Grapher

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Welcome to Grapher

Grapher is an **easy-to-use** yet powerful and intuitive graphing environment which provides a clear and efficient user interface to build the most amazing and responsive graphs.
This help documentation is designed so you can quickly learn Grapher as a new user or enhance your knowledge as a regular user.
Learn about graphing functions, plotting tables of data, evaluating equations, computing area below curves and volume of revolution, transformations, discontinuities, turning points, inflection points, intersection points, and more! If you have questions that aren't answered here, email us at terrenceali123@gmail.com.

Getting started with Grapher

New to Grapher

- Read the Introduction section to know more about Grapher, its different editions and system requirements.
- Follow the Quick Start Guides to familiarize yourself with the processes of creating graphs.

Regular user of older Grapher versions

- Read the What's new in Grapher section to have a quick look at major changes.
- Run through the Quick Start Guides to familiarize yourself with the new version.

Terminology

Plot This is a a two-dimensional graph which can contain an unlimited number of plot-items. Plot-items might be **curves, markers, zones, or grid**. A plot can have up to four axes, with each plot item attached to a **x** and **y** axis. The scales at the axes can be explicitly set through the plot properties pane, or are calculated from the plot items, using algorithms (ScaleEngine). The ScaleEngine, for each axis, can be configured through the plot properties pane.

Curve A curve could be one of three types. Line curve (or curve), Spectrocurve and Spectrogram.

- **Line curve (or curve)** A plot-item that represents a series of points in the x-y plane. It supports different display styles, interpolation and symbols.
- **Spectrocurve** A plot item that displays 3D points as dots, where the z coordinate is mapped to a color.
- **Spectrogram** A plot item which displays a spectrogram. A spectrogram displays 3-dimensional data, where the 3rd dimension (the intensity) is displayed using colors. The colors are calculated from the values using a color map.

Marker A marker can be a horizontal line, a vertical line, a symbol, a label or any combination of them, that is drawn around a center point inside a bounding rectangle.

Zone Displays a zone. A horizontal zone highlights an interval on the y axis that is unbounded on the x axis. A vertical zone an interval on the x axis that is unbounded on the y-axis. It is filled with a brush and its border lines are optionally displayed with a pen.

Grid A cartesian coordinate grid. A coordinate grid consists of major and minor vertical and horizontal grid lines. The locations of the grid lines are determined by the X and Y scale divisions.

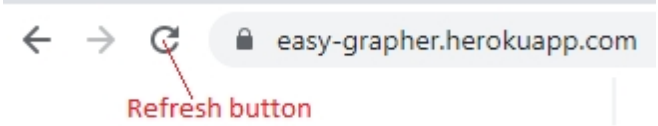
Introduction

About Grapher

Grapher is an easy-to-use yet powerful and intuitive graph generating environment. It provides a clear and efficient user interface to build the most amazing graphs. You just have to enter or import data to obtain a graphical representation of it.
Forget about bloated user interfaces and incomprehensible tools. Grapher is engineered to provide graphing functionality in it's simplest form: creating, maintaining, decorating, saving, and getting information from plots is could be a painful process. However, thanks to Grapher you may surprise yourself enjoying these tasks!

Please email us at terrenceali123@gmail.com and let us know of your experience with Grapher and any suggestions for improvement.

Although Grapher tries to handle bad user input gracefully, it may, at times, encounter bad input that drives it into a state from which it cannot recover. The only solution is to refresh the browser.



We appreciate users reporting instances of Grapher non-response or freeze. Include as much information about the situation that led to the freeze in your Email to terrenceali123@gmail.com.

System requirements

Grapher is designed to run in any modern browser.

What's new in Grapher

Enhanced user interface
Grapher's user interface is constantly evolving to better serve users:

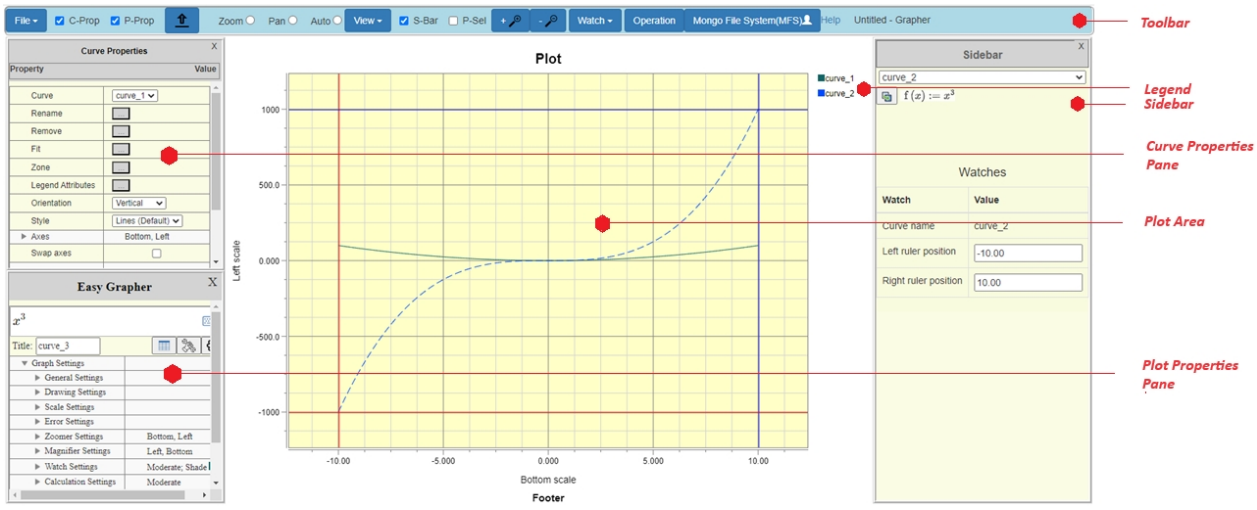
- No addition or modification made

Bug fixes

- No bugs reported or fixed

Overview of Grapher Interface

The Grapher is a single-page application. All components is contained in a single window.



The components of the Grapher are:

[Toolbar]

- Allows access to the functions of the Grapher
- Is hidden during printing

[Sidebar]

- Sets the current curve
- Allow for assigning a value to any unknown coefficient of a function
- Displays enabled watches
- Is hidden during printing

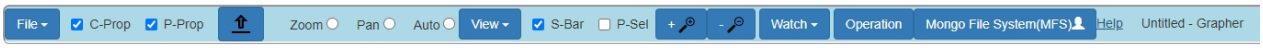
Legend
- Plot items can be represented on a legend

Plot area
- The plot, plot items (curves, spectrocurves, spectrograms, grids, symbols, markers, etc.), and legend are drawn in this area

Curve properties pane
- Set and modify curve properties
- Is hidden during printing

Plot properties pane
- Set and modify plot properties
- Is hidden during printing

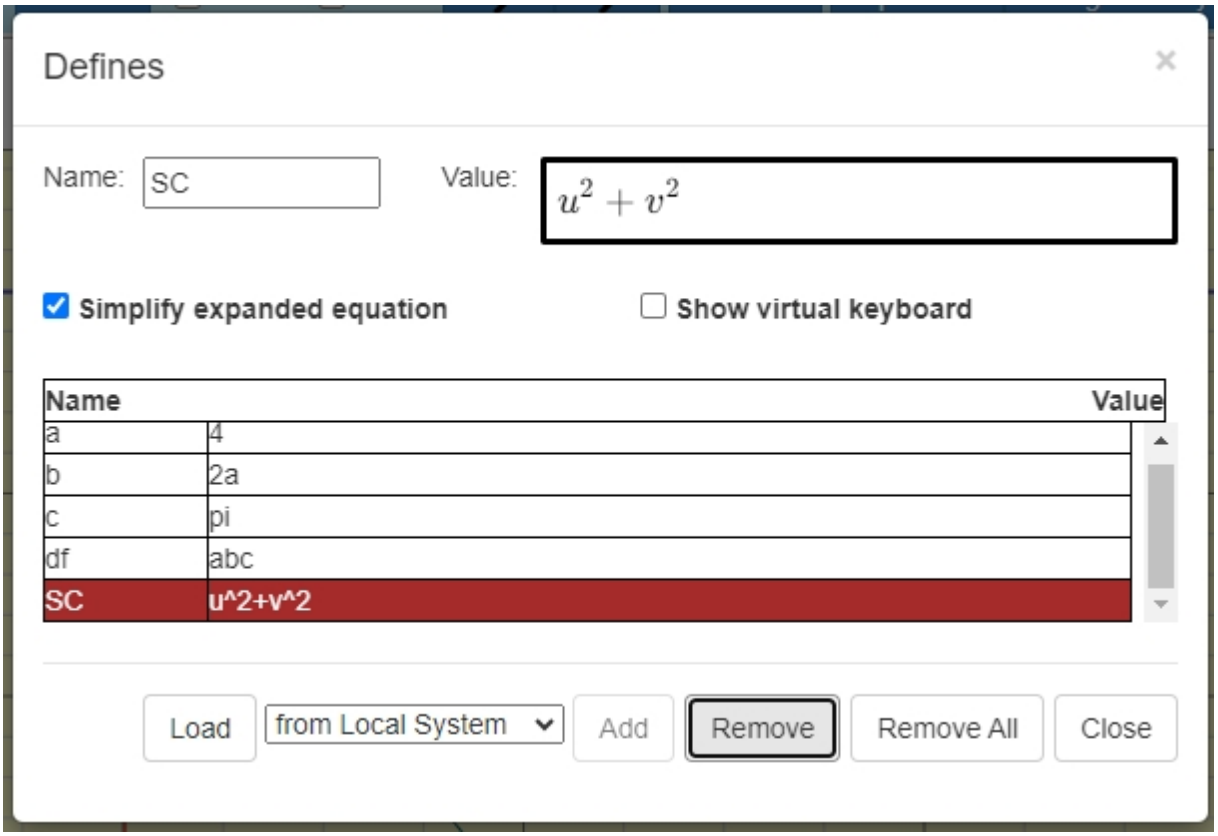
Tool Bar



The Toolbar is located at the top of the window. It contains tool buttons and dropdown menus. Hovering over a button or menu item displays a tooltip.

File

Displays a drop-down list of commands:
- **Dowload** Saves the plot to a file on your system hard drive.
- **Point entry** Launches the dialog used for point entry operations (adding / removing points to / from a curve).
- **Calculator** Launches the system calculator. You might be prompted to allow Grapher access. Pop-up must be enabled.
- **Defines** Launches the dialog used for definitions.

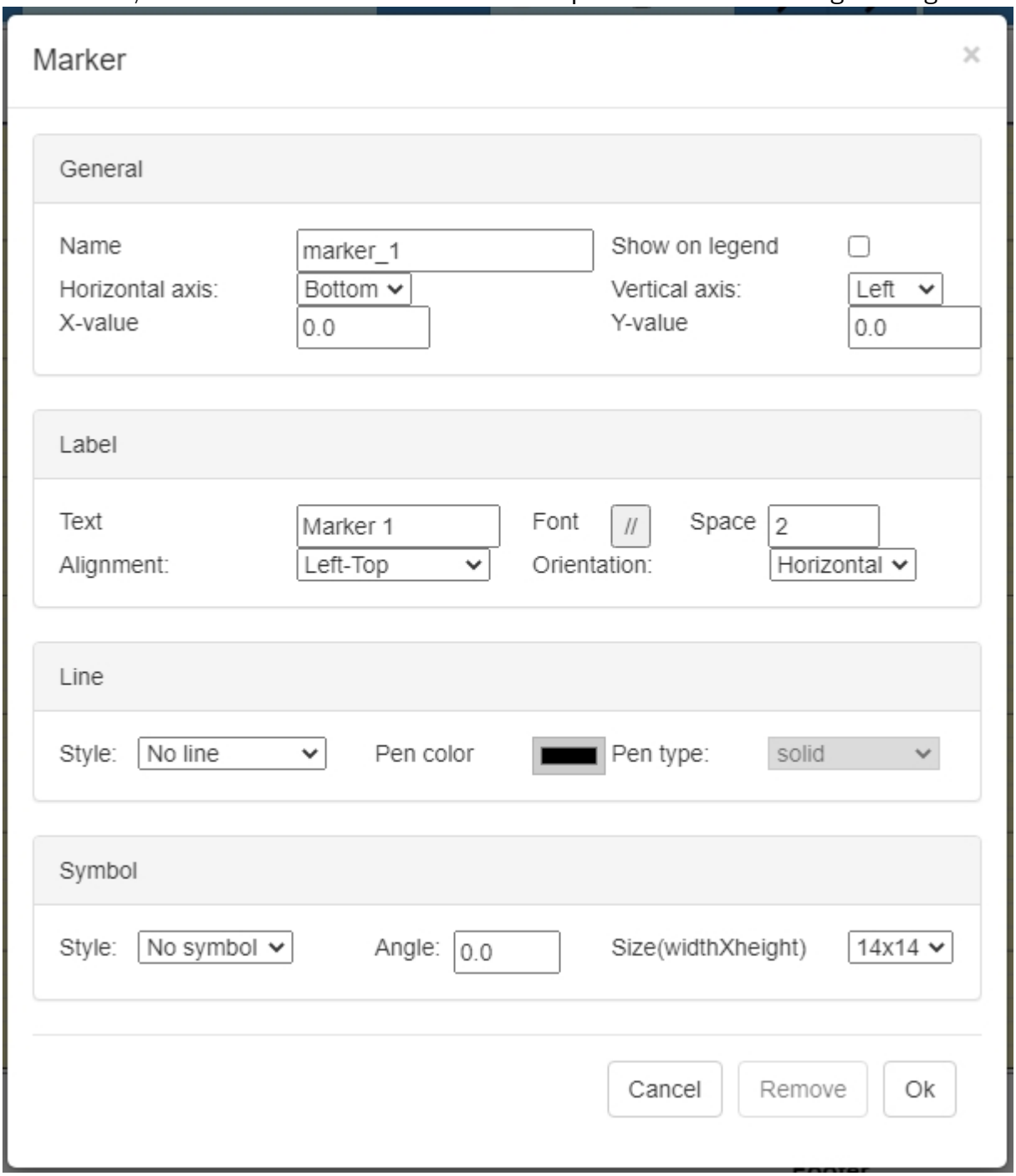


You enter a unique name in the name field. The value field can contain any combination of a constant, an expression that evaluates to a constant, or any expression that could be resolved by the Grapher.
Press **Add** to register the name as a definition. All definitions added through the define dialog are displayed in a table.
In the Defines dialog above, **"a = 4"** is the first constant defined. **"b=2a"** (i.e. b = 2x4=8) is the second constant defined. **"c=pi"** (i.e. c=22/7) is third constant defined. **"df=abc"** is the fourth constant defined. It is similar to the second definition and shows that a definition can be in terms of other definitions. **"SC=u^ 2+v^ 2"** is the fifth definition. Note the name is "SC" (with a uppercase C) and not "Sc" (with a lowercase). The Grapher will not allow the name "Sc" at this stage because "c" is used in a previous define name for definition "c=pi". The value of SC is u^ 2+v^ 2. Since u and v are undefined and are not constants known to the Grapher, if they are not independent variables, they are treated as unknowns.
You use the **Load** button to launch the file explorer and upload a definition file (i.e a CSV .def, .txt or EXCEL). If you are logged-in to **Mongo File System (MFS),** you have the option to upload from the the mongoDb cloud system provided by the Grapher.

	A	B
1	c	0.842
2	v1	x * x + (y - c) * (y + c)
3	v2	x * (y + c) + x * (y + c)
4	f	1 / (v1 * v1 + v2 * v2)
5		

You can load a valid definition file before or after adding definitions through the **Add** button.
You select a defininition by clicking on it. You remove a definition by double clicking it or clicking the **Remove** button. Use the **Remove All** button to clear all definitions.

- **Marker** Launches the dialog used for defining, modifying and removing a marker. A marker can be a horizontal line, a vertical line, a symbol, a label or any combination of them, which can be drawn around a center point inside a bounding rectangle.



In the symbol section of the dialog, you assign a symbol to the marker. The symbol is drawn at the point specified by the X-value and Y-value in the general section of the dialog. You set the angle and size of the symbol through the "Angle" and "Size" fields

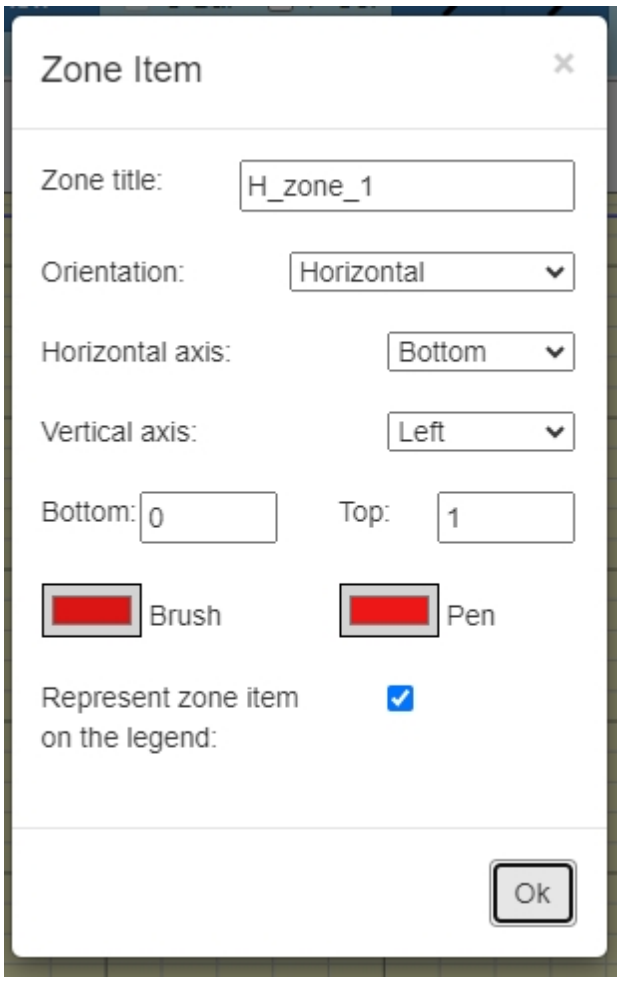
respectively.

In the label section of the dialog, a label can be assigned to the marker.
The Alignment field specifies where the label is drawn. The interpretation of the alignment depends on the marker's line style. The alignment refers to the center point of the marker, which means, for example, that the label would be printed left above the center point if the alignment was set to Left-Top. When the label is not centered on the marker position, the spacing is the distance between the position and the label. You set the spacing through the Space field in the dialog.

You enter a unique name in the name field and a constant or an expression that evaluates to a constant in the X-value and Y-value fields. The X and Y values position the marker. They are associated with the marker axes. You change the marker axes through the Horizontal and Vertical axis fields.

Checking the Show on legend checkbox represent markers on the legend.

- **Zone** Launches the dialog used for defining a zone. A horizontal zone highlights an interval of the y axis that is unbounded in the x direction. A vertical zone hightlights an interval of the x axis that is unbounded in the y direction. It is filled with a brush and its border lines are optionally displayed with a pen.



Zone title The automactically generated zone title may be change by the user. This title

is diplayed on the legend and is unique.
Orientation Sets the orientation of the zone. Zones are either vertical or horizontal.
Horizontal axis Sets the horizontal axis associated with the zone.
Vertical axis Sets the vertical axis associated with the zone.
Left and Right / Bottom and Top When Orientation is vertical the Left and Right fields hold the lower and upper x limits. When Orientation is horizontal the Bottom and Top fields hold the lower and upper y limits.
Brush Sets the color of the brush use to fill the zone.
Pen Sets the color of the pen use to draw the border lines of the zone.
Represent zone item on the legend If checked, the zone item is represented on the legend.

- **Print** Prints the plot. The toolbar, property panes and sidebar are hidden during printing

- **Reserved words** Display a list of reserved words (keywords) use by the Grapher.

- **Recycle bin** Shows the recycle bin. Plot items remove from the plot are held in the recycle bin where the consume memory. Emptying the recycle bin may improve performance.

- **C-Prop** Displays the curve properties pane.
- **P-Prop** Displays the plot properties pane.

Upload Files
Launches your system's file explorer. From the explorer, you select the table file (.txt, .xls) or plot file (.plt) uploaded to the Grapher. (see Plotting From Data File)

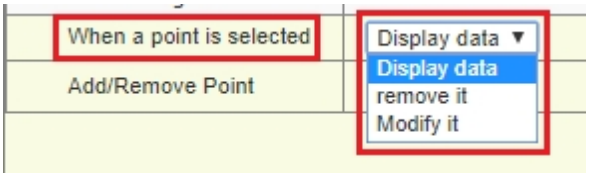
Auto-Pan-Zoom
A radio button group that enables and disables specific modes. None or, at most, one of the modes can be enabled at any time.

- **Auto** This is the default mode. In this mode, the scales used are calculated by the Grapher. The scales allow the full extent of all curves to be visible. User actions (e.g. zooming, magnifying, setting a user defined scale) that change the scales will cause the Auto mode to be disabled.
- **Pan** When selected, all plot items (curves, symbols, zones, rulers, etc.) in the plot can be dragged to a new location. You hold down the left mouse button and drag the mouse to move plot items.
- **Zoom** When selected, a plot can be quickly zoomed. You hold down the left mouse button and drag to display a zooming rectangle. When the mouse button is released, the Grapher re-calculates the scales so that the contents of the zooming rectangle occupy the entire plot. The Grapher saves zoomed states on a zoom stack. You cycle through the zoom stack as follows: Use the Esc key to return to the base of the stack (i.e. the state before the first zoom). Use the shift + middle mouse-button to go one level up the stack. Use the middle mouse-button to go one level down the stack.

View
Displays a drop-down list of commands:

- **Left axis** Enables / disables the left axis.
- **Bottom axis** Enables / disables the bottom axis.
- **Right axis** Enables / disables the right axis.
- **Top axis** Enables / disables the top axis.
- **Major gridlines** Enables / disables Major grid lines. **Note:** Minor gridlines cannot exist without Major gridlines. Thus, disabling Major gridlines automatically disables Minor gridlines.
- **Minor gridlines** Enables / disables Minor grid lines. **Note:** Minor gridlines cannot exist without Major gridlines. Thus, Minor gridlines option is only available if Major gridlines are enabled.
- **Title** Displays any defined title.
- **Footer** Displays any defined footer.
- **Legend** Displays / hide the legend. **Note:** The legend will not show if the plot contains no curves.

- **S-Bar** Displays the sidebar. **Note:** The sidebar will not show if the plot contains no visible curves.
- **P-Sel** Enables / disables point selection.



When **P-Sel** is enabled, you can click a selected point on a curve and perform the operation specified by the selection in "**When a point is selected**" in the Plot properties. Additionally, you can drag and drop a selected point to a new position with the left mouse button. Drag the point outside the plot area to abort the drag-drop process.
Note:
Enabling Point selection turns off "Add/Remove Point" *and turns on mouse tracking.* Mouse tracking may affect the Grapher's performance. It should only be enabled when needed.

+ and -
Zoom in and out. The keyboard short-cuts are Shift modifier plus the + key or the - key.

Watch
Displays a drop-down list of commands:

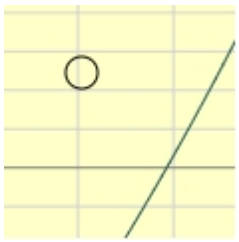
- **Curve name** Enables / disables curve name watch.
- **Left ruler position** Enables / disables Left ruler position watch.
- **Right ruler position** Enables / disables Right ruler position watch.
- **Bottom ruler position** Enables / disables Bottom ruler position watch.
- **Top ruler position** Enables / disables Top ruler position watch.
- **Slope at left ruler** Enables / disables slope watch.

- **Area below the curve** Enables / disables area watch. Use Watch Settings in the Plot Properties Pane to configure Area below the curve watch. The default configuration is to shade the area and show the centroid.
- **Volume of revolution(X)** Enables / disables volume watch.

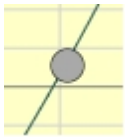
Note: Slope, Area and Volume watches require the Grapher to perform calculations that can be time consuming . Only enable these features when needed and disable them immediately after.

Operation

Displays a menu of the various operations that could be performed on curves. When an operation is selected the cursor changee to the selecting cursor. This is an unfilled circle as shown in the image below.



Moving the selection cursor over a point in the curve causes the circle to be filled as shown in the image below.



Clicking a curve with the grey filled cursor selects it.

With a curve or curves selected, clicking anywhere in the plot area will perform the operation selected. You can abort the operation by holding down shift and clicking anywhere in the plot area.

Mongo File System (MFS)

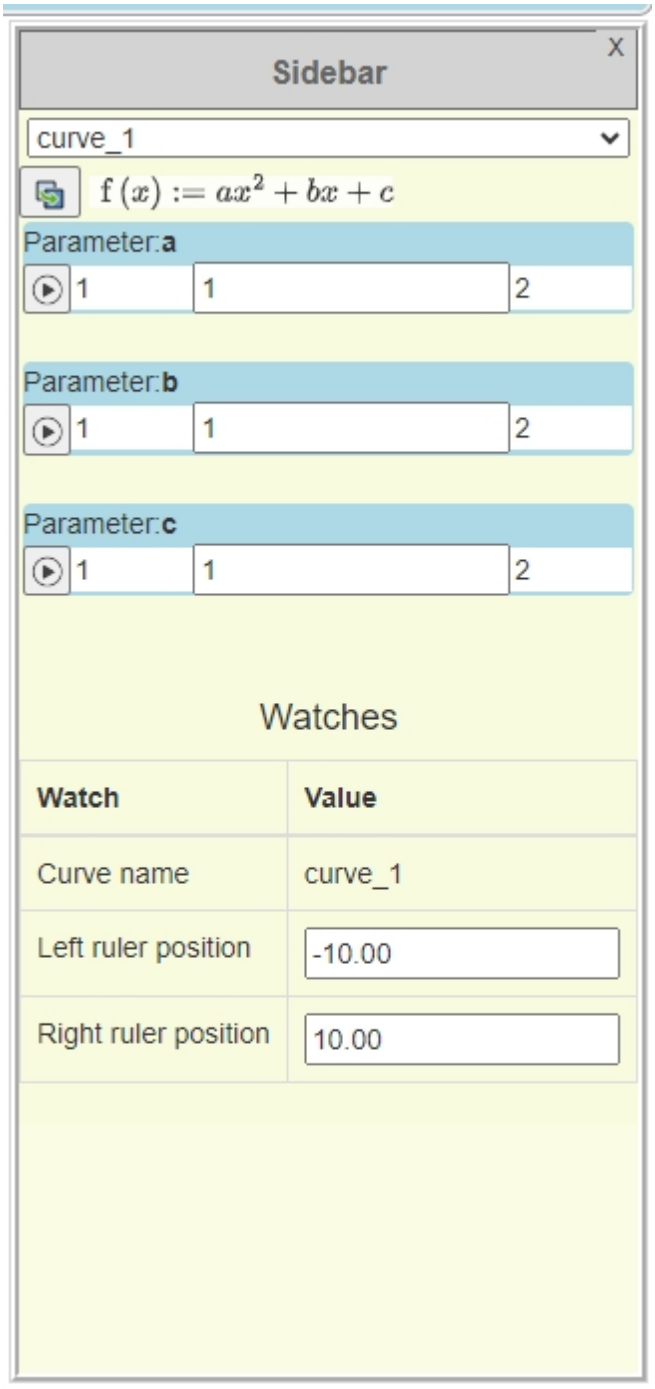
Allow registration for and login to a cloud base (MongoDB) filesystem. Once you are

logged in, you have access to a windows-like explorer and a minimal notepad. This cloud storage facility is an alternative to the saving on your local filesystem.

Help
Launches the help documentation you are currently reading.

Side Bar

The Sidebar provides a "drop-down select list" of all line curves, spectrocurves and spectrograms in the plot. The selected curve is the current curve. If the current curve is of a function with unknown(s), the sidebar provides as many set-ups for unknowns as there are unknowns. A set-up consist of three input fields in a row. The central input field contains the value that is assigned to the unknown. It is initialized to 1. The input fields immediately to the left and right of the central input contain the lower and upper limit respectively of the values that can be assigned to the unknown. They are initialized to 1 and 2 respectively. Pressing the play button at the left of a set-up animates the curve.
If a "watch" is enabled, the "Sidebar" displays the watch associated with the current curve. Some watch values (for example rulers) are displayed in a spin-box that permit the value to be varied. Watches (e.g. Area below curve, Volume of revolution, and Slope) may consume significant processing time. It is a good idea to disable watches that are no longer needed.
Watches are not defined for Spectrocurves and Spectrograms.
Note: The Sidebar option on the Toolbar is only available if there is at least one visible line curve in the plot.



Plot area

The Plot area is the area of the window where the application draws the various components of the graph. These components are:

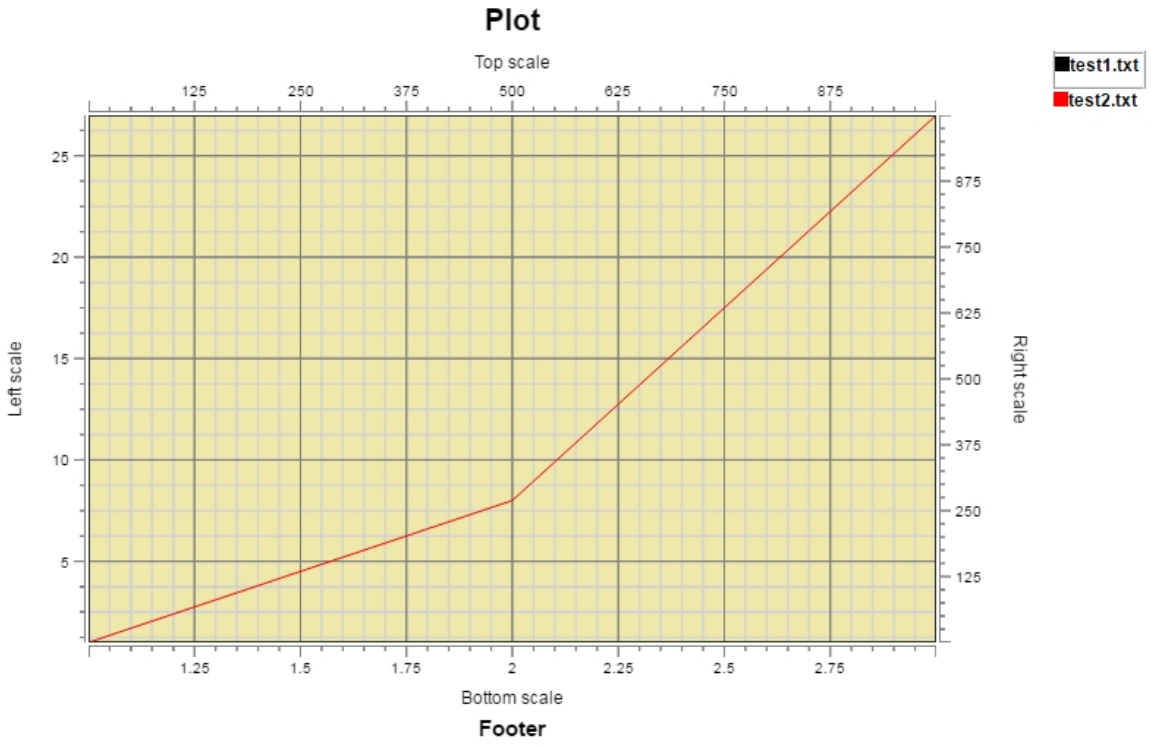


Fig. 4

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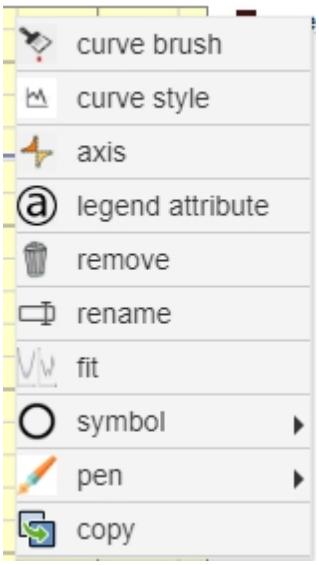
Most of a graph's components are typical. However, the legend requires discussion.

The Legend

A quick look at the legend for the plot in Fig.4 suggest that there are two curves. Yet only one curve is displayed. A closer look at the legend reveals that the first legend item is checked. A legend item is checked by clicking it. Checking legend item is hides the plot item and any associted specific items, such as symbols. If auto-scale is enabled, hiding a plot items usually results in axes re-calculation. All remaining visible plots are redrawn as per the revised axis scale.

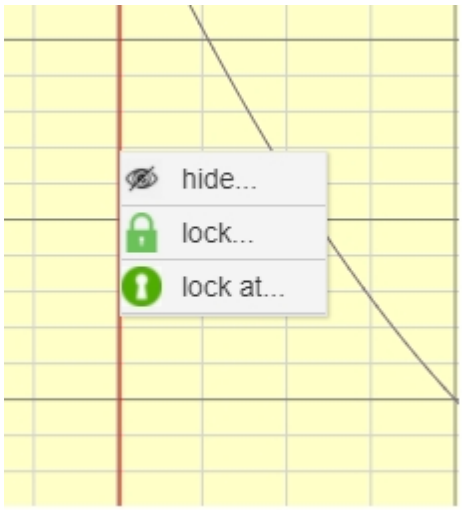
Right clicking a legend item brings up a context menu. This menu allows the activation of curve specific commands. It is possible to see the function of each command by hovering over a menu item and reading the tool tip.



Plot Area context menus

Right clicking a selected ruler brings up a menu (see below)

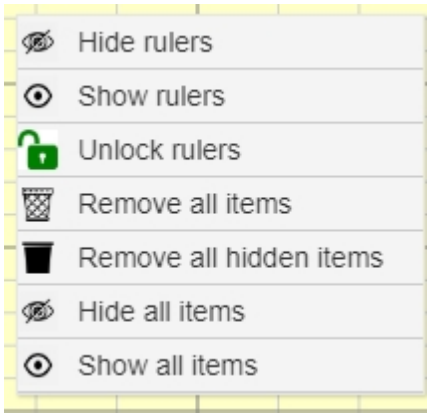
with ruler specific commands.



Click hide to hide the selected ruler.
Click lock to lock the selected ruler in its current position.
Click lock at to launch a dialog to set the position at which you would like the selected ruler locked. (Note: The position set by the dialog is validated by Grapher *algorithms that keep the ruler on the curve)*

NB: Rulers at the extreme edge of the Plot Area cannot be selected. Zoom or set the margin (Plot Properties > Scale Settings > Margins) to move the rulers from the edge of the Plot Area.

Right clicking in the Plot Area (not on a ruler) brings up the menu shown below.

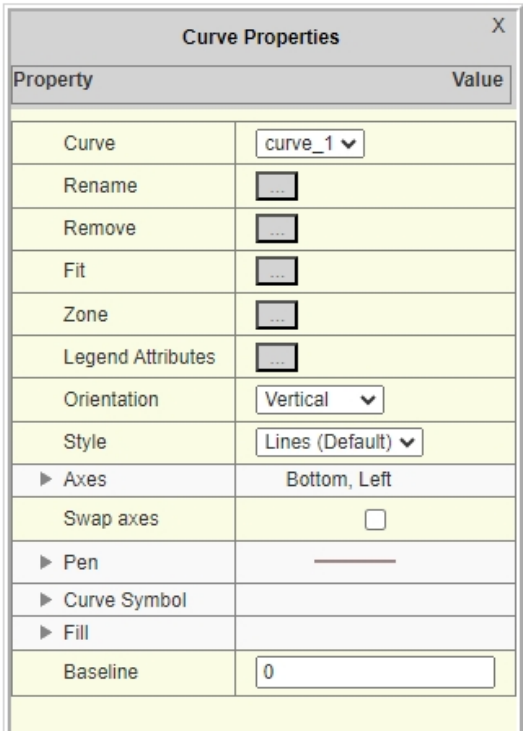


Click Hide rulers to hide all rulers.
Click Show rulers to show all hidden rulers.
Click Unlock rulers to unlock all locked rulers.
Click Remove all items to move all plot items to the recycle bin.
Click Remove all hidden items to move all hidden plot items to

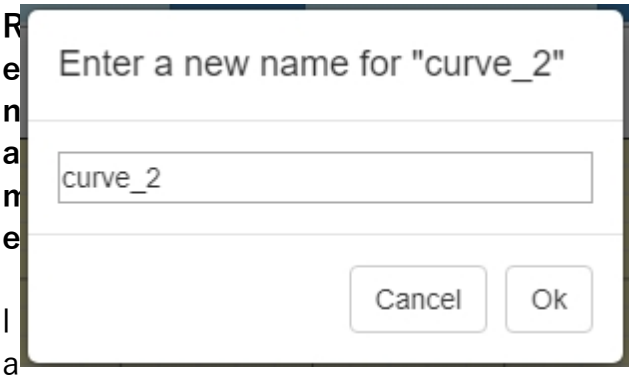
the recycle bin.
Click Hide all items to hide all plot items.
Click Show all items to show all plot items.

Curve properties pane

You display the "Curve properties pane" by checking **C-Prop** checkbox on the toolbar.
The pane opens with the "Curve" field populated with the names of all curves known to the plot. From the "Curve" field, you select the curve whose properties you wish to modify. The properties available within the property pane depends o the type of curve selected. You can hover over a property (or property value) to display a tool-tip.



- **Rename**



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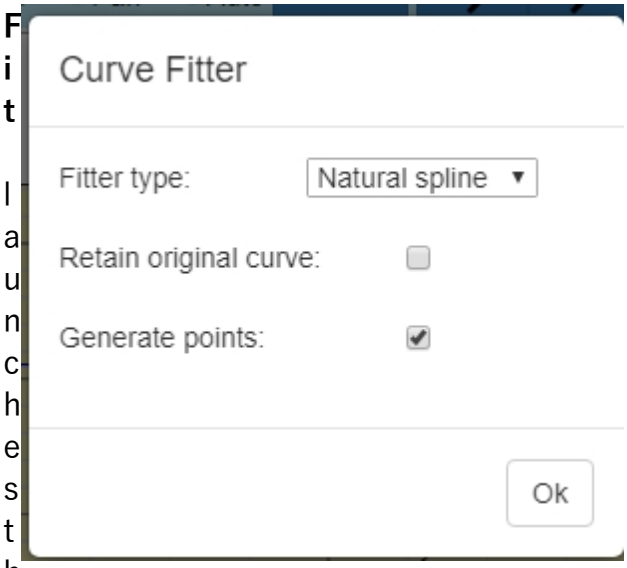
- **Remove** moves the curve, with all attributes, to the recycle bin.

- **Fit**



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- **Zone**

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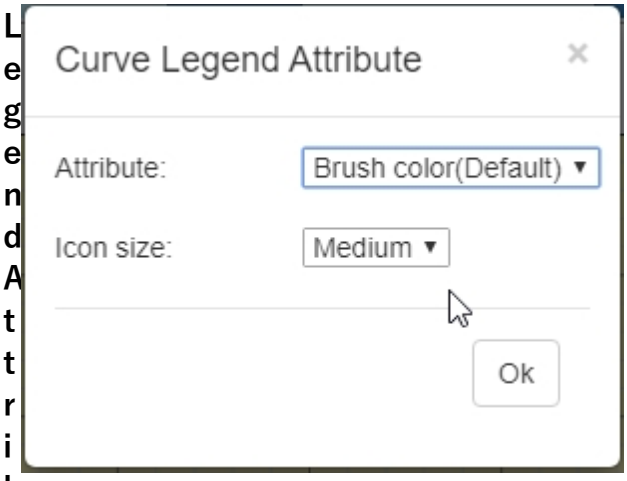
- **LegendAttributes**



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- **Orientation**

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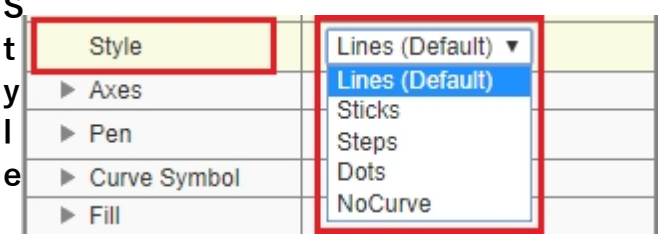
- **S t y l e**



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Lines Connect the points with straight lines. The line

esmight be interpolated depending on the 'Fitted' attribute. Curve fitting can be config

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baseline.
Steps Connect the points with a step function. The step

function is drawn from the left to the right or vice versa, depending on the Inverted attribut

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Dots

Draw dots at the locations of the data points. Note: This is different from added dotted line obtai

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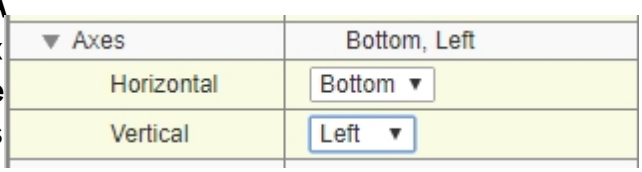
- **A x e s**



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- **S w a p a x e s**

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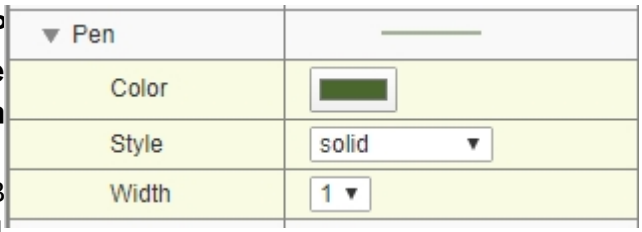
- **Pen**



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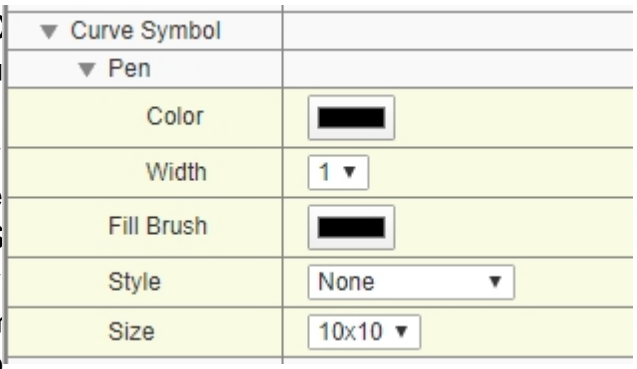
- **CurveSymbol**

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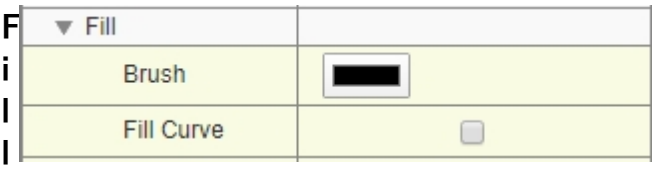
- **Fill**



If "FillCurve" is checked, the area between

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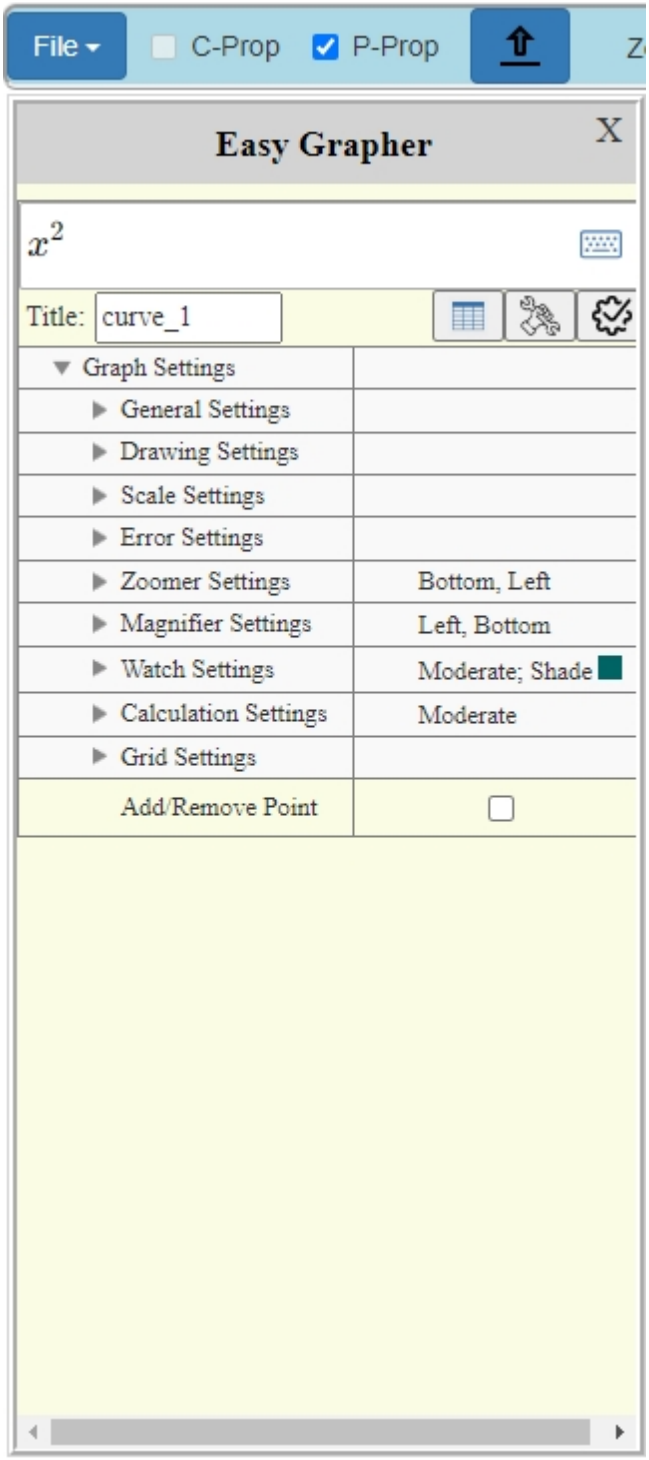
- **Baseline** Sets the value of the baseline.The baseline is needed for filling the curve with a brush or the Sticks drawing style. The interpretation of the baseline depends on the orientation. With *Vertical* orientation, the baseline is interpreted as a horizontal line at y = baseline value, with *Horizontal* orientation, it is interpreted as a vertical line at x = baseline value. The default value is 0.0.

Plot properties pane

You display the "Plot properties pane" by checking **P-Prop** checkbox on the toolbar. At the top of the pane there is a function input field that accepts an expression that is plotable. The Grapher is flexible and accepts various forms of expression. See Plotting Functions for more details. The row below the function input has a small text input to the left and three buttons to the right. The text input holds a automatically generated curve title. You can change this to any unique title you desire. See Plotting Functions for details on buttons to the right.
The pane has ten sections under Graph Settings. The **General Settings, Drawing Settings, Scale Settings, Error Settings, Zoomer Settings, Magnifier Settings, Watch Settings, Calculation Settings, Grid Settings and Add / Remove Point**.

General Settings
The "Title" tab allows for the setting of a Graph title text, text font, text color, and text weight.
The "Footer" tab allows for the setting of a Graph footer text, text font, text color,

and text weight.
The "Background" tab allows for the setting of the plotting area background color.
The "Legend" tab allows for the setting of legend area background color and how a curve is represented on the legend.



Scale Settings
The "Title" tab allows for the setting of the scales title text, text font, text color, and text weight.
The "Type and precision" tab allows for selecting either the linear or log scale. If a log scale is selected, you can set the base. The precision sets how the labels are shown on a scale. "Attibutes" allow for setting how scales are constructed during autoscaling.
The "User limits" tab allows for setting the scale limits. Check the "Enable user scale" checkbox to edit the scales.
The "Margins" tab allows for setting margins. Positive margins allow the curve to be fully displayed within the plotting area with room (margins) to spare.

Error Settings
Sets how the application responds when it encounters an error.

Zoomer Settings
This section allows the axes associated with the zoomer to be set. The default is to Zoom according to the current curve axes.

Magnifier Settings
This section allows the axes associated with the magnifier to be set. The default is the bottom and left.

Watch Settings
In this section you configure shading, and centroid watch.

The *Decimal places in* **Calculation accuracy** (see below) must be consistent with the decimal places in the axes scale for proper calculation on watches.

Note: If shading in auto scaling mode, the default is to shade up to the axis. This may result in poor graphical representation. You uncheck the **"Shade to axis"** checkbox to limit shading to within the bounding rectangle of the curve. This may result in the centroid marker being outside of the Plot Area. The bounding rectangle is the smallest rectangle that can be drawn around the curve(s)

Calculation accuracy
In this section you configure calculation accuracy. The default calculation accuracy is moderate. Generally, you choose a low accuracy for curves consisting of visible line segments and a high accuracy for smooth non-linear curves.
The *Decimal places in* **Calculation accuracy** must be consistent with the decimal places in the axes scale for proper calculation on watches, turning points and points of intersection. If *Enable user selection* is checked, the user can manually set the decimal places used in calculation for any axis. Otherwise, the decimal places are computed from algorithms.

Grid Settings
This section has three tabs that allow setting of the grid attributes.

Add/Remove Point
You enable "plotting with the mouse pointer" by checking "Add/Remove point". Double click in the plot area to add a point to the current curve. If no current curve exists, one is created. Select a point and left click to remove it from the current curve.

Additionally, you can drag and drop a selected point to a new position with the left mouse button. Drag the point outside the plot area to abort the drag-drop process.
You cannot remove the only point on a curve by this method. You must, instead, delete the curve. If there are more than one curve in the plot, use the Sidebar "dropdown select list" to choose the curve to which a point is added to or removed from.

Note:

1. To force the creation of a new curve, simply hide all existing curves by checking the legend item. The Grapher will not be able to find a current curve and is force to create one.
2. **Add/Remove point** enables mouse tracking and may affect performance. If not needed, disable Add/Remove point.

Quick start guides

Launching Grapher

You launch the Grapher from https://easy-grapher.herokuapp.com/. The Grapher opens with a new empty plot ready for curves.

Create a new plot

Create a new plot.

Adding curves to a plot

You have several ways to add curves to your plot.

- Plotting from data file
- Plotting functions
- Plotting with the mouse
- Plotting through the point entry dialog

Creating a plot

Creating a new plot

To create a new plot, launch the Grapher (https://easy-grapher.herokuapp.com/). The Grapher opens with a new empty plot ready for curves.

Open an existing plot

Use the **Upload Files** or **Mongo File System(MFS)** button on the toolbar to launch your systems or the Mongo cloud file explorer. Navigate to the plot file (i.e. files with the **.plt** extension) and open it in the Grapher.

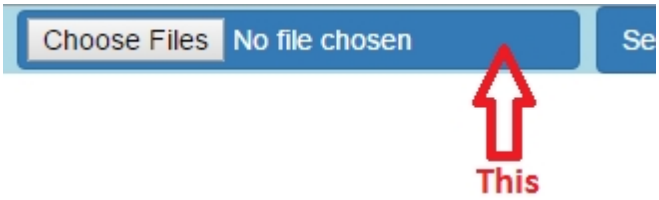
Plotting Data

The Grapher provides three ways of plotting data. They are

1. Plotting data from a file
2. Plotting functions
3. Plotting with the mouse pointer
4. Plotting through a point entry dialog

Plotting From Data File

The Grapher allows plotting of data stored in .txt, .xls, .xlsx, files on your system's hard drive or .txt files in your Mongo storage. Examples of valid data files are shown in Fig. 1 through Fig. 5. Simply click the "Choose Files" or "Mongo File System (MFS)" button on the menu to the file explorer. In the file explorer, navigate to the data file and



open or double click it. That's it.
You have the option of putting a keyword at the first line of a data file to instruct Grapher how the data should be plotted. Use the keyword **Curve** for Line Curves, keyword **Spectrocurve** for Spectrocurves and keyword **Spectrogram** for Spectrograms. Omitting the keyword forces Grapher to determine how the data should be plotted. Data files that contain only two values in the first line or row are plotted as Line Curves. Data files that contain only three values in the first line or row are checked to see if their x and y values described a xy grid. If an xy grid is described, the data is plotted as a Spectrogram otherwise it is plotted as a Spectrocurve .
The data files in Fig. 1 and Fig. 2 are plotted as Line Curves. The data file in Fig. 3 is plotted as a Spectrocurve. The data files in Fig. 4 and Fig. 5 are plotted as a Spectrogram.

Note: Put a # character at the beginning of any line to force the Grapher to ignore that line during plotting. For example, a line **# 8, 64** will be ignored by the Grapher.

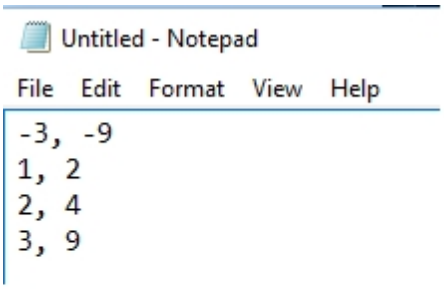


Fig. 1

1	Curve	
2	-4	16
3	-3.9	15.21
4	-3.8	14.44
5	-3.7	13.69
6	-3.6	12.96
7	-3.5	12.25
8	-3.4	11.56
9	-3.3	10.89
10	-3.2	10.24
11	-3.1	9.61
12	-3	9
13	-2.9	8.41
14	-2.8	7.84
15	-2.7	7.29
16	-2.6	6.76
17	-2.5	6.25
18	-2.4	5.76
19	-2.3	5.29
20	-2.2	4.84
21	-2.1	4.41
22	-2	4

Fig. 2

	A	B	C
1	1	1	1
2	2	2	4
3	3	3	9
4	4	4	16
5	5	5	25
6	6	6	36
7	7	7	49
8	8	8	64
9	9	9	81
10	10	10	100
11	11	11	121
12	12	12	144
13	13	13	169
14	14	14	196
15	15	15	225

Fig. 3

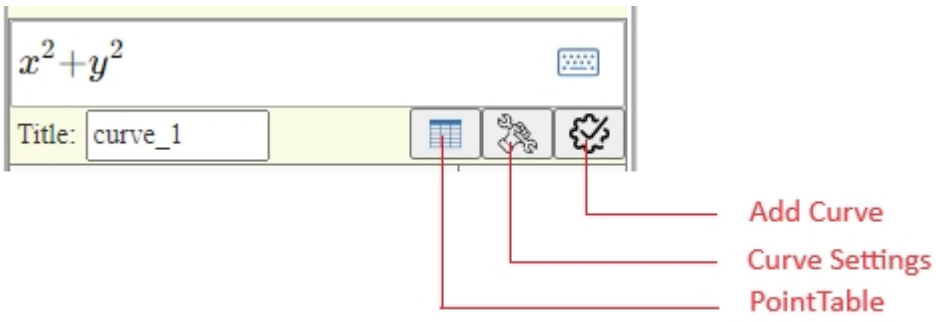
	A	B	C
1	-1.5	-1.5	0.031643707839
2	-1.5	-1.4	0.036868913141
3	-1.5	-1.3	0.043205078521
4	-1.5	-1.2	0.050925890723
5	-1.5	-1.1	0.060364707105
6	-1.5	-1	0.071908254910
7	-1.5	-0.9	0.085961674498
8	-1.5	-0.8	0.102852964217
9	-1.5	-0.7	0.122627356698
10	-1.5	-0.6	0.144684273530
11	-1.5	-0.5	0.167295160848
12	-1.5	-0.4	0.187295337351
13	-1.5	-0.3	0.200565304945
14	-1.5	-0.2	0.203695143566
15	-1.5	-0.1	0.195950440771
16	-1.5	0	0.179713598023
17	-1.5	0.1	0.158948872126
18	-1.5	0.2	0.137262759662
19	-1.5	0.3	0.116960333655
20	-1.5	0.4	0.099096623192
21	-1.5	0.5	0.083910503269
22	-1.5	0.6	0.071227094349
23	-1.5	0.7	0.060713552258

Fig. 4

	A	B	C
1	spectrogram		
2	-1.5	-1.5	0.054738642282
3	-1.5	-1.4	0.066403138845
4	-1.5	-1.3	0.081119648212
5	-1.5	-1.2	0.099601081401
6	-1.5	-1.1	0.122439857973
7	-1.5	-1	0.149666095988
8	-1.5	-0.9	0.179932286228
9	-1.5	-0.8	0.209520878761
10	-1.5	-0.7	0.232202640894
11	-1.5	-0.6	0.241486754355
12	-1.5	-0.5	0.234715009265
13	-1.5	-0.4	0.214970573375
14	-1.5	-0.3	0.188531463889
15	-1.5	-0.2	0.161052618441
16	-1.5	-0.1	0.135855007443
17	-1.5	0	0.114214340722
18	-1.5	0.1	0.096227972474
19	-1.5	0.2	0.081489292884
20	-1.5	0.3	0.069455275448
21	-1.5	0.4	0.059606835199
22	-1.5	0.5	0.051502625264
23	-1.5	0.6	0.044786385766

Fig. 5

Plotting Functions



The Grapher allows plotting of 2D and 3D functions. Click Curve Settings

button to launch the Curve Function dialog. In the dialog, set the various properties and click "Ok". Next click the Add Curve button to add a curve to the plot.

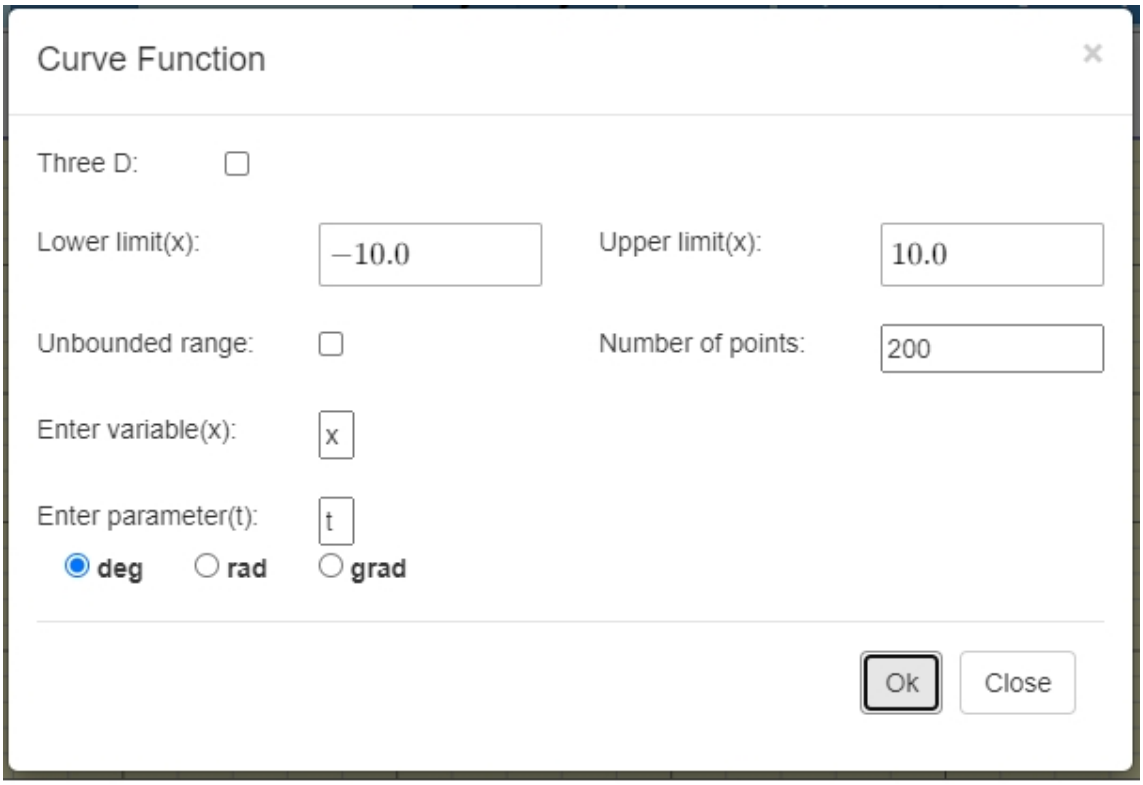


Fig. 1

Two D Functions

If the Three D checkbox in the Curve Function dialog is unchecked (Fig. 1), The Graphe

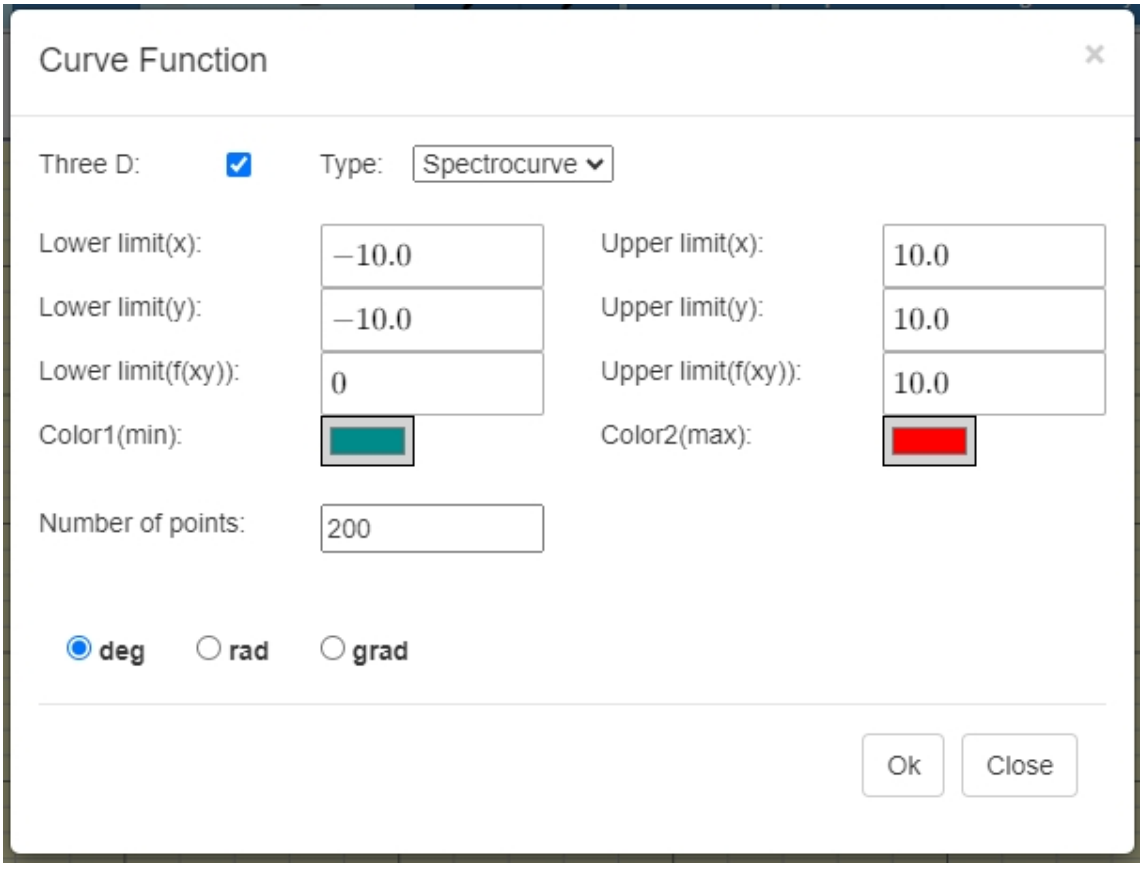


Fig. 2

r tries to plot a Two D curve of the functio n.
A 2D functio n may contain as many as five unkno wn coeffici ents.

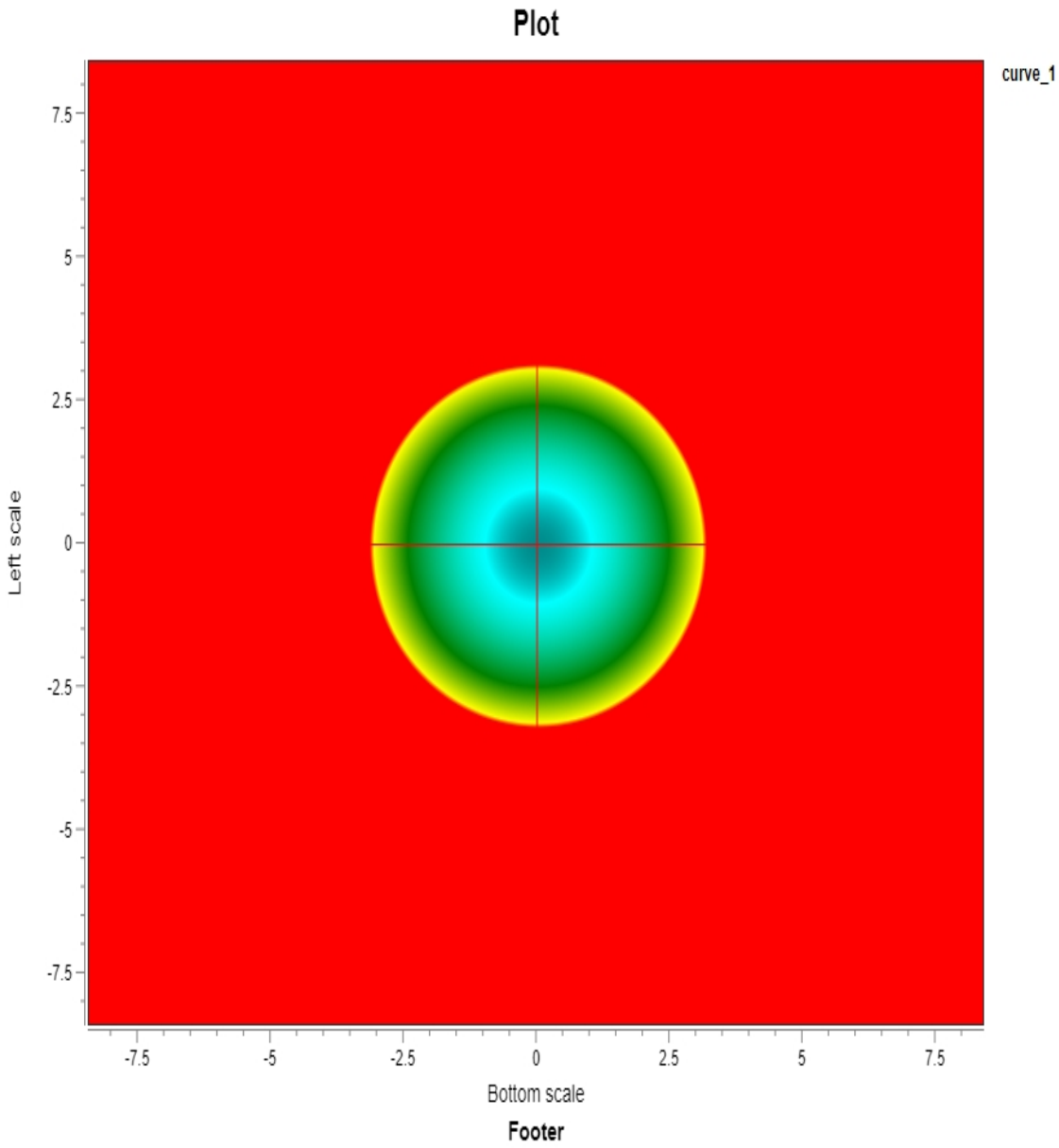


Fig. 3

The "Functi on" field of the dialog, allows many differe nt forms of inputs:

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  - 4 x ^ 2 4

x^2+2x+8, ax^2+bx+c

trigs - sin(x)cos(x)

4*sin(x)

a*c

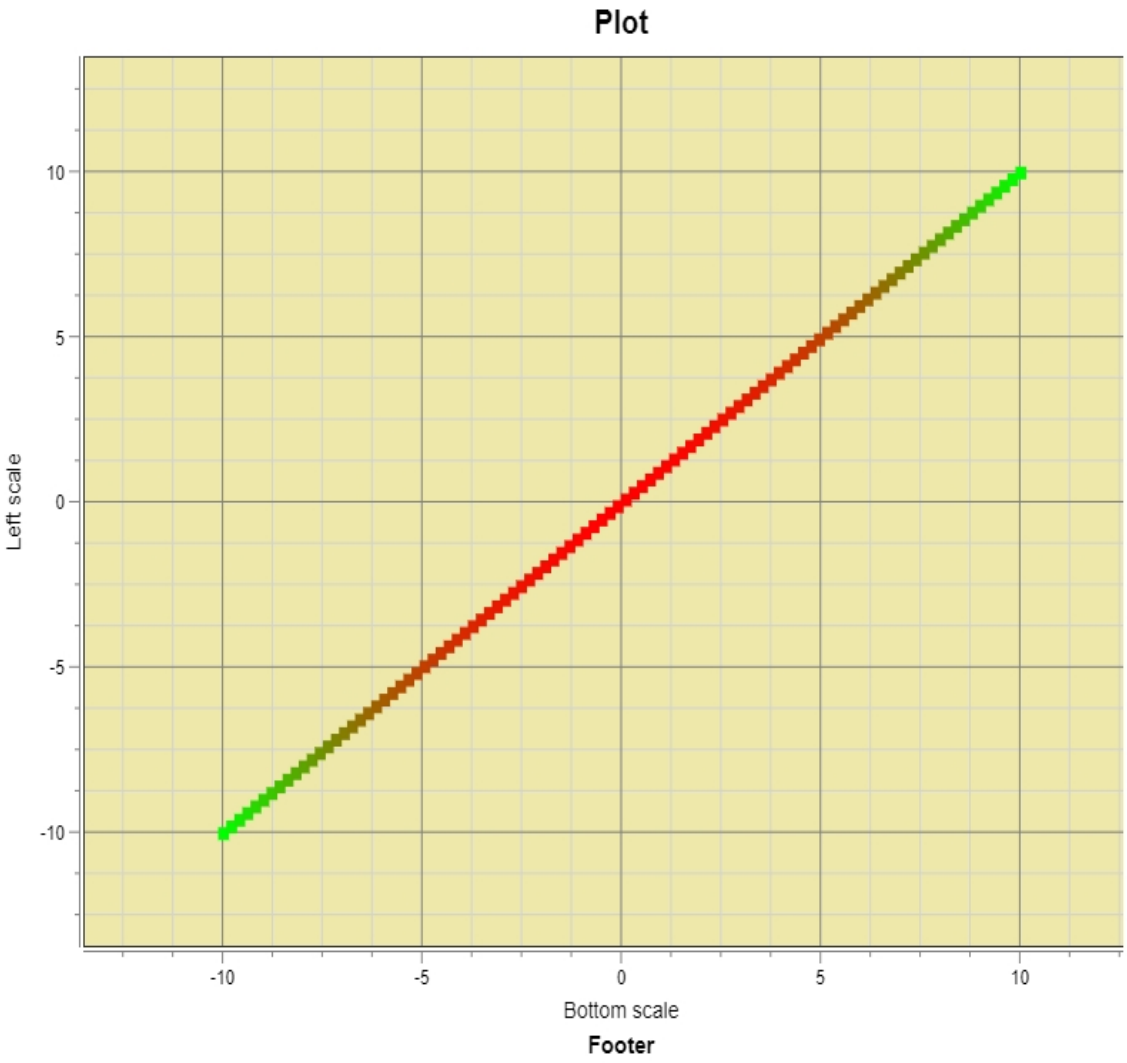

Fig. 4

os(x)

Notes: For trigs, the product sign is required di

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og3 is for base 3, etc. Use nor log (without the number

suffix)

fornaturallogarithm.

constants

- e, pi

Notes:
The "Lower limit" and "Upper limit" fields

accept numbers or expressions that evaluates to numbers. The expressions may contain Grapher constants such as e and PI or user defined constants. If variables other than x (for 2D) or x and y (for 3D) or the Grapher is unable to determine variable(s), the

"Enter variable" field is displayed. you must enter a valid variable. Valid variables are any alpha character other than 'e'. 'e' is a mathematical constant that is the base of the natural logarithm. The "Number of points" field can hold a value 2 or greater. Too high a value leads

to longer processing time. Too small a value leads to curves that are not very smooth. The default of 100 is adequate for most user cases. If periodic curves with many cycles are not drawn as expected, it is usually due to too small a value for "Number of points". If the

"Unbounded range" field is checked, the limits are disregarded. If the plot is panned, the curve is redrawn to the new limits created by panning. Theoretically, the limits are infinite. In the "Unbounded range" mode, curve points are computed on the fly but are not cached. Thus, point

dependent operations are not possible in this mode. In particular, ruler operations and shading of watch area will not work.

Three D Functions

If the Three D checkbox in the Curve Function dialog is checked (Fig. 2), The Grapher tries to plot

a Three D curve of the functio n. You set the Type field of the dialog to instruct Graphe r to plot either a Spectro curve or Spectro gram. Fig. 3 and Fig. 4 show a Spectro gram and Spectro curve, respect ively, of the functio n x^ 2+y ^ 2.

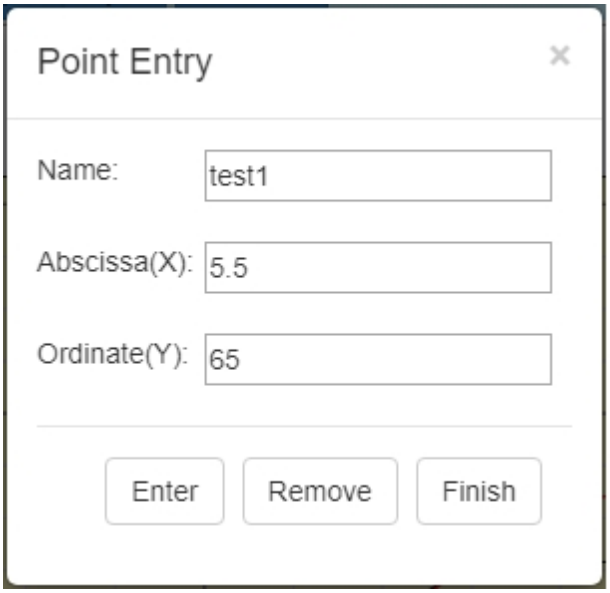
Plotting with the mouse pointer

You enable "plotting with the mouse pointer" by checking "Add/Remove point" in Plot Properties pane. Double click in the graph area to add a point to the current curve at the selected position. If no current curve exists, one is created. Left click a selected point to remove it from the current curve. You cannot remove the only point on a curve by this method. You must, instead, delete the curve. If there is more than one curve in the plot, use the Sidebar "drop-down list" to choose the curve to which a point is added to or removed from.

Note:

1. To force the creation of a new curve, simply hide all existing curves by checking the legend item. The Grapher will not find a current curve and is forced to create one.
2. **Add/Remove point** enables mouse tracking and may affect performance. If not needed, disable Add/Remove point.

Plotting Through Point Entry Dialog



You launch the Point Entry dialog through the File toolbar button.
The dialog has three fields for entering point data. They are:

- **Name** field
- **Abscissa(X)** field
- **Ordinate(Y)** field

At the bottom of the dialog there are three command bottoms. They are:

- **Enter** button
- **Remove** button
- **Finish** button

Command buttons are enabled/disabled based on point data information entered in the name, abscissa and ordinate fields.

Name	The name of the curve to be modified by point operation. If the Grapher cannot find a curve with that name, it creates a new curve with that name.
Abscissa(X)	The X - value of the point that is the subject of point operation.
Ordi	The Y - value of the point that is the

nate (Y)	subject of point operation.
Add	Enters the point (X, Y) in the curve identified by the name in the name field.
Remove	Removes the point (X, Y) in the curve identified by the name in the name field. The remove option is only available for existing curves with at least two points.
Finish	Closes the dialog.

Note:
The Name, Abscissa and Ordinate field entries are validated by the Grapher prior to enabling/disabling the Add and Remove options. Invalid data will result in both the Add and Remove option being disabled. The Abscissa and Ordinate fields accept numbers or expressions that evaluate to numbers. The expressions may contain Grapher constants such as e and PI or user defined constants.

Videos

Introducton

A brief description of the grapher window.

Your browser does not support the video tag.