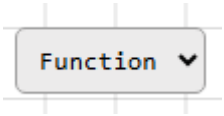
MATHCRAFT

User manual

GRAPH MODES:

There are three main graph modes:

- **Function**: used to draw any curve which can be represented in x.
- **Circle**: used two draw circles.
- **Ellipse**: used to draw ellipses.

You can change modes by using the mode selector 

Function mode:

Using this mode, you can graph any curve that you can represent in terms of x *(eg: tan(x))*. To create a new equation, click the Add new equation button which will give you an interface to enter your equation.

- **Equation:** the expression in terms of x
- **Domain:** The range of x axis to cover. (entire x-axis by default) ---> [a,b]

- **Color:** It is a color picker that will allow you to choose any color for the graph

With every equation you create there will be a corresponding equation control bar on the left-hand side of the screen. This holds true in any graph mode.

It allows you to do the following actions

- **Edit:** You can edit the equation (change expression, color etc...) by clicking the pencil button.
- **Delete:** You can delete the equation by clicking the cross button
- **Select:** You can select the equation by clicking the cursor button. This will change the equation color into white or black depending on your theme. You can perform commands on any selected entities which we will see further.

Below is the input syntax for expressions while drawing your equations. The renderer can draw almost any type of curve that can be represented in terms x. It can't handle more than one variable yet. Hence, we have different modes.

Operations:

Operation	Symbol
Addition	+
Subtraction	-
Multiplication (implicit multiplication not allowed eg: 3x, enter 3*x)	*
Division	/
Exponentiation	^ or **

Functions:

Functions	Symbols
sin	sin
cos	cos
tan	tan
ln (natural log)	ln
log (log to base 10)	log
tan inverse	atan

sin inverse	asin
cos inverse	acos
modulus	abs
exponents e^(f(x))	exp(f(x))
square roots (f(x))^0.5	sqrt(f(x))

Symbols:

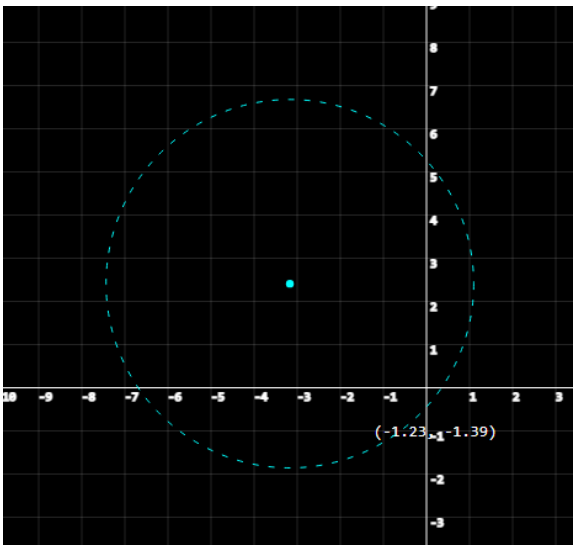
The only symbol you can enter is the number e: Syntax is a capital e --> E.

It's important that you pay attention to the order of precedence while writing your equations. Make good use of brackets to control which sub-expression has a higher precedence.

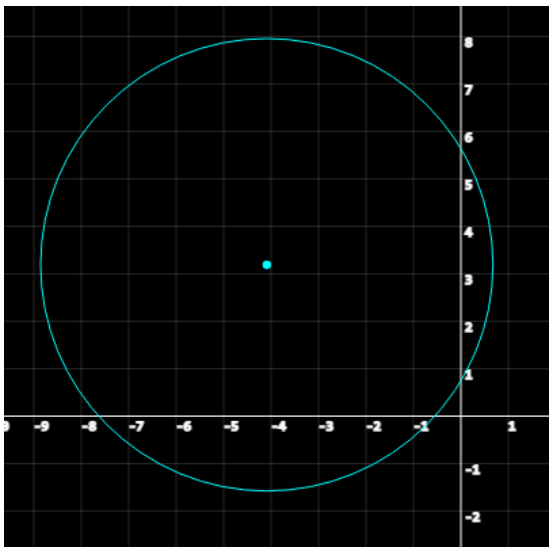
Example, exp((x-sin(x))^2)

Circle mode:

In this mode you can create circles on the fly. Left-click ---> hold-and-drag.



When you drag, you get a preview



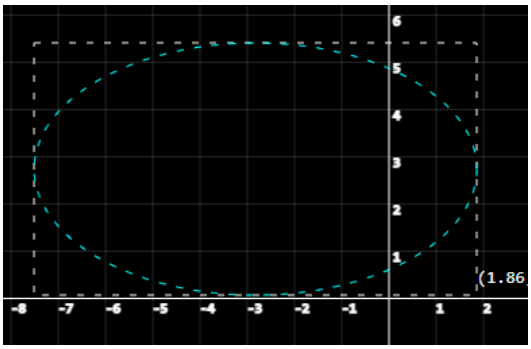
When you lift the mouse you get the circle

When you are in circle mode and click the add new equation button, it will give you an interface to make more accurate circles as seen below

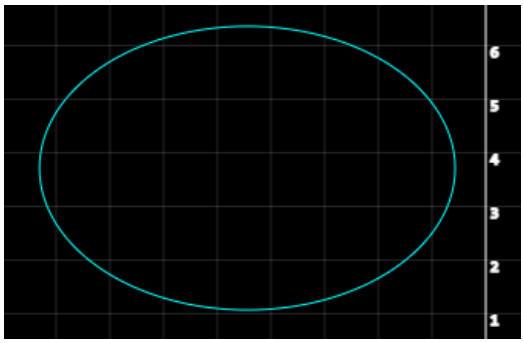
Here you can enter the center and radius more accurately than dragging.

Ellipse mode:

Just like the circle mode you can drag and draw ellipses. Left-click ---> hold-and-drag.

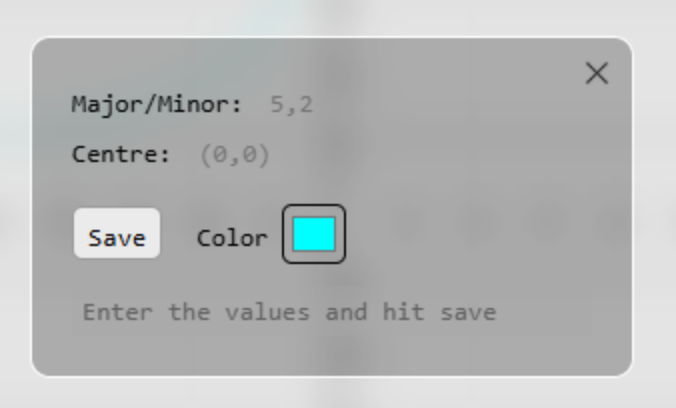


When you drag while holding left click



When you let go of left click after drag

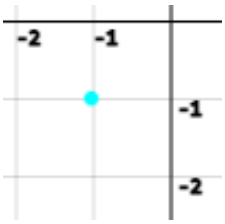
Just like the circle mode when you click on the add new equation button while in ellipse mode, you will get an interface to draw ellipses more accurately.



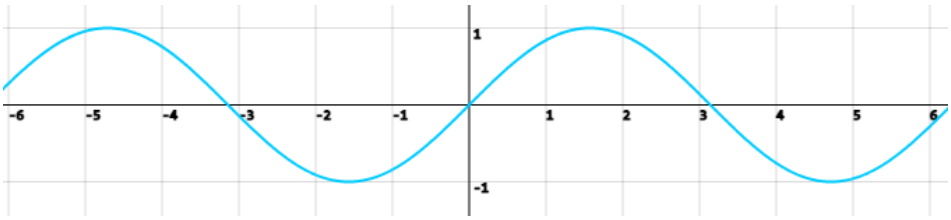
ENTITY INHERITANCE CHAIN:

In Mathcraft anything that you can draw on the graph is known as an entity. As of now there are two child objects that come under the Entity label.

- **Points:** No matter what graph mode you are in you can always add points by left clicking or using the add point command (more on commands later).
- **Equations:** These are all the different types of curves you can render as seen previously.



points



Equations

SELECTING ENTITIES:

One of the most powerful features of Mathcraft, is that it allows you to select any entity on the screen. Selecting entities allows you to perform commands on them.

For example, for the roots command mathcraft needs to know which equation you want to find the roots of, hence you select the equation first.

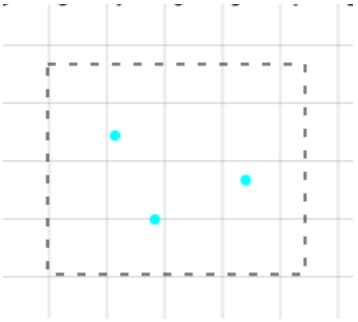
There are many ways you can select entities:

Selecting points:

There are two ways to select points. Either directly clicking on the point you want to select or use a selection box to select one or more points.

To use the selection box: Right-click ---> hold-and-drag

When you lift the right mouse button, all the points within the selection box will be selected. All selected entities will either turn white or black according to the theme you are in.



Selecting equations:

There are two ways to select any equation in any graph mode. You can either click on the equation you want to select or click on the corresponding select button in the equation control bar.

Select button

by clicking on the equation

COMMANDS:

Commands are actions performed on selected entities. This is a way by which different entities can interact with each other. Points with equations, points with points and so on.

Here is the list of commands that are implemented as of now.

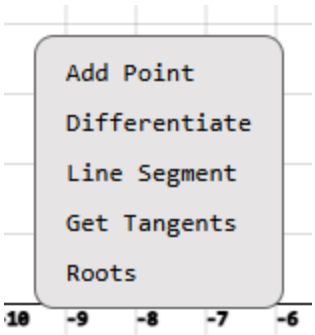
Command	What it does
Get Tangents	Gets the tangents from or at a point of any equation
Differentiate	Will graph the derivative of the selected curve. Only equations made in function mode
Add point	Gives an interface to add points more accurately
Open	Opens the selected points and allows you to edit them
Roots	Will plot the roots of any equation
Line Segment	Will plot a line between two points
Best fit	Will plot the line of best fit for selected points. If no selected points, then it will consider all the points as inputs.
Remove All	It will remove all selected entities. Points and equations.

There will be many more in the future.

Execution of a command.

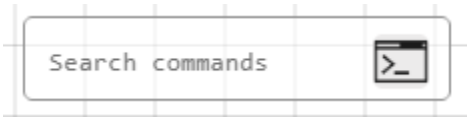
There are two ways to execute a command

1. **Command context menu:** When you right click on the graph, it will show you all the possible commands you can execute based on the state of your graph. Every time you add or remove an entity you are changing the state of the graph. To execute a command just click on the one you want.

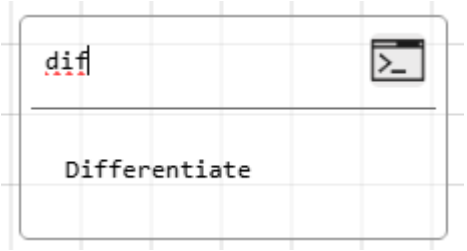


Command menu.

2. **Search bar:** There is a search bar on the top-right of the screen. Using this you can type and search for commands that are available, then either press enter or click on the command line button to execute.



If you execute a command which is half written as seen below, it will execute the command closest to the string you entered. If it can't find any, then it will give an error.



If you do not meet the requirements for a command that you are trying to execute it will give you an error telling you the proper requirements. For example, if you execute the differentiate command without having a selected equation in your graph, it will give the following error.