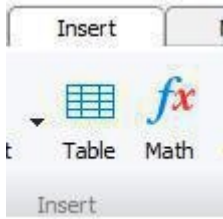


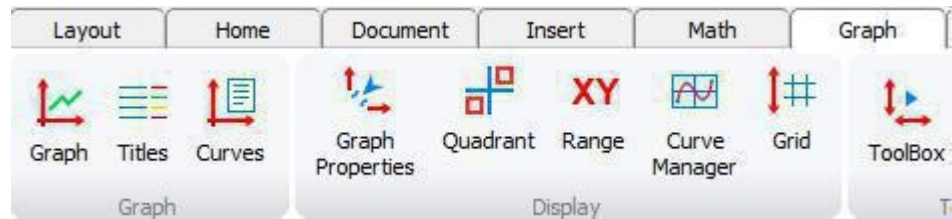
2D graphs in MatDeck

There are two ways of inserting a 2D graph in MatDeck. You can place it in a document like an object, or create a graph widget.

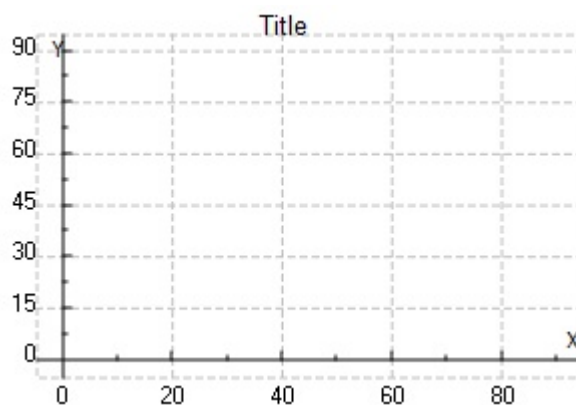
To insert a graph like an object, you can use the Insert tab > Graph icon (or you can use Graph tab > Graph icon) and choose the place in the document you want to place that graph.



Insert tab



Graph tab



Empty 2D graph object

To insert a graph widget, create a variable that contains the graph2d function within itself.

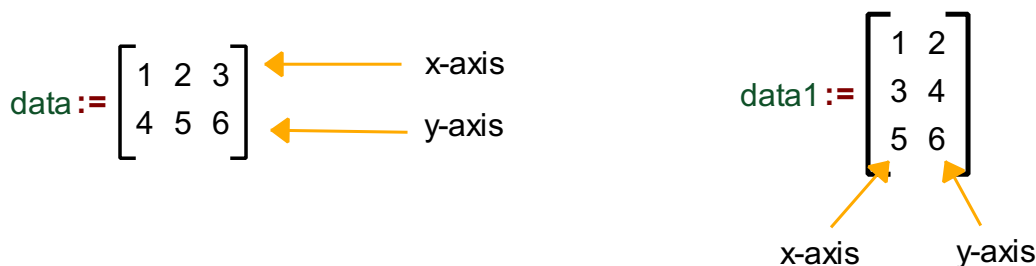
```
a1 := graph2d(0 , data matrix)
```

The zero value in the first argument means that this is the top level widget, because widgets are parent-child based.

For more information about widgets see GUIUserManual.pdf from the User Manual document.

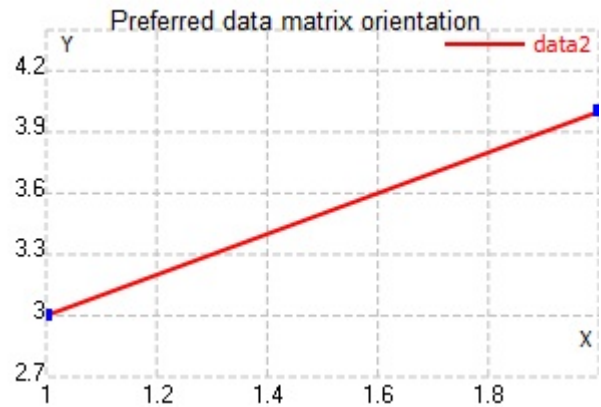
When a widget is created it is not visible, you can choose to embed it into a document (function **embed widget()**) or you can choose to show it as an independent object in a new window on the screen (function **show()**).

MatDeck 2D plots handles the data stored in a matrix with 2 columns or 2 rows, where one columns/column is the x-axis values and the other is the y-axis values. A matrix of data has to be stored in a variable.



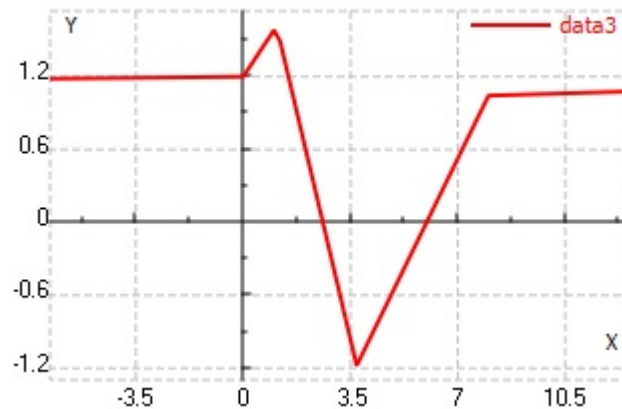
Column oriented matrices are preferred, for example if we have 2x2 matrix it can be considered that the first column has the x-axis values and in the second column has the y-axis values.

```
data2 := [ 1 2
           3 4 ]
```



If we have a vector of x-axis values for a graph and we want to create y-axis values, it can be done like this

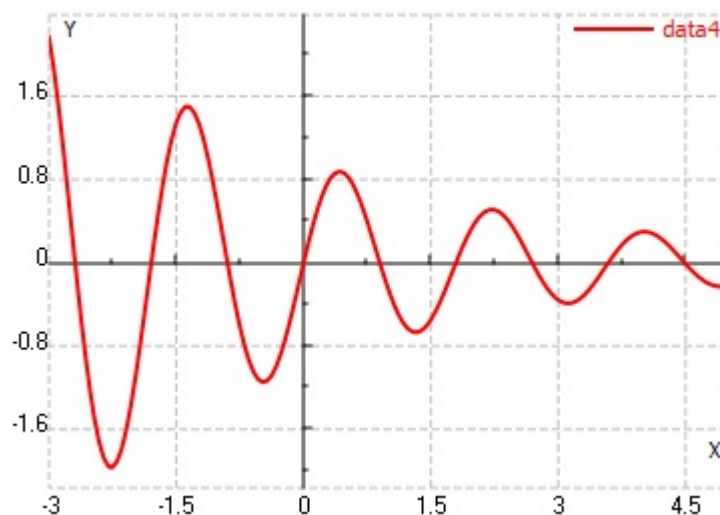
```
x1 := [ 8 1 -6.3 0 1.2 12.45 3.7 ]
xs := sort(x1, "a")
y := cos(xs) + sin(xs) + 0.2
data3 := join_mat_rows(xs, y)
```



If we want to plot the function $y = e^{-0.3x} \sin(3.5x)$ for $-3 \leq x \leq 5$, we do as follows:

```
data4 := curve2d(e-0.3 x · sin(3.5 x), -3, 5, 300)
```

Function x start value x end value Number of samples for x

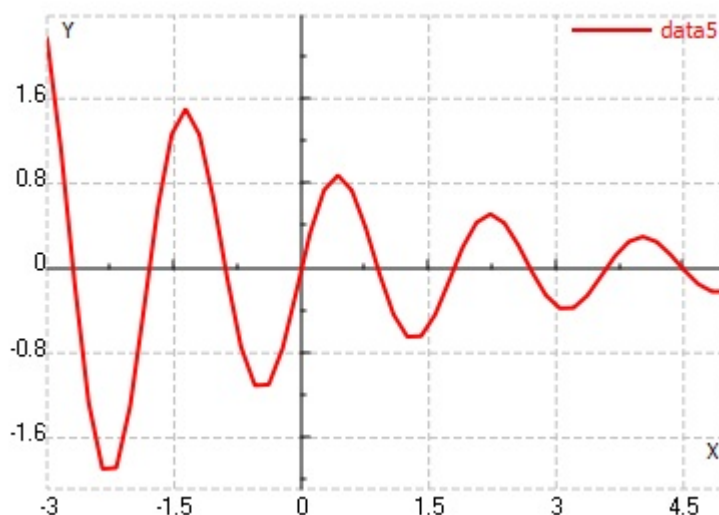


Function **curve2d** result is a matrix, in the above example, the size of the result matrix is 300x2, where the x-

axis data (first column) are values between -3 and 5 divided into 300 samples. The y-axis data (second column) is corresponding values of the specified function for the x values.

Changes of the number of samples argument will affect the accuracy of the graph, if we decrease the number of samples in the above sample to 50, the graph will look like this

$$\text{data5} := \text{curve2d}\left(e^{-0.3x} \cdot \sin(3.5x), -3, 5, 50\right)$$



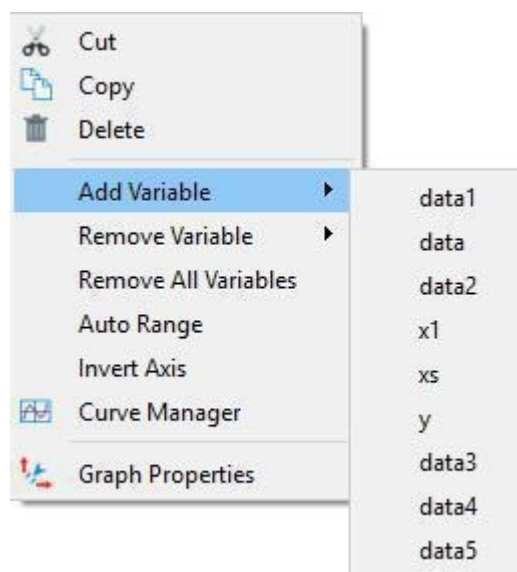
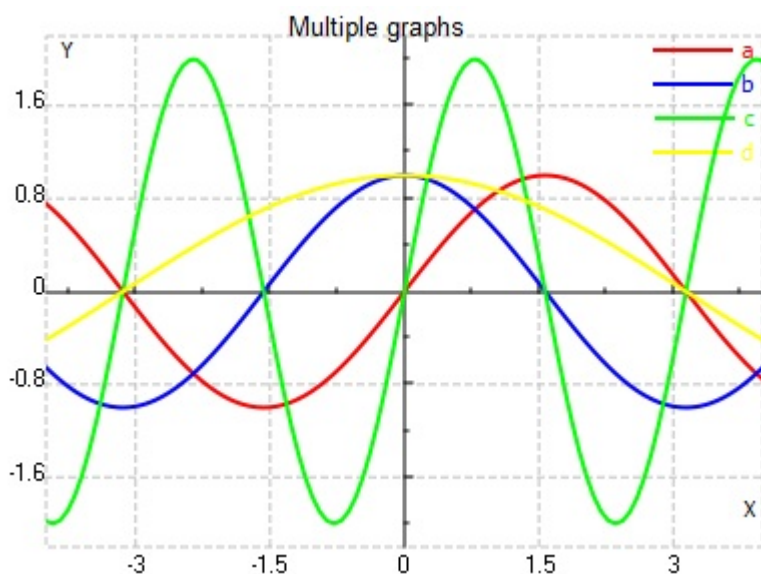
If we want to plot the several graphs on the same graph object, create the graphs data, save it in some variables, and from the context menu choose the variables that you want to plot

$$a := \text{curve2d}\left(\sin(x), -4, 4, 200\right)$$

$$c := \text{curve2d}\left(2 \cdot \sin(2x), -4, 4, 200\right)$$

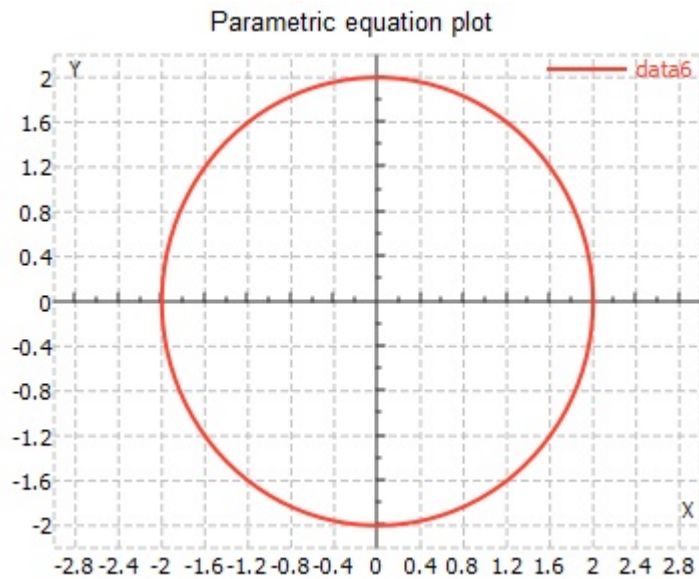
$$b := \text{curve2d}\left(\cos(x), -4, 4, 200\right)$$

$$d := \text{curve2d}\left(\cos\left(\frac{x}{2}\right), -4, 4, 200\right)$$



Another function that we can use for plotting graphs in 2D is `curve2d_param()` that expects graph equation in parametric form. Result of this function is matrix with same form as with `curve2d()` function. Function result we have to store in a variable and choose to plot from 2D graph context menu. For example, if we want to plot the circle with parametric equations functions we will do it like this

```
data6 := curve2d_param(2 cos(t), 2 sin(t), 0, 2 pi, 100)
```



When we talk about the plot forming, there are a wide range of formatting options that you can implement in your graph: add a title to the plot, add axis names, format the axis font style, add legend, change the thickness and color of plot, change plot line style, draw source data points, draw inner data points, change the axis numeration style and change grid size, change the axis base from linear to logarithmic, and much more.

Here are a several examples of plot formatting in MatDeck.

