2 + 0 (x - 1) + 2

Or:

y(x) = 1,9716 x^3 - 8,8866 x^2 + 11,8582 x - 2,9433

See also: CERCHAS, CERCHAKCO, CERCHAHCO, CERCHAC y CERCHACOEF.

Other functions

CERCHASD

CERCHASD(X; Range_xy ; Frontiz ; Viz ; Frontde ; Vde ; Nd)

Required arguments: **X ; Range_xy ; Frontiz ; Viz ; Frontde ; Vde**

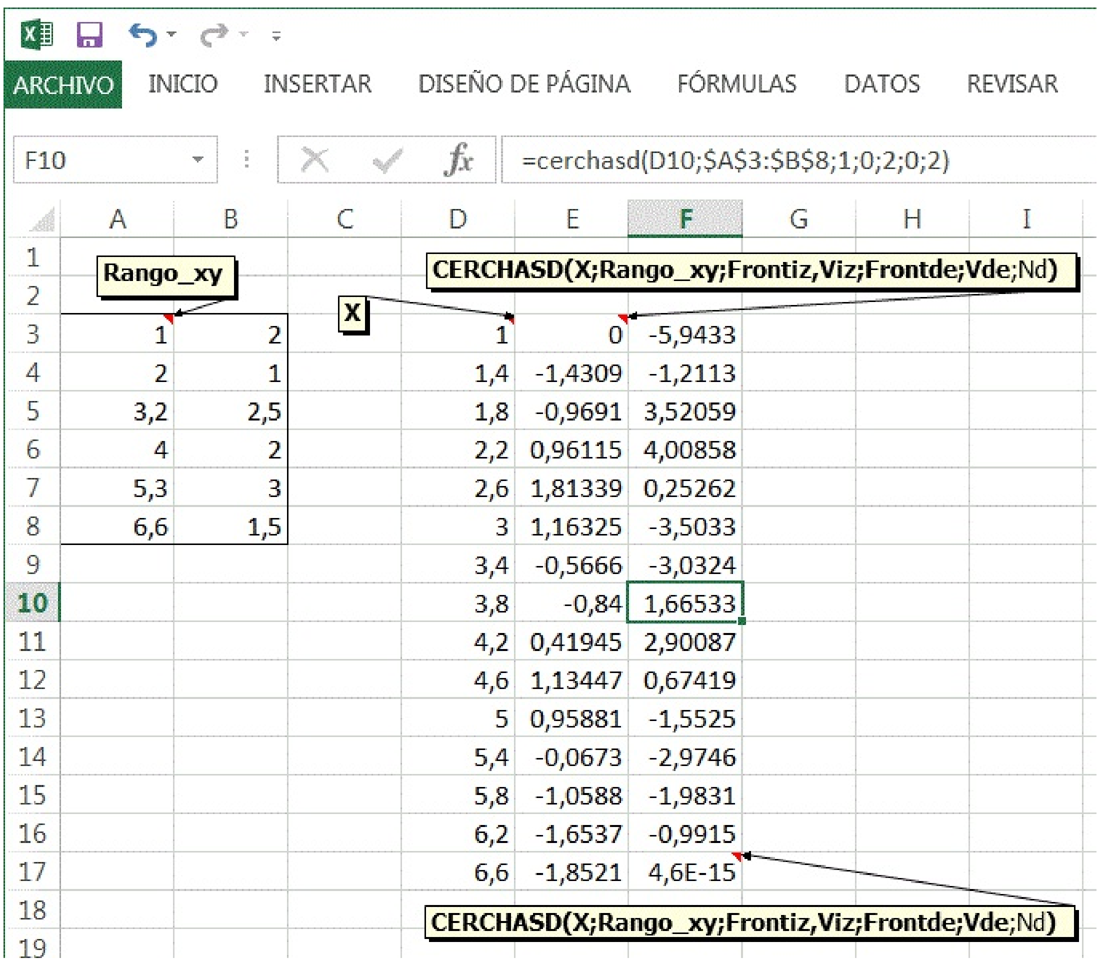
Optional argument: **Nd**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

Function to obtain the value of first or second derivative of the spline at X value. In order to get second derivative an optional argument **Nd** has to be entered and its value has to be 2. If **Nd** is different than 2 first derivative will be obtained.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHASD to obtain first derivative (1st column after X values) and second derivative (last column):



	A	B	C	D	E	F
3	1	2		1	0	-5,9433
4	2	1		1,4	-1,4309	-1,2113
5	3,2	2,5		1,8	-0,9691	3,52059
6	4	2		2,2	0,96115	4,00858
7	5,3	3		2,6	1,81339	0,25262
8	6,6	1,5		3	1,16325	-3,5033
9				3,4	-0,5666	-3,0324
10				3,8	-0,84	1,66533
11				4,2	0,41945	2,90087
12				4,6	1,13447	0,67419
13				5	0,95881	-1,5525
14				5,4	-0,0673	-2,9746
15				5,8	-1,0588	-1,9831
16				6,2	-1,6537	-0,9915
17				6,6	-1,8521	4,6E-15

See also: CERCHAP, CERCHAPI, CERCHAPF, CERCHACI, CERCHACF, CERCHACU,

CERCHAS, CERCHAKD y CERCHAH2D.

Other functions

CERCHASIN ____

CERCHASIN(X ; Range_xy ; Frontiz ; Viz ; Frontde ; Vde)

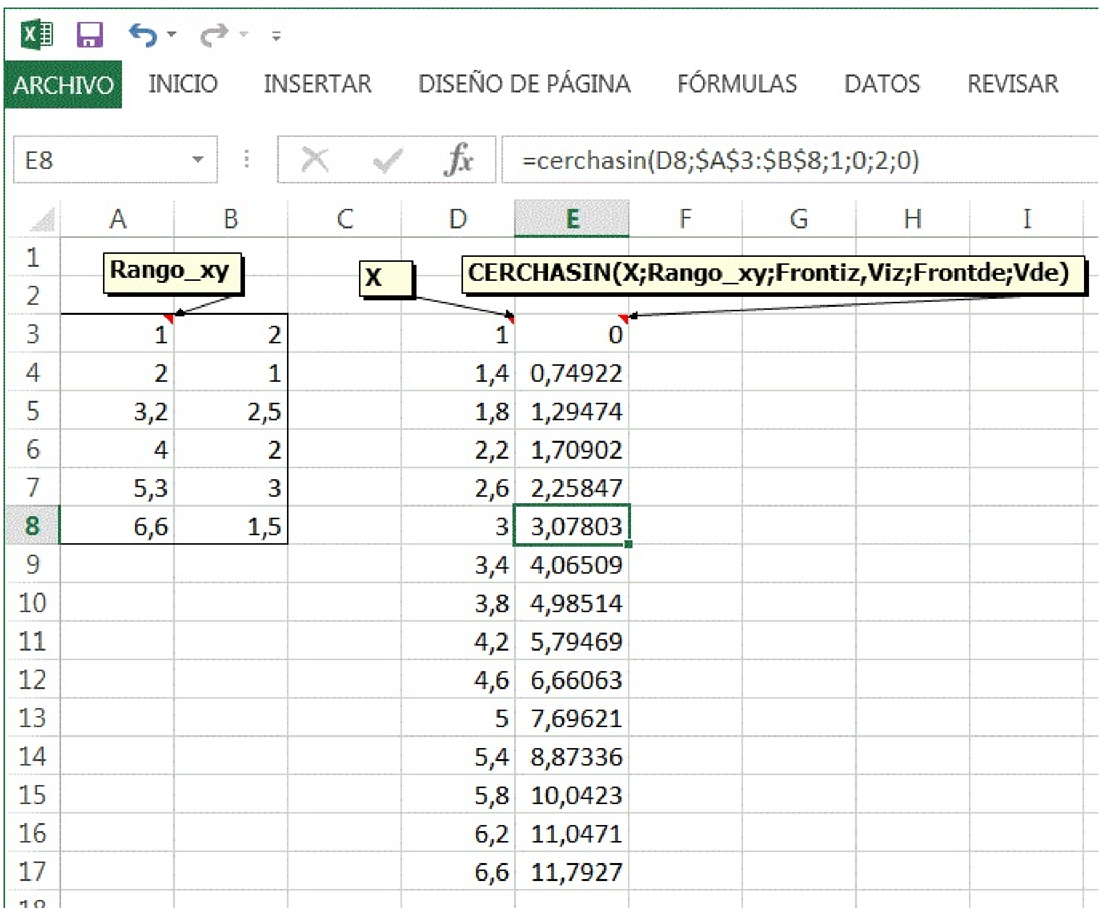
Required arguments: **X; Range_xy ; Frontiz ; Viz ; Frontde ; Vde**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function calculates the area under the spline from the first ordinate in **Range_xy** up to the last one.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHASIN:



	A	B	C	D	E
3	1	2		1	0
4	2	1		1,4	0,74922
5	3,2	2,5		1,8	1,29474
6	4	2		2,2	1,70902
7	5,3	3		2,6	2,25847
8	6,6	1,5		3	3,07803
9				3,4	4,06509
10				3,8	4,98514
11				4,2	5,79469
12				4,6	6,66063
13				5	7,69621
14				5,4	8,87336
15				5,8	10,0423
16				6,2	11,0471
17				6,6	11,7927

See also: CERCHAREA, CERCHAS, CERCHAKIN Y CERCHAHIN.

Other functions

CERCHAK

CERCHAK(X ; Range_xy)

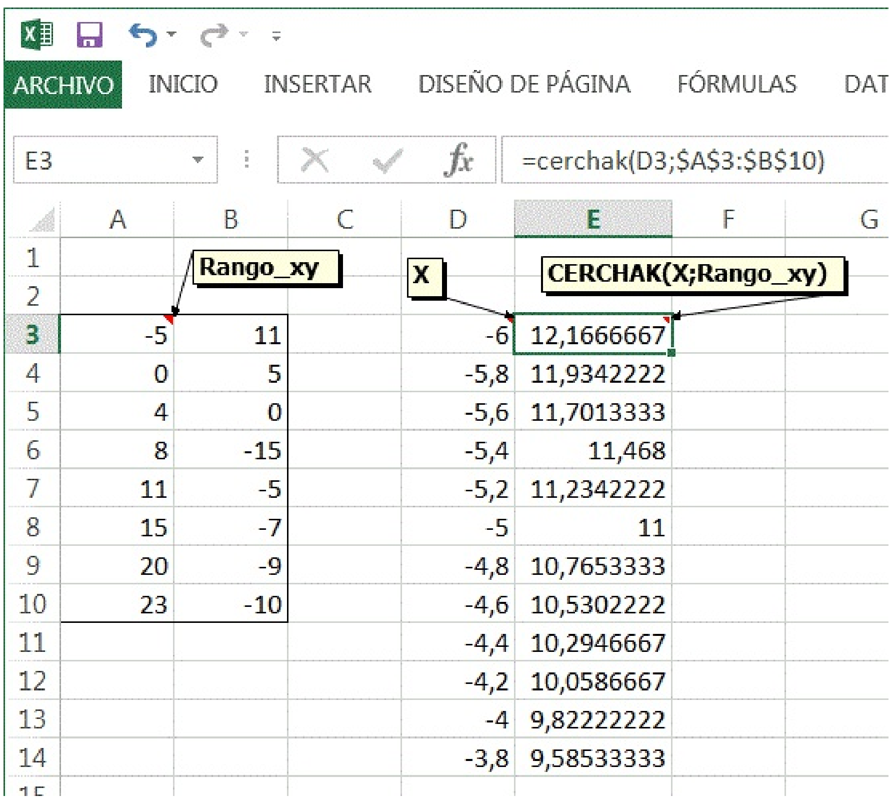
Required arguments: **X**; **Range_xy**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

As other functions in this Add-in, this function serves to interpolate and extrapolate using cubic splines but, with the particularity of Akima type of spline. This type of spline is stable to the outliers. The disadvantage of normal cubic splines is that they could oscillate in the neighborhood of an outlier.

No less than 5 points are required to construct the Akima spline. Data can be sorted in ascending or descending mode.

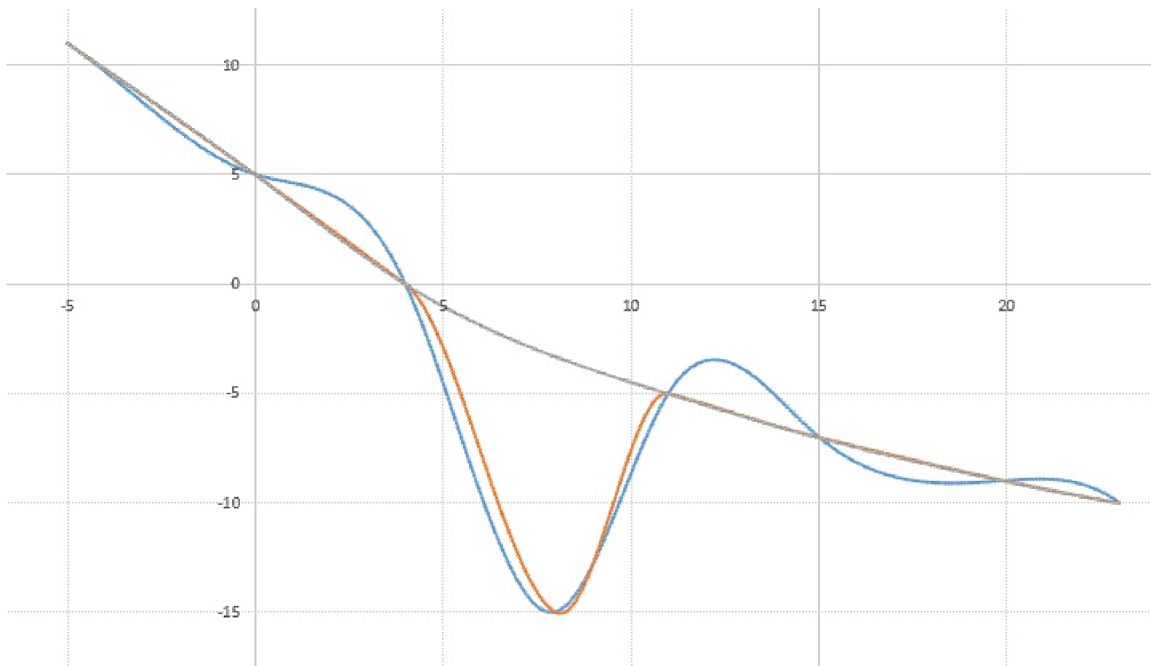
Use of CERCHAK:



	A	B	C	D	E
3	-5	11		-6	12,1666667
4	0	5		-5,8	11,9342222
5	4	0		-5,6	11,7013333
6	8	-15		-5,4	11,468
7	11	-5		-5,2	11,2342222
8	15	-7		-5	11
9	20	-9		-4,8	10,7653333
10	23	-10		-4,6	10,5302222
11				-4,4	10,2946667
12				-4,2	10,0586667
13				-4	9,82222222
14				-3,8	9,58533333

Curve Comparison. In the above picture can be seen several splines. The red one is Akima spline, blue one is a clamped (forced) with same slopes than Akima's at the origin and at the end, and the grey one is the resulting clamped spline if point (8,-15) would not exist.

Can be seen the no oscillation of Akima spline due to the outlier point (8,-15).



See also: CERCHA, CERCHAH y CERCHAS.

Other functions

CERCHAKCO ___

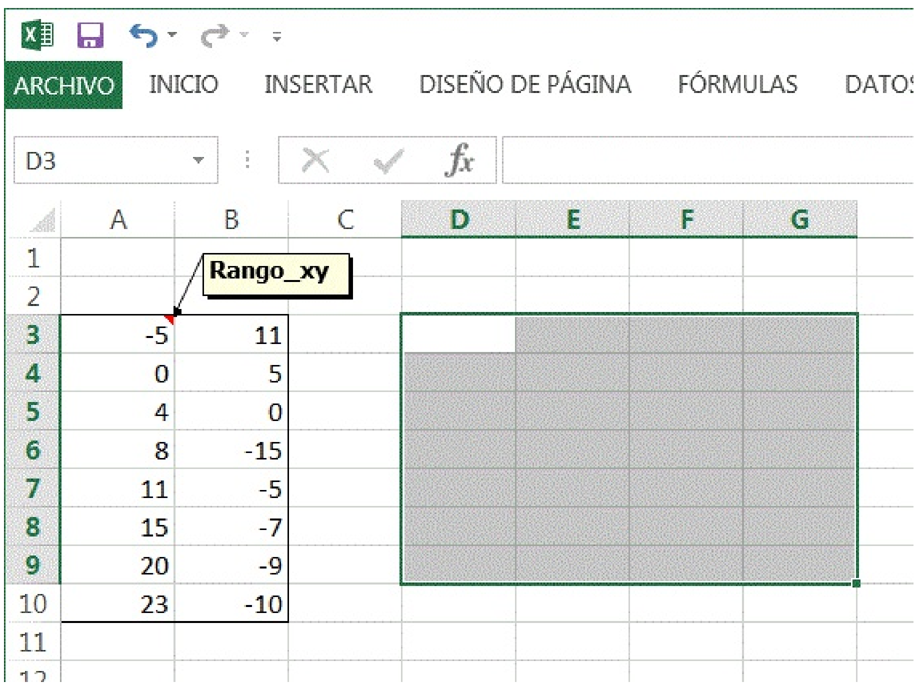
CERCHAKCO(Range_xy ; Orig)

Required argument: **Range_xy**
Optional argument: **Orig**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

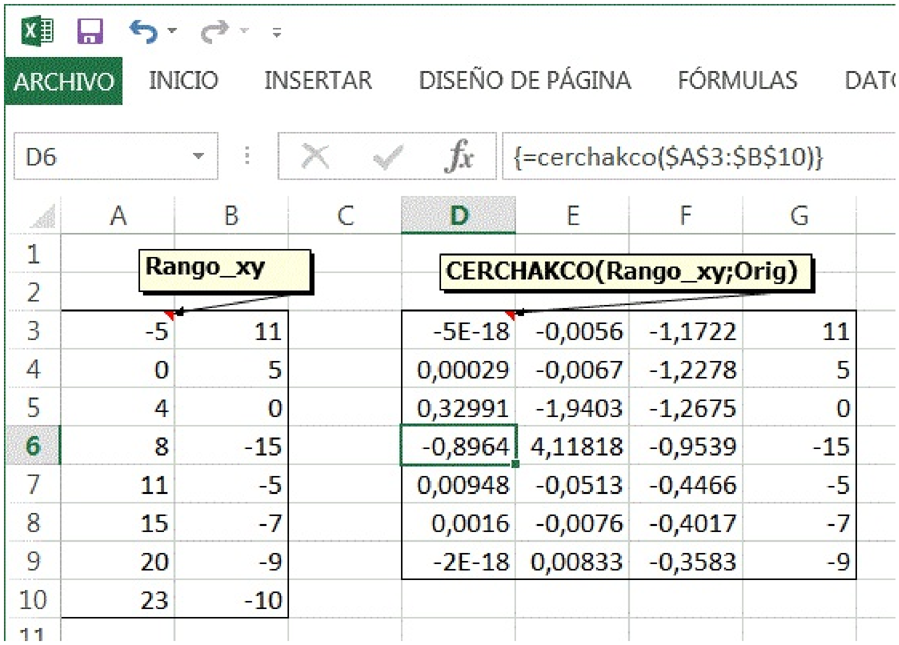
This is a **matrix function** and then, once the data has been introduced in the Function Wizard or in the formula bar, key sequence: **Ctrl+Shift+Enter** must be pressed. With this function Akima spline polynomial coefficients are obtained.

No less than 5 points are required to construct the Akima spline. Data can be sorted in ascending or descending mode.

Use of CERCHAKCO:

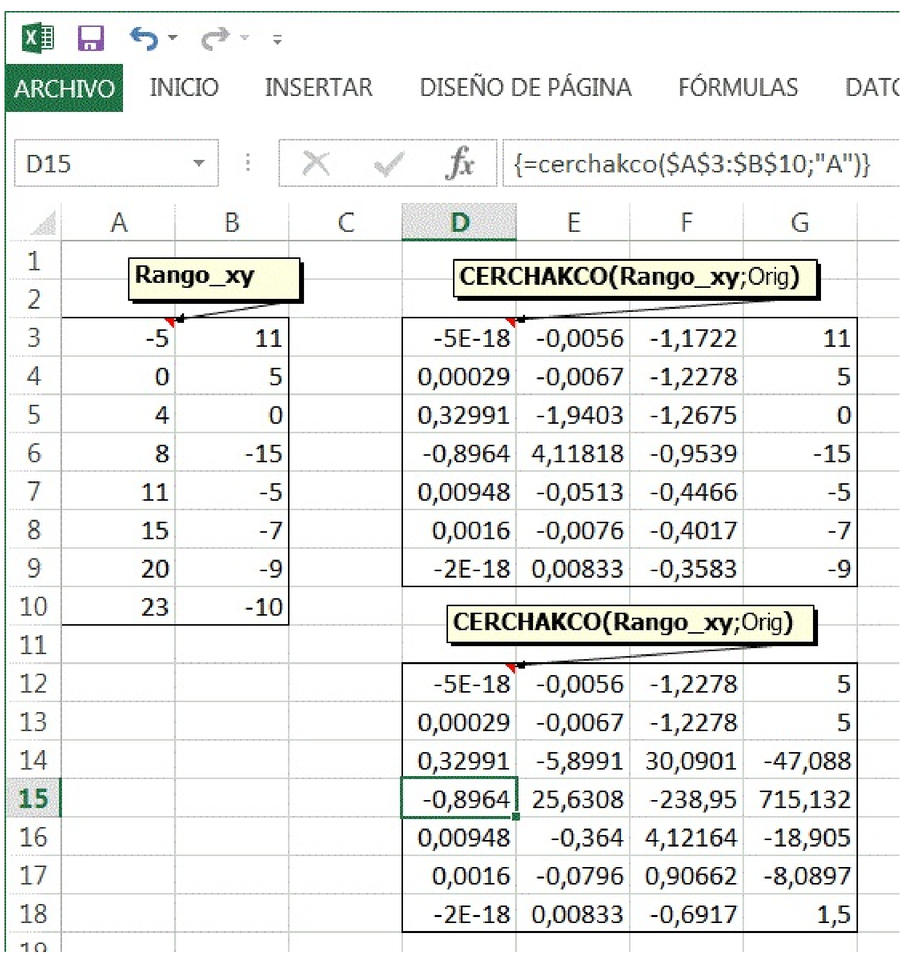


Initially, a range of 4 columns and a of number of rows equal to the number of rows in **Range_xy** minus one has to be selected. Then, pressing**: Ctrl+Shift+Enter**, hence:


D6 {=cerchakco($A$3:$B$10)}

	A	B	C	D	E	F	G
1	Rango_xy			CERCHAKCO(Rango_xy;Orig)			
2							
3	-5	11		-5E-18	-0,0056	-1,1722	11
4	0	5		0,00029	-0,0067	-1,2278	5
5	4	0		0,32991	-1,9403	-1,2675	0
6	8	-15		-0,8964	4,11818	-0,9539	-15
7	11	-5		0,00948	-0,0513	-0,4466	-5
8	15	-7		0,0016	-0,0076	-0,4017	-7
9	20	-9		-2E-18	0,00833	-0,3583	-9
10	23	-10					

If the optional argument **Orig** is introduced, the coefficients will be referred to the coordinate origin as is showed in the lower part of the next figure:


D15 {=cerchakco($A$3:$B$10;"A")}

	A	B	C	D	E	F	G
1	Rango_xy			CERCHAKCO(Rango_xy;Orig)			
2							
3	-5	11		-5E-18	-0,0056	-1,1722	11
4	0	5		0,00029	-0,0067	-1,2278	5
5	4	0		0,32991	-1,9403	-1,2675	0
6	8	-15		-0,8964	4,11818	-0,9539	-15
7	11	-5		0,00948	-0,0513	-0,4466	-5
8	15	-7		0,0016	-0,0076	-0,4017	-7
9	20	-9		-2E-18	0,00833	-0,3583	-9
10	23	-10		CERCHAKCO(Rango_xy;Orig)			
11							
12				-5E-18	-0,0056	-1,2278	5
13				0,00029	-0,0067	-1,2278	5
14				0,32991	-5,8991	30,0901	-47,088
15				-0,8964	25,6308	-238,95	715,132
16				0,00948	-0,364	4,12164	-18,905
17				0,0016	-0,0796	0,90662	-8,0897
18				-2E-18	0,00833	-0,6917	1,5

In the above picture the first group of results does not have the optional argument **Orig** then, the resulting polynomials are referred to their ordinate (Y value). The last group of coefficients are referred to coordinate origin, point (0,0) because letter A has been introduced in the formula. **Orig** is a letter (a or A) so that, it is necessary to quoted this letter but only in the case of use of the formula bar. If Function Wizard is been used the quoted is automatically typed but in the formula bar (near the symbol fx) it is necessary to quote the letter.

The first polynomial is: For x >= -5   and   x <= 0

y (x) = 0 (x - (-5))^3 - 0,0056 (x - (-5))^2 - 1,1722 (x - (-5)) + 11

Or:

y(x) = 0 x^3 - 0,0056 x^2 - 1,2278 x + 5

See also: CERCHAC, CERCHACOEF, CERCHAK, CERCHASCO y CERCHAHCO

Other functions

CERCHAKD ____

CERCHAKD(X ; Range_xy ; Nd)

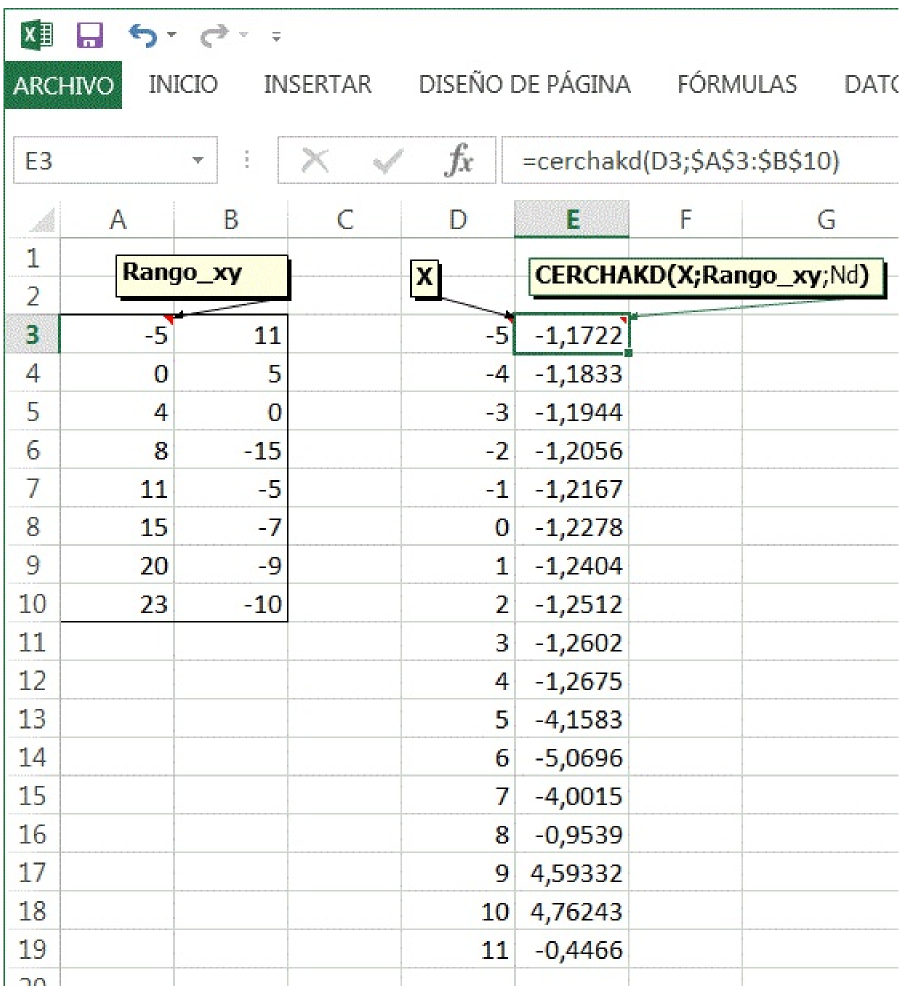
Required arguments: **X**; **Range_xy**
Optional arguments: **Nd**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

With this function the slope or the second derivative of the spline at point X is obtained. To obtain the second derivative number 2 must be introduced en the optional argument Nd.

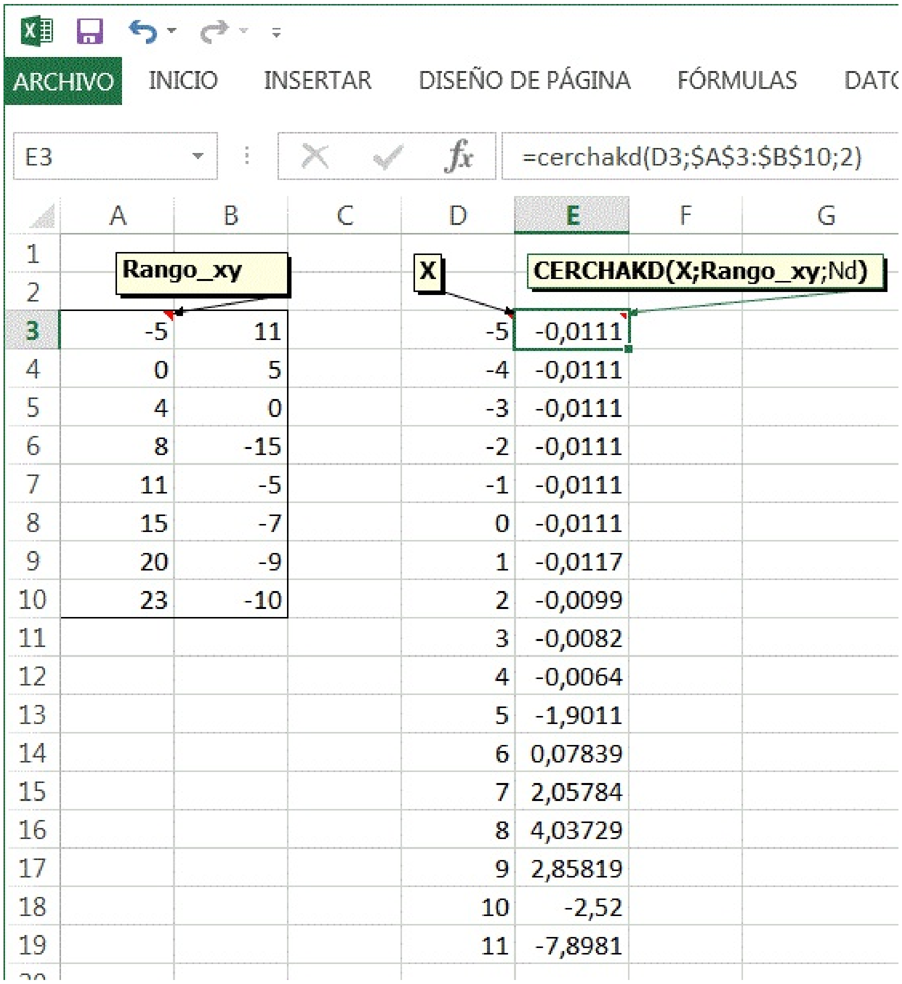
No less than 5 points are required to construct the Akima spline. Data can be sorted in ascending or descending mode.

Use of CERCHAKD to get the slope at **X**:



	A	B	C	D	E
3	-5	11		-5	-1,1722
4	0	5		-4	-1,1833
5	4	0		-3	-1,1944
6	8	-15		-2	-1,2056
7	11	-5		-1	-1,2167
8	15	-7		0	-1,2278
9	20	-9		1	-1,2404
10	23	-10		2	-1,2512
11				3	-1,2602
12				4	-1,2675
13				5	-4,1583
14				6	-5,0696
15				7	-4,0015
16				8	-0,9539
17				9	4,59332
18				10	4,76243
19				11	-0,4466

Use of CERCHAKD to get the second derivative at **X**::



	A	B	C	D	E
3	-5	11		-5	-0,0111
4	0	5		-4	-0,0111
5	4	0		-3	-0,0111
6	8	-15		-2	-0,0111
7	11	-5		-1	-0,0111
8	15	-7		0	-0,0111
9	20	-9		1	-0,0117
10	23	-10		2	-0,0099
11				3	-0,0082
12				4	-0,0064
13				5	-1,9011
14				6	0,07839
15				7	2,05784
16				8	4,03729
17				9	2,85819
18				10	-2,52
19				11	-7,8981

See also: CERCHAP, CERCHAPI, CERCHAPF, CERCHACI, CERCHACF, CERCHACU, CERCHASD y CERCHAH2D

Other functions

CERCHAKIN

CERCHAKIN(X ; Range_xy)

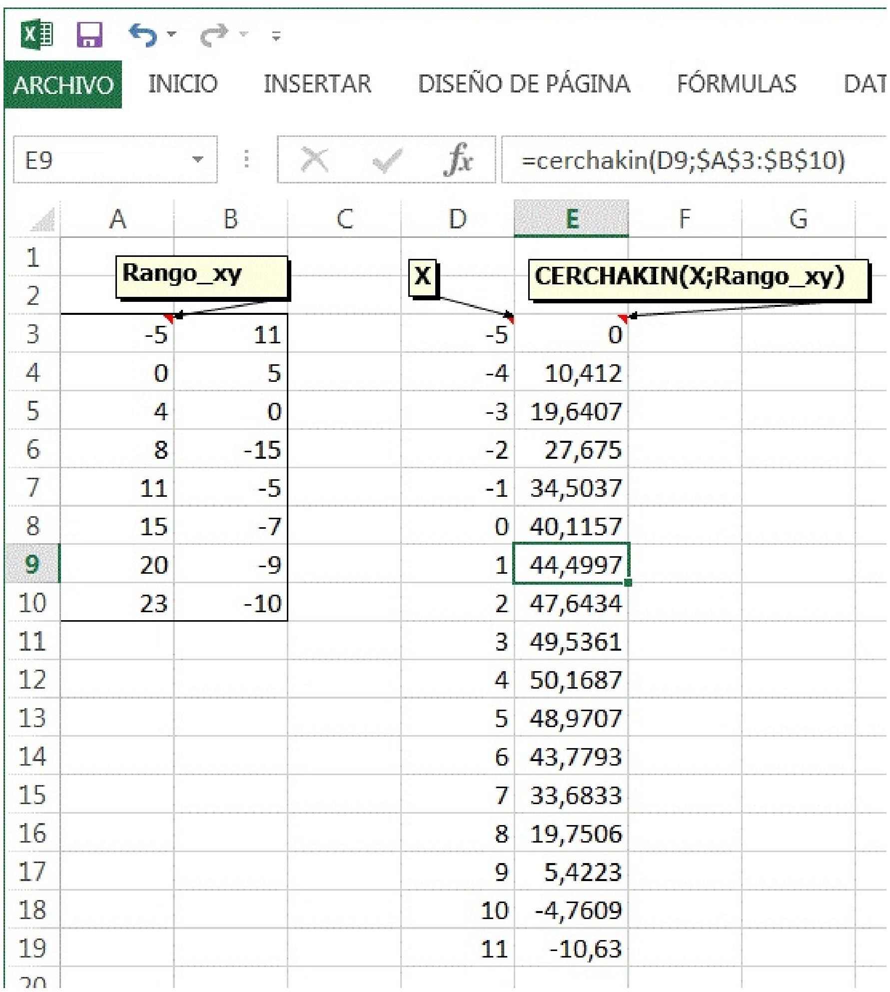
Required arguments: **X**; **Range_xy**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function calculates the area under the Akima spline from the first ordinate in **Range_xy** up to the last one.

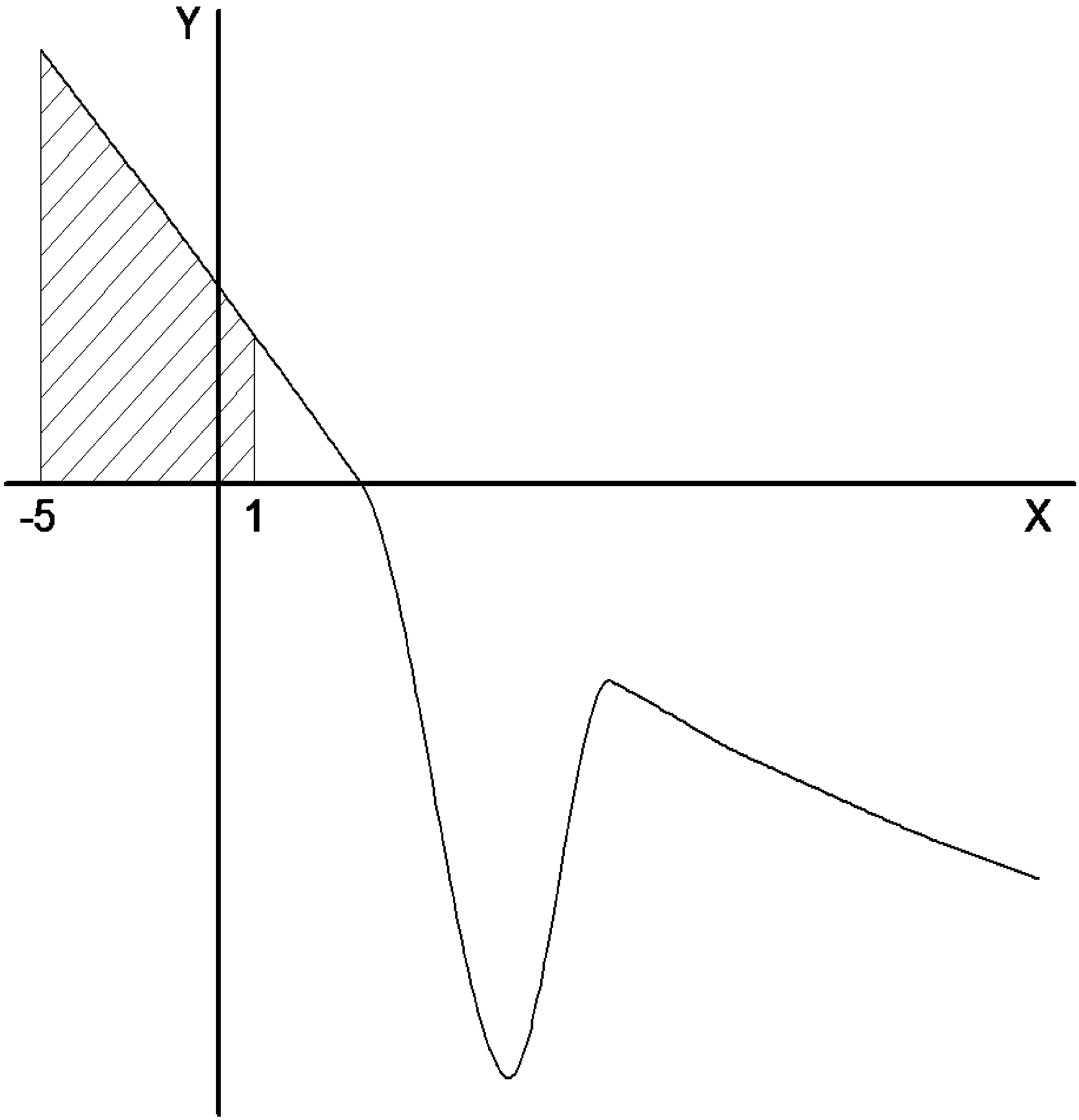
No less than 5 points are required to construct the Akima spline. Data can be sorted in ascending or descending mode.

Use of CERCHAKIN:



	A	B	C	D	E
3	-5	11		-5	0
4	0	5		-4	10,412
5	4	0		-3	19,6407
6	8	-15		-2	27,675
7	11	-5		-1	34,5037
8	15	-7		0	40,1157
9	20	-9		1	44,4997
10	23	-10		2	47,6434
11				3	49,5361
12				4	50,1687
13				5	48,9707
14				6	43,7793
15				7	33,6833
16				8	19,7506
17				9	5,4223
18				10	-4,7609
19				11	-10,63

Next picture indicates the area from the first ordinate up to the value of X = 1, that is to say: from x = -5 to x = 1.



See also: CERCHAREA, CERCHASIN y CERCHAHIN.

Other functions

CERCHAH

CERCHAH(X ; Range_xy ; Deri)

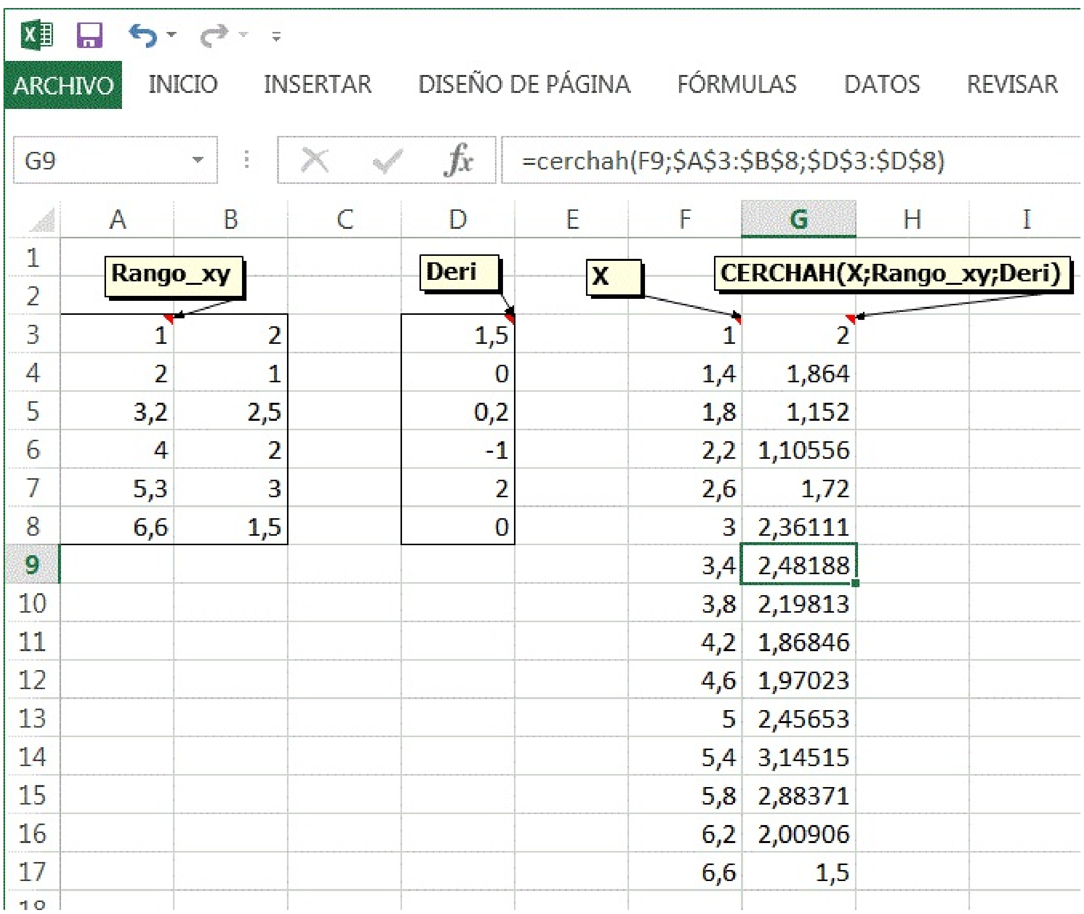
Required arguments: **X**; **Range_xy; Deri**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function serves to interpolate and extrapolate using cubic splines but, with the particularity of Hermite type of spline. It is required to indicate a range (**Deri**) with first derivative values at given points (well known data). Deri must have one column and the same number of rows than **Range_xy**.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHAH:



	A	B	C	D	E	F	G
3	1	2		1,5		1	2
4	2	1		0		1,4	1,864
5	3,2	2,5		0,2		1,8	1,152
6	4	2		-1		2,2	1,10556
7	5,3	3		2		2,6	1,72
8	6,6	1,5		0		3	2,36111
9						3,4	2,48188
10						3,8	2,19813
11						4,2	1,86846
12						4,6	1,97023
13						5	2,45653
14						5,4	3,14515
15						5,8	2,88371
16						6,2	2,00906
17						6,6	1,5

See also: CERCHA. CERCHAK y CERCHAS

Other functions

CERCHAHCO ____

CERCHAHCO(Range_xy ; Deri ; Orig)

____

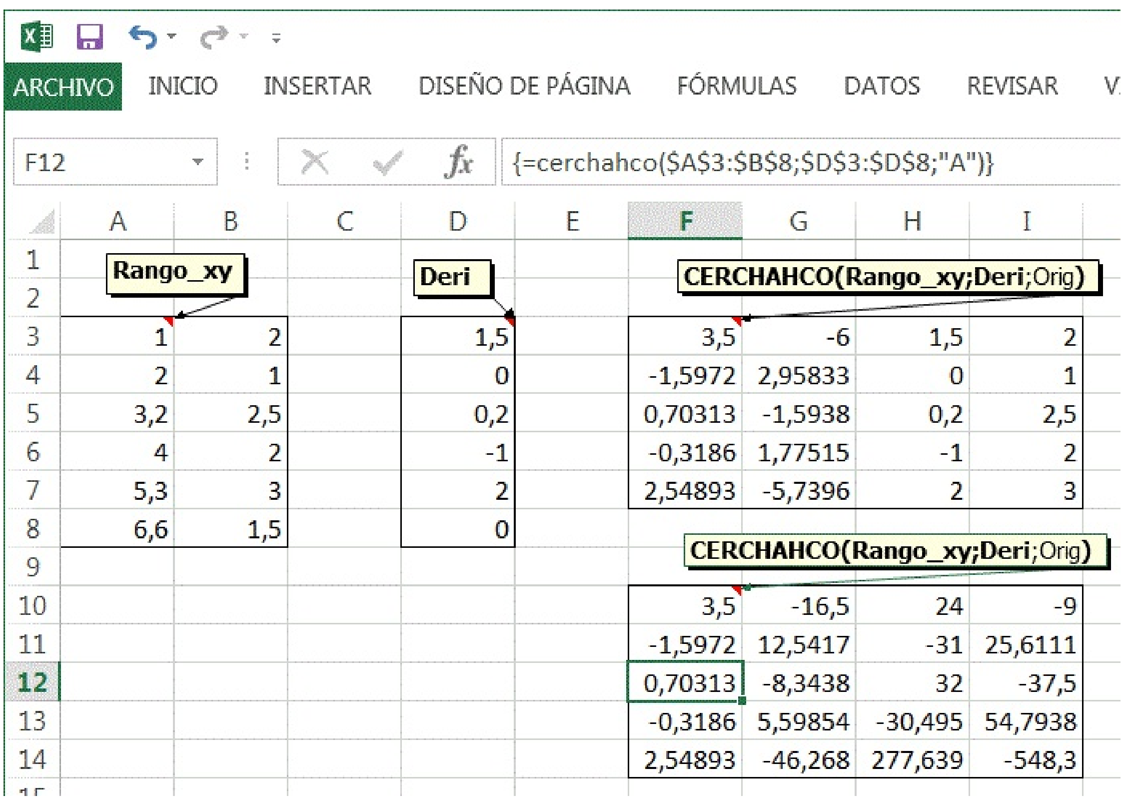
Required arguments: **Range_xy ; Deri**
Optional argument: **Orig**
Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This is a **matrix function** and then, once the data has been introduced in the Function Wizard or in the formula bar, key sequence: **Ctrl+Shift+Enter** must be pressed. With this function Hermite spline polynomial coefficients are obtained.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHAHCO:

Initially, a range of 4 columns and of a number of rows equal to the number of rows in **Range_xy** minus one has to be selected. Then, pressing**: Ctrl+Shift+Enter**, hence:



	A	B	C	D	E	F	G	H	I
3	1	2		1,5		3,5	-6	1,5	2
4	2	1		0		-1,5972	2,95833	0	1
5	3,2	2,5		0,2		0,70313	-1,5938	0,2	2,5
6	4	2		-1		-0,3186	1,77515	-1	2
7	5,3	3		2		2,54893	-5,7396	2	3
8	6,6	1,5		0					
10						3,5	-16,5	24	-9
11						-1,5972	12,5417	-31	25,6111
12						0,70313	-8,3438	32	-37,5
13						-0,3186	5,59854	-30,495	54,7938
14						2,54893	-46,268	277,639	-548,3

In the above picture the first group of results does not have the optional argument **Orig** then, the resulting polynomials are referred to their ordinate (Y value). The last group of coefficients are referred to coordinate origin, point (0,0) because letter A has been introduced in the formula. **Orig** is a letter (a or A) so that, it is necessary to quoted this letter but only in the case of use of the formula bar. If Function Wizard is been used the quoted is automatically typed but in the formula bar (near the symbol fx) it is necessary to quote the letter.

The first polynomial is: For x >= 1 and x <= 2

y (x) = 3,5 (x - 1)^3 - 6 (x - 1)^2 + 1,5 (x - 1) + 2

Or:

y(x) = 3,5 x^3 - 16,5 x^2 + 24 x - 9

See also: CERCHAC, CERCHACOEF, CERCHAH, CERCHAKCO y CERCHASCO

Other functions

CERCHAH2D ____

CERCHAH2D(X; Range_xy ; Deri)

____

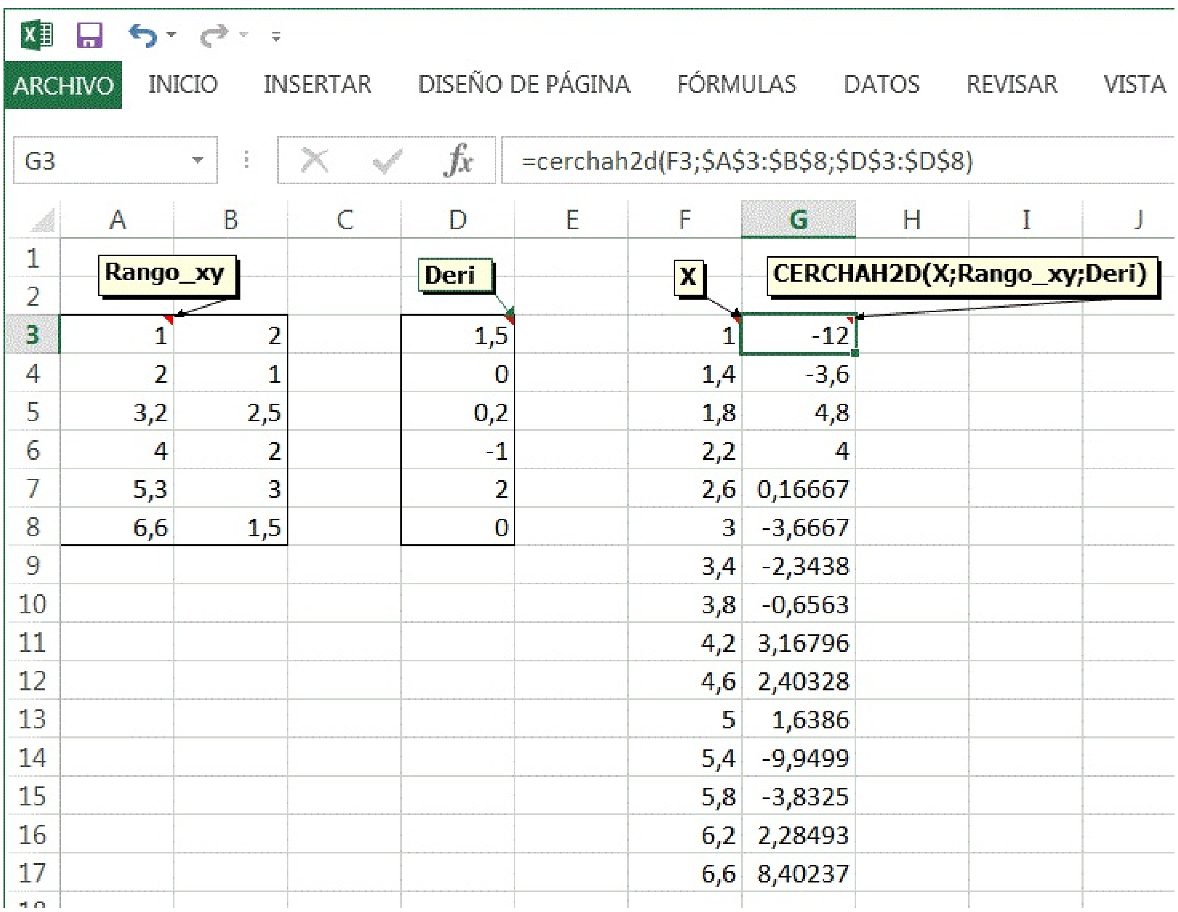
Required arguments: **X**; **Range_xy; Deri**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

With this function the second derivative of the spline at point X is obtained.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of CERCHAH2D:



	A	B	C	D	E	F	G
3	1	2		1,5		1	-12
4	2	1		0		1,4	-3,6
5	3,2	2,5		0,2		1,8	4,8
6	4	2		-1		2,2	4
7	5,3	3		2		2,6	0,16667
8	6,6	1,5		0		3	-3,6667
9						3,4	-2,3438
10						3,8	-0,6563
11						4,2	3,16796
12						4,6	2,40328
13						5	1,6386
14						5,4	-9,9499
15						5,8	-3,8325
16						6,2	2,28493
17						6,6	8,40237

See also: CERCHACI, CERCHACF, CERCHACU, CERCHAKD y CERCHASD.

Other functions

CERCHAHIN

CERCHAHIN(X ; Range_xy ; Deri)

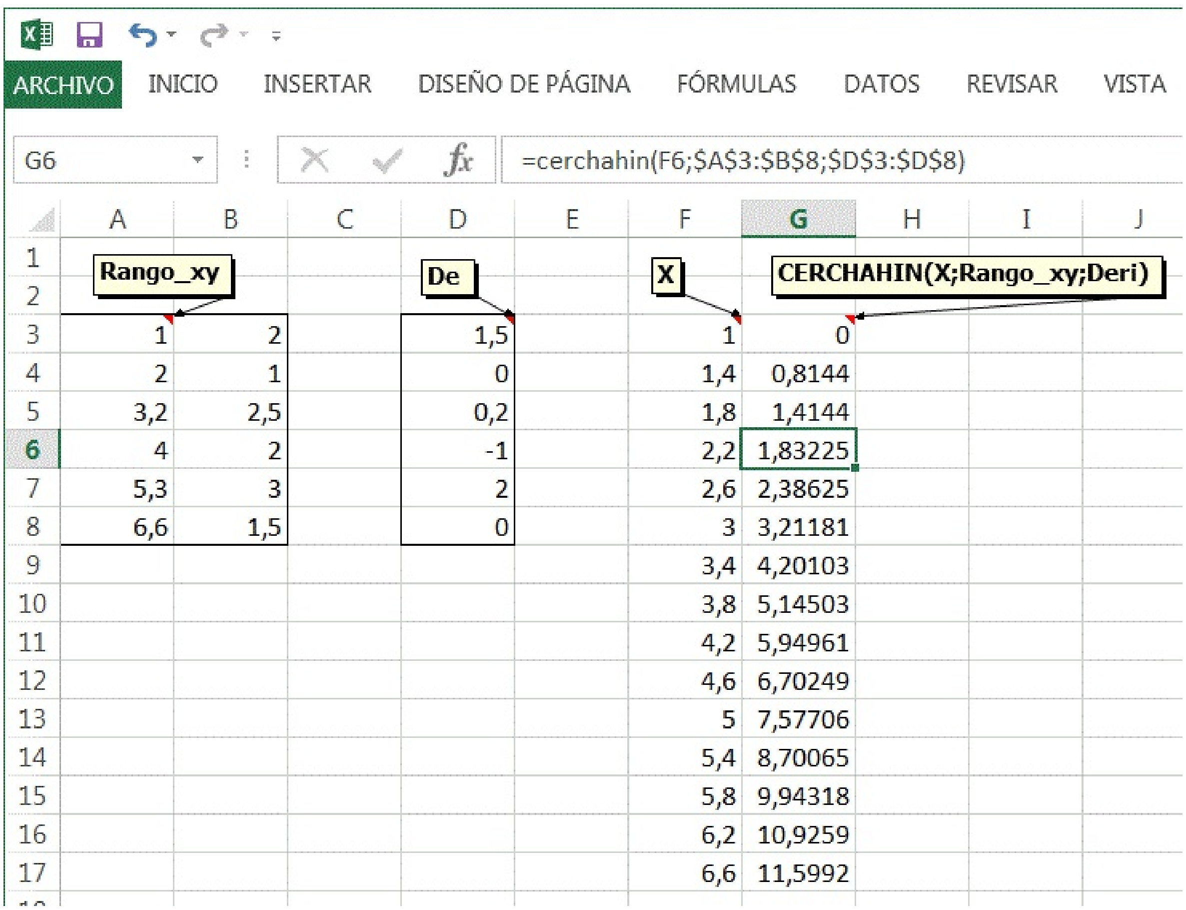
Required arguments: **X**; **Range_xy; Deri**

Important: the positions and the separators must be respected (";" or "," according to Excel or Windows configuration).

This function calculates the area under the Hermite spline from the first ordinate in **Range_xy** up to the last one.

No less than 2 points are required to construct the spline. Data can be sorted in ascending or descending mode.

Use of:



ARCHIVO INICIO INSERTAR DISEÑO DE PÁGINA FÓRMULAS DATOS REVISAR VISTA

G6 =cerchahin(F6;$A$3:$B$8;$D$3:$D$8)

	A	B	C	D	E	F	G
1	Rango_xy			De		X	CERCHAHIN(X;Rango_xy;Deri)
2							
3	1	2		1,5		1	0
4	2	1		0		1,4	0,8144
5	3,2	2,5		0,2		1,8	1,4144
6	4	2		-1		2,2	1,83225
7	5,3	3		2		2,6	2,38625
8	6,6	1,5		0		3	3,21181
9						3,4	4,20103
10						3,8	5,14503
11						4,2	5,94961
12						4,6	6,70249
13						5	7,57706
14						5,4	8,70065
15						5,8	9,94318
16						6,2	10,9259
17						6,6	11,5992

See also: CERCHAREA, CERCHAH, CERCHAKIN Y CERCHASIN

Other functions

Interpolation.xla
Excel ® Add-in
Freeware

Installing 2.0 version:

Once downloaded and unzipped, you will see two files. You have to move **Interpolation.chm** and **Interpolation.xla** to the following folder:

C:\Program files[(x86)]\Microsoft Office\OFFICE1n\Library (You can see the correct path in "Trusted Locations" of "Trust Center" in File | Options)

OFFICE1n indicates version number of Excel (OFFICE12 for Excel 2007, OFFICE14 for Excel 2010, OFFICE15 for Excel 2013)

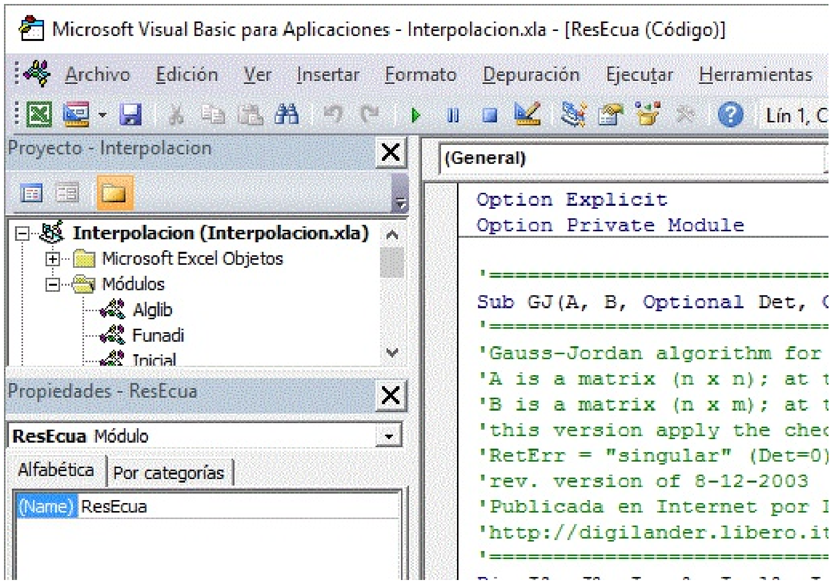
Previously, you have to change the properties of "Interpolation.chm" because Windows blocks this type of files when they are downloaded from the Internet, as it does with other types of files, for example, **xls** files. If you do not do this, help with functions will not be available.

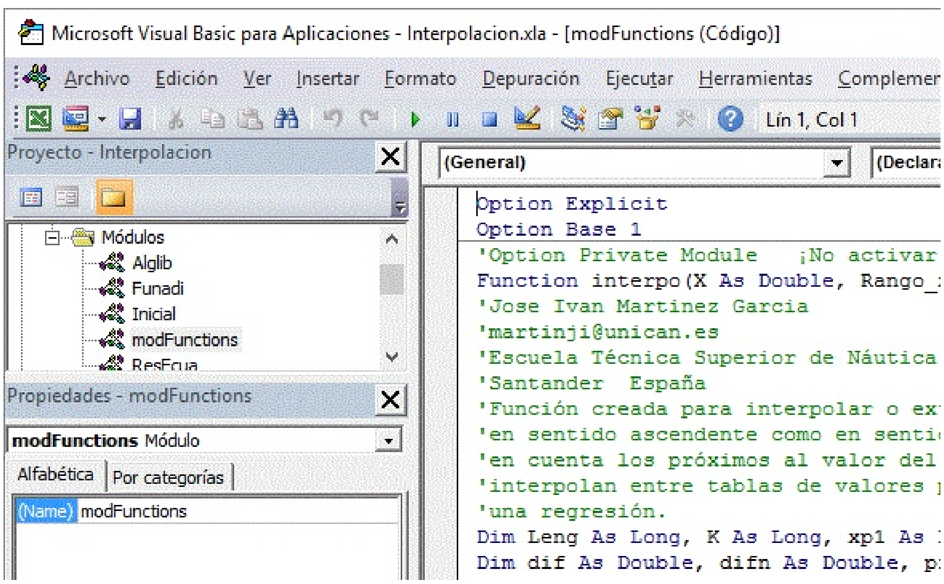
Once in Excel click on FILE | Options | Add-ins | Go. Browse the file Interpolation.xla and charge it as an Excel Add-in.

Interpolation.xla file can be placed in the first folder that Excel shows when it tries to load an Add-in or in the folder you prefer.

EDITING INTERPOLATION.XLA:

First of all, you have to clear the Read only attribute check box of file properties using Windows file explorer. Once Excel ® is opened, press Alt + F11, this will open VBA and then you would be able to see modules with Visual Basic Code.





In order to add the code of new functions, click with right button on "modFunctions" and "View Code", it will appear the suitable place to do it on the right of the screen . The sentence "Option Explicit" forces the declaration of variables. The sentence "Option Base n" changes depending on the module it has been used.

After altering code it is important to reload this Add-in so that the new features can be used.

OPERATION DESCRIPTION:

Functions in "modFunctions" receive arguments, and once it has been verified that all these are correct and logical, they are sent to the procedure "Sol", that has 5 zones of calculation:

- First zone: for the solution of cubical spline of Hermite (2 points are known and the slopes at them).
- Second zone: for a first degree equation (option "pg").
- Third zone: for a second degree equation (option "sg").
- Fourth zone: for the solution of a matrix with more than three diagonals, that will be what produces option X (spline periodic). For the solution procedure GJ is used (Gaussian - Jordan).
- Fifth zone: for the solution of the tridiagonal system , that will be the one to be solved in the rest of cases.

"Sol" procedure put back the data to the functions the coefficients of the resulting polynomials (splines), that are going to be used for the final calculation.

CERCHALON Function calculates the length by approaches, stopping and giving the result when the differences between the values that are calculated are lower than the requested precision. It calculates the length of small secants, resulting of dividing the separations between the given values of x.

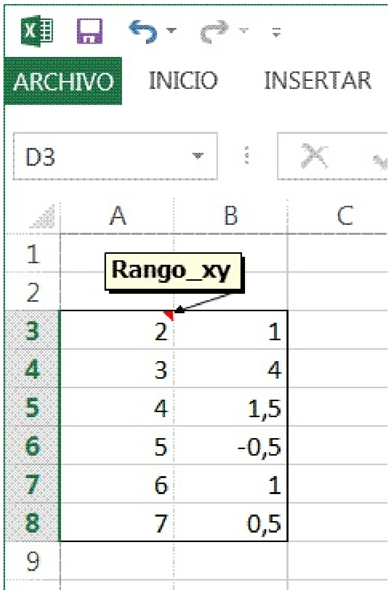
Cerchak function and the following ones in the main page list are created using ALGLIB algorithms (numerical analysis library, GPL 2+ license. See: htpp://www.alglib.net/)

Please send me suggestions
martinji@unican.es

Functions

X: value to interpolate or to extrapolate. You can introduce a number or an Excel range (one cell), but the normal way is using "RefEdit" of the formulae assistant in order to select it. The cell have to contain a number. Extrapolation is possible, but it is important to check the results and It is recommended the use of (**e** extrapolated) conditions.

Range_xy: Two column range of cells and at least 2 rows that contain values of the independent variable (**X**, 1st column) and the dependent variable (**Y**, 2nd column).



Functions

"Keys" Type of splines: (you have to type 2, 1 or none) By default it will work with cubical segments, but it is possible to indicate:

- Splines of first degree (straight line)
type " **PG** " or "pg"
- Splines of second degree (quadratic)
type " **SG** " or "sg" (the number of rows must be odd).
- Cubic Splines

Keys: For example (**fp**). Here it is indicated the type of end-point constraints for the spline (see more combinations down). It does not matter whether they are introduced in capital or lower-case, and combinations between different types can be done, but taking into account that the options (**h**), **(x**) do not admit combinations because the special type they involve. In addition, in case of single **Range_xy** having 2 or 3 rows, the function will assign the option (**h**) in the case of 2 rows and (**p**) in the case of 3 rows. The assistant will add quote marks or you will have to type them in the bar of formulae (as you like). If a constraint lacks, **n** will be considered, no matter if values in **V1** or **V2** are introduced. Also, the positions must be respected in order to assign the value of V2.

End-point constraints

Functions

V1: Value of the slope (1st derivative) or the curvature (2nd derivative) at the first given point.

V2: Value of the slope (1st derivative) or the curvature (2nd derivative) at the last given point.

It is necessary to separate values with "**;**" or with "**,**" separator set up in Excel or Windows**.**

W1: First integration interval value for the area. It must be referred to the origin of coordinates (x=0). By default the smaller value of **X** in the **Range_xy** is assigned.

W2: Last integration interval value for the area. It must be referred to the origin of coordinates (x=0). By default the greater value of **X** in the **Range_xy** is assigned.

It is necessary to separate both values with ";" or with the separator formed in Windows.

Functions

prec :

Whole number that will be the negative power of ten indicating the precision that is required for the calculation of the length of the chord of the spline.
It is not necessary to indicate the sign.

example: prec = 4 ==> precision = 0,0001

By default, **prec** will take the value of 2. The maximum value is 7. In case of very high numbers in Range_xy it could be possible that the expected precision will not be obtained. This can be solved scaling the values.

Functions

x: Value to interpolate or extrapolate. It could be a figure o a range reference. The normal way to get it is using the Function Wizard "RefEdit". Cell with data must have a number, otherwise a string will be assigned as result.

Functions

Frontiz: Required argument to indicate the type of spline that is desired. It assigns one end constraint to the **left (initial) part** of the spline.

These are the options:

-1 periodic spline (cyclic). In this case:

The argument **Frontde** has to be **-1** also.
Values in **Viz** y **Vde** are going to be ignored but a value has to be inserted.
The last value of **Y** in **Range_xy** will be changed to be equal to the first one.

0 parabolic spline (parabolically terminated)

Values in **Viz** y **Vde** are going to be ignored but a value has to be inserted.

1 which corresponds to the first derivative end condition.

2 which corresponds to the second derivative end condition.

Functions

Viz: Required argument to indicate the value to be assigned at the end constraint:

If **Frontiz** equals **-1** or **0**, **Viz** is going to be ignored but a value has to be inserted.
If **Frontiz** equals **1**, **Viz** will indicate the value of the first derivative at the origin of first polynomial.
If **Frontiz** equals **2**, **Viz** will indicate the value of the second derivative at the origin of first polynomial.

Functions

Frontde: Required argument to indicate the type of spline that is desired. It assigns one end constraint to the **right (final) part** of the spline.

These are the options:

-1 periodic spline (cyclic). In this case:

The argument **Frontiz** has to be **-1** also.
Values in **Viz** y **Vde** are going to be ignored but a value has to be inserted.
The last value of **Y** in **Range_xy** will be changed to be equal to the first one.

0 parabolic spline (parabolically terminated)

Values in **Viz** y **Vde** are going to be ignored but a value has to be inserted.

1 which corresponds to the first derivative end condition.

2 which corresponds to the second derivative end condition.

Functions

Vde: Required argument to indicate the value to be assigned at the end constraint:

If **Frontde** equals **-1** or **0**, **Viz** is going to be ignored but a value has to be inserted.
If **Frontde** equals **1**, **Viz** will indicate the value of the first derivative at the end of last polynomial.
If **Frontde** equals **2**, **Viz** will indicate the value of the second derivative at the end of last polynomial.

Functions

End-point constraints :

Natural (n), also called "variational". The curvature at the end is null. The spline begins or finishes in a straight line. It is the default option in CERCHA*, so if you want it to be "forced" at first point and "natural" at last point, typing "f" or "f " or "fn" is equivalent, and also "Fn" or "FN", because it is not case-sensitive. A blank space is equivalent to one "n".

Forced or Clamped (f). A value is assigned to the slope. When it is used in a ship stability curve, if heel is in degrees, the slope at the origin (GMc) must be multiplied by PI () /180, being PI () /180 = 0.0174532 or divided by a radian expressed in degrees = 57.29578

Curvature (c). A value is assigned for the 2nd derivative.

Extrapolated (e), also called "Not-a-Knot". The same cubic one for the first and the second section (three first points) and/or for last and penultimate (three last points).

Parabolic (p) (parabolic termination). The spline (first and/or last section) will be a parabola. The rest of the spline will be cubical functions if there is enough data (at least 4 rows). Generally, when there are less than 4 rows in Range_xy, this will be the applied type.

Periodic (x). The slope and the curvature (based on 2nd derivative) at the beginning will be the same one as at the end. It does not admit combinations of arguments.

Hermite (h). In case of having two points (2 rows in Range_xy) and the slopes at these points, it will interpolate with the cubic spline of Hermite.

Functions

Orig: Optional argument. Indicates the origin at which polynomials are referred. If this argument is left in blank or a different letter than "a" o "A" is typed polynomials will be referred to their own ordinate (value of **X** in **Range_xy**). If "a" o "A" is typed all of them will be referred to the coordinate origin (0,0).

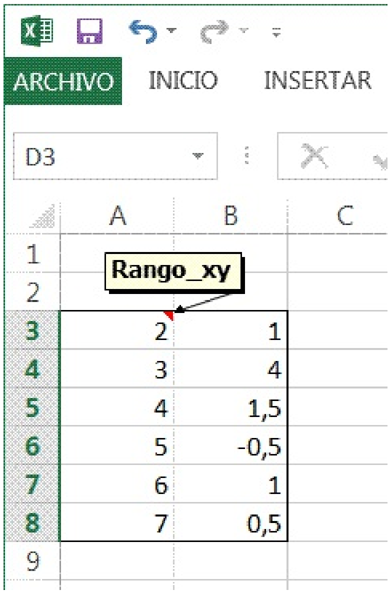
Functions

Nd: Argument to introduce in order to get the second derivative of the spline at point **X.**

Value of **Nd** must be **2**.

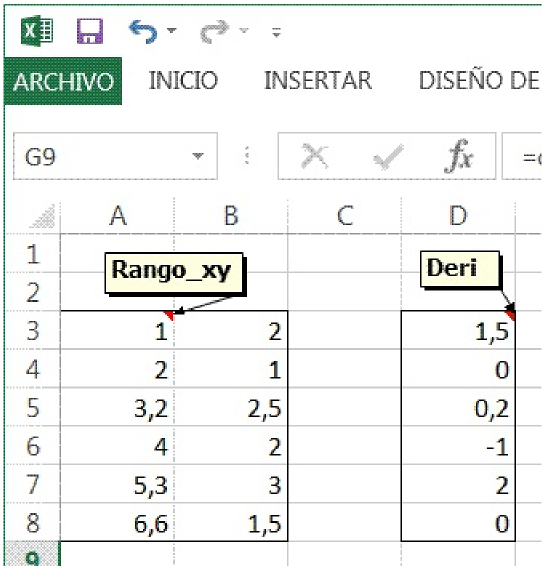
If **Nd** is not introduced or **Nd** is not equal to 2, the function result will be the slope of the spline at **X**.

Range_xy: Cell range of 2 columns and at least 5 rows containing given data (**X** in 1st column and **Y** in 2nd column).



Functions

Deri: Required argument. It consists in a range of one column an the same number of rows than **Range_xy,** with first derivative data at given points (well known data).



Functions