plot3d

three-dimensional plotting

Calling Sequence

plot3d(expr, x=a..b, y=c..d, opts)

plot3d(f, a..b, c..d, opts)

plot3d([exprf, exprg, exprh], s=a..b, t=c..d, opts)

plot3d([f, g, h], a..b, c..d, opts)

Parameters

`expr`	-	expression in **x** and **y**
`f, g, h`	-	procedures or operators
`exprf, exprg, exprh`	-	expressions in **s** and **t**
`a, b`	-	real constants, procedures, or expressions in **y**
`c, d`	-	real constants, procedures, or expressions in **x**
`x, y, s, t`	-	names
`opts`	-	(optional) equations of the form **option=value** where **option** is described in plot3d/option

Description

- The **plot3d** command computes the plot of a three-dimensional surface. The first two calling sequences describe surface plots in Cartesian coordinates, while the second two describe parametric surface plots.

Other plotting facilities include the plot command for 2-D plotting, the plots package for specialized plots and the plottools package for plotting objects.

For further resources for plotting, and a pictorial listing of the

See Also

coords
plot
plot/colornames
plot/colorscheme
plot/computation
plot/device
plot/interface
plot3d/colorfunc
plot3d/coords
plot3d/option
plot3d/structure
plots
plotsetup
Plotting Guide
plottools
Using the Interactive Plot Builder

available types of plots, see the Plotting Guide. **Note** that this guide is only available in the Standard interface.

- Maple includes the **Interactive Plot Builder**, which provides a point-and-click interface to the plotting functionality including two and three-dimensional plots, animations, and interactive plots with sliders. To launch the **Plot Builder**, run the **plots[interactive]** command. You can also launch the **Plot Builder** in the Standard Worksheet from the **Tools** menu. Select **Assistants**, and then **Plot Builder**. For more information, see Using the Interactive Plot Builder.
- In the first calling sequence, **plot3d(expr, x=a..b, y=c..d)**, the expression **expr** must be an expression in the names **x** and **y**. The range **a..b** must evaluate to real constants and the range **c..d** must either evaluate to real constants or be expressions in **x**. Alternatively, the range **c..d** must evaluate to real constants and the range **a..b** must either evaluate to real constants or be expressions in **y**. These specify the range over which **expr** is plotted.
- In the second calling sequence, **plot3d(f, a..b, c..d)**, **f** must be a procedure or operator that takes two arguments. Operator notation must be used, that is, the procedure name is given without parameters specified, and the ranges must be given simply in the form **a..b**, rather than as an equation. At least one of the ranges must have arguments evaluating to real constants; the other range may have arguments evaluating to real constants or be procedures of one variable.
- A parametric surface can be defined by three expressions **exprf, exprg, exprh** in two variables. In the third calling sequence, **plot3d([exprf, exprg, exprh], s=a..b, t=c..d)**, **exprf**, **exprg**, and **exprh** must be expressions in the names **s** and **t**. In the fourth calling sequence, **plot3d([f, g, h], a..b, c..d)**, **f**, **g**, and **h** must be procedures or operators taking at most two arguments. As with the second calling sequence, operator notation must be used.
- With any of these calling sequences, the range arguments may be omitted. In that case, the **plot3d** command assumes default ranges of -10 to 10, or -2π to 2π in the case where a trigonometric function is detected. The first argument **f** or **expr** can also be omitted or set to the empty list **[]**, in which case an empty plot is created.
- Any additional arguments are interpreted as options, which are specified as equations of the form **option = value**. For example, the option **grid = [m, n]** where **m** and **n** are positive integers, specifies that the plot is to be constructed on an **m** by **n** grid at equally spaced points in the ranges **a..b** and **c..d** respectively. By default, a 49 by 49 grid is used and 2401 points are generated.

Other options include specification of alternate coordinate systems and rendering styles. For more information, see plot3d/options.

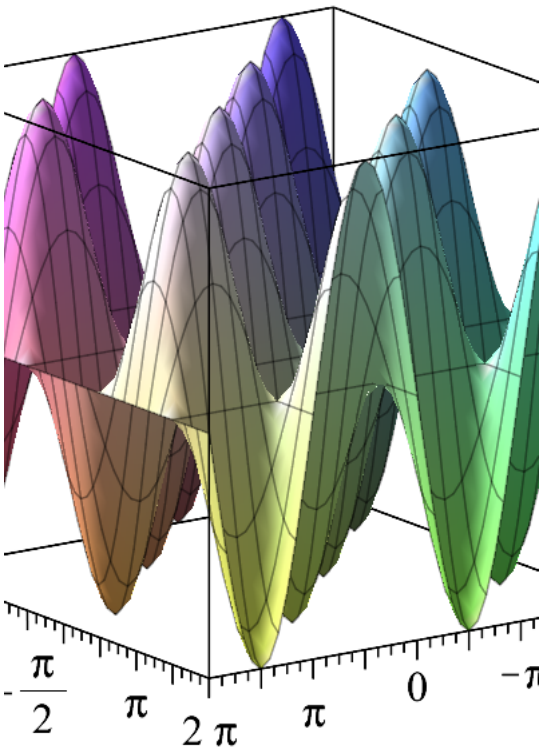
- If the first argument in any of the calling sequences is a set or list of surfaces, then the surfaces are plotted together. If a list is provided, then particular option values can also be given as lists, with elements corresponding to elements of the list of surfaces. The options that can take lists as values are: **color**, **coords**, **grid**, **linestyle**, **numpoints**, **shading**, **style**, **symbol**, **symbolsize**, **thickness**, and **transparency**. A list of three algebraic expressions or procedures is always interpreted as a parametric plot. To specify a list of three distinct plots, the option **plotlist=true** (or simply **plotlist**) must be provided.
- Plots in alternative coordinate systems, such as spherical and cylindrical systems, can be generated by using the **coords** option. For more information, see the examples below or the plot3d/coords help page.
- There are several ways to color 3-D surfaces created by the **plot3d** command. See the plot/color, plot3d/colorfunc and plot/colorscheme help pages for more information.
- When **plot3d** evaluates its arguments, any errors generated during the evaluation are suppressed. A symptom that something has gone wrong with the evaluation of your expression is a resulting empty plot.
- Help pages describing plotting commands and interactive plotting features are written with the assumption that you are using the Standard Worksheet interface. If you are using a different interface, see plot/interface.
- An output device may be specified using the plotsetup command. See plot/device for a list of supported devices.
- The result of a call to **plot3d** is a **PLOT3D** data structure containing enough information to render the plot. The user can assign a **PLOT3D** value to a variable, save it in a file, then read it in for redisplay. For more information, see plot3d/structure.
- All plotted expressions are evaluated numerically, that is, as floating point expressions, rather than symbolically. For more information about the computational environment used by the **plot3d** function, see plot/computation.

Examples

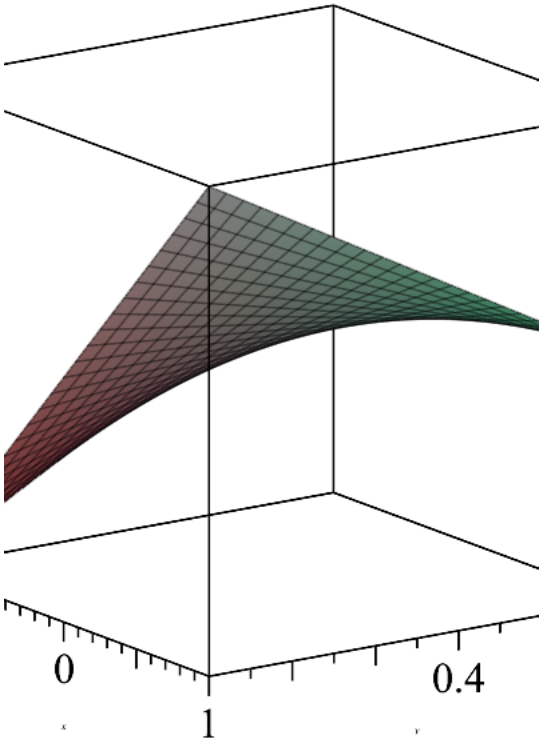
Default ranges in 3-D plots

For trigonometric functions, default ranges of -2π .. 2π is used.

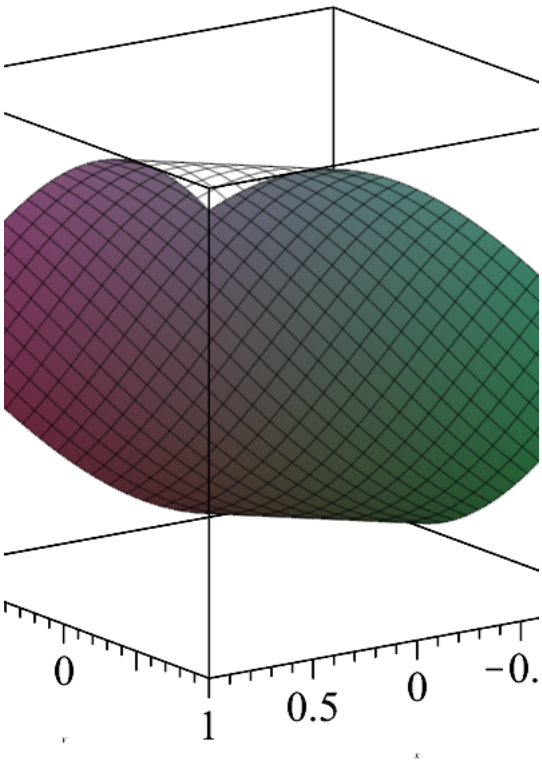
```
> plot3d(sin(x) * cos(y));
```


$-\frac{\pi}{2}$
π
2 π
π
0
−π

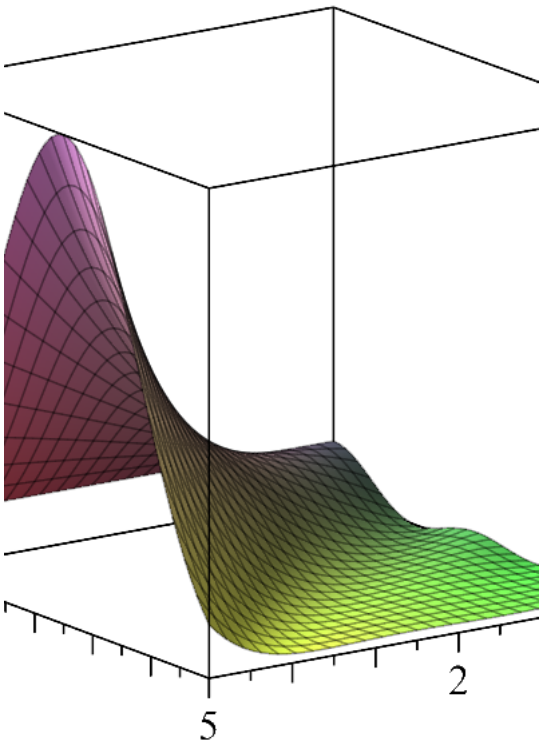
>


0
0.4
1

>

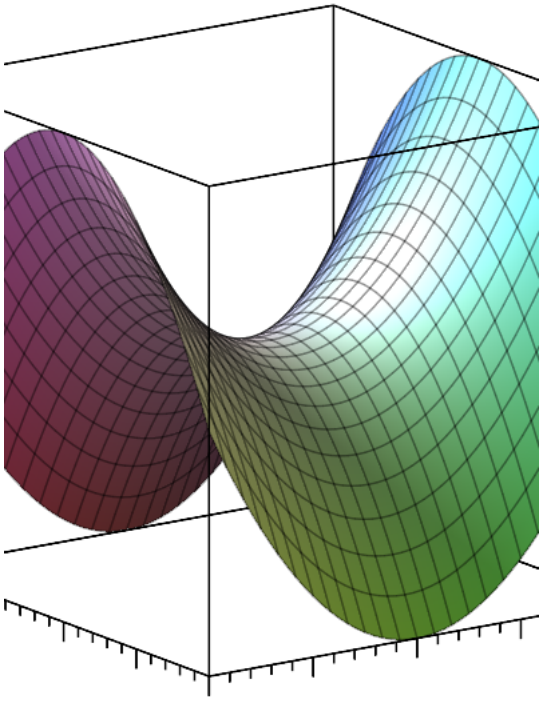

0
1
0.5
0
-0.

>

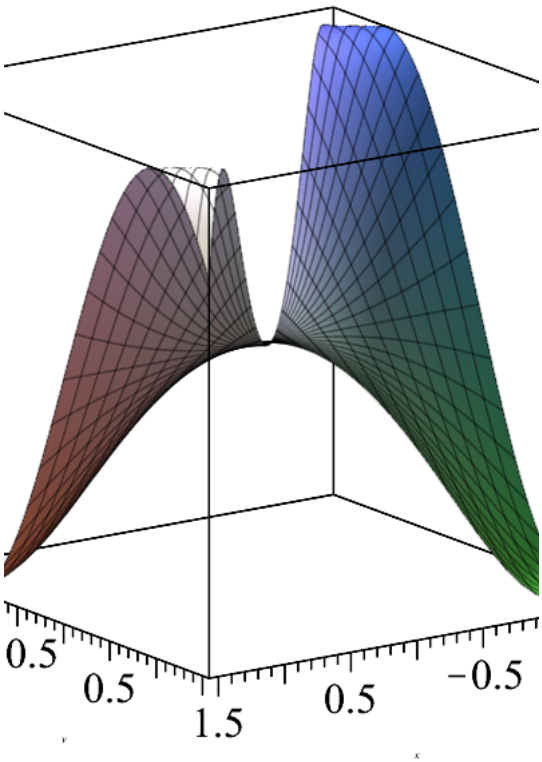

5
2

>

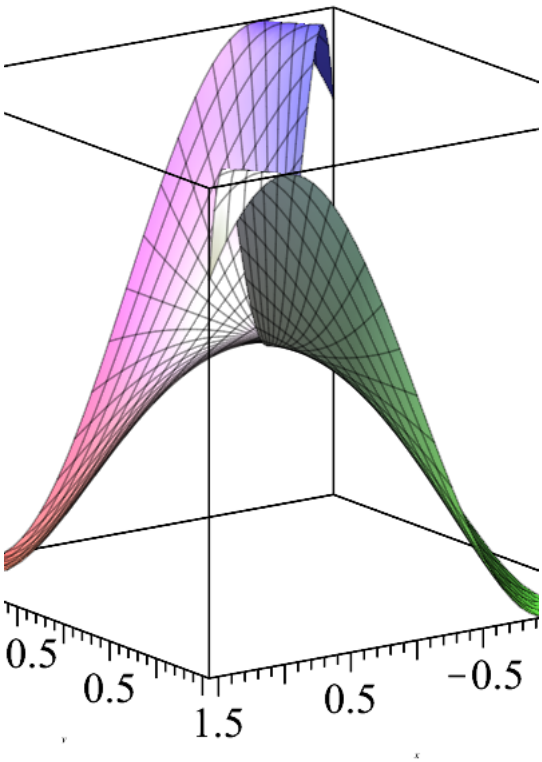
>



>


0.5
0.5
1.5
0.5
−0.5

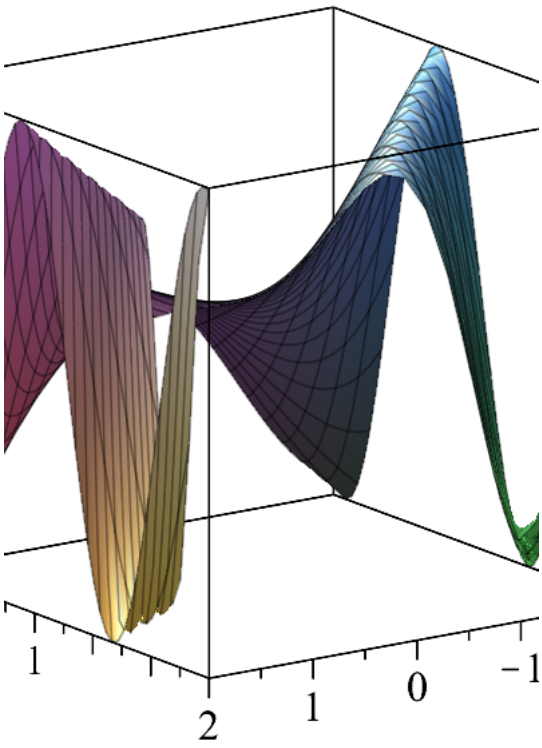
>


0.5
0.5
1.5
0.5
−0.5

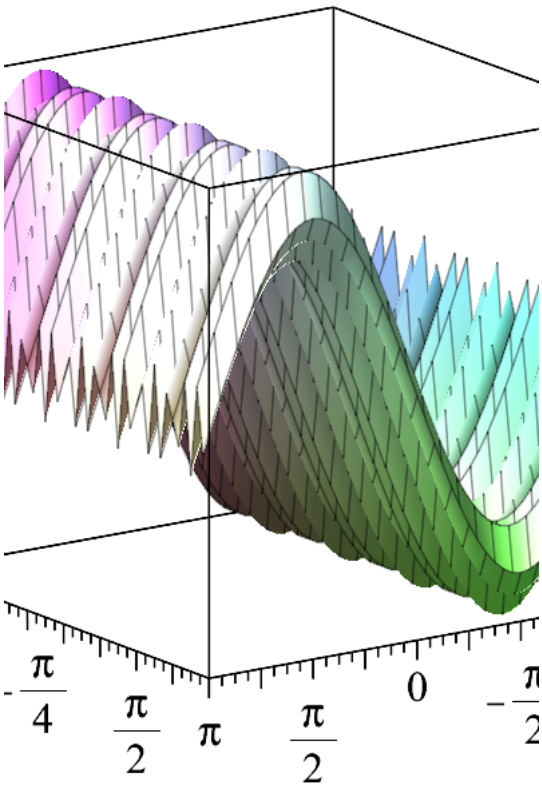
>

>

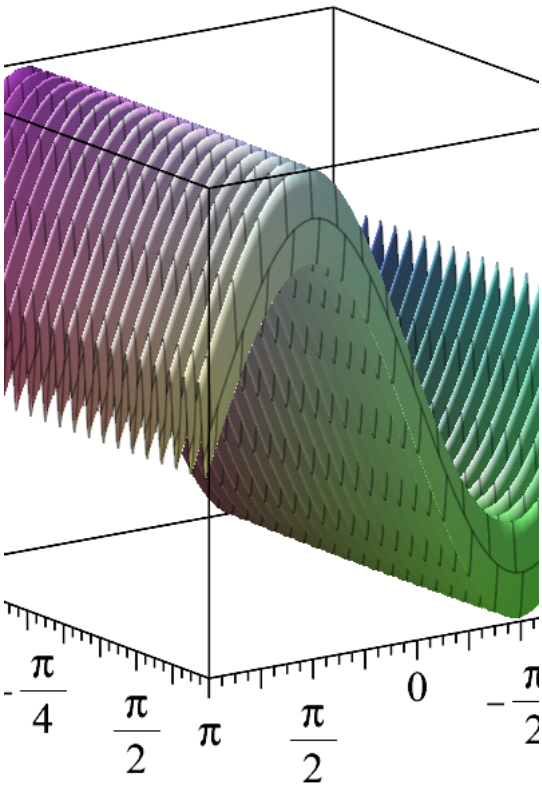
>


1
2
1
0
−1

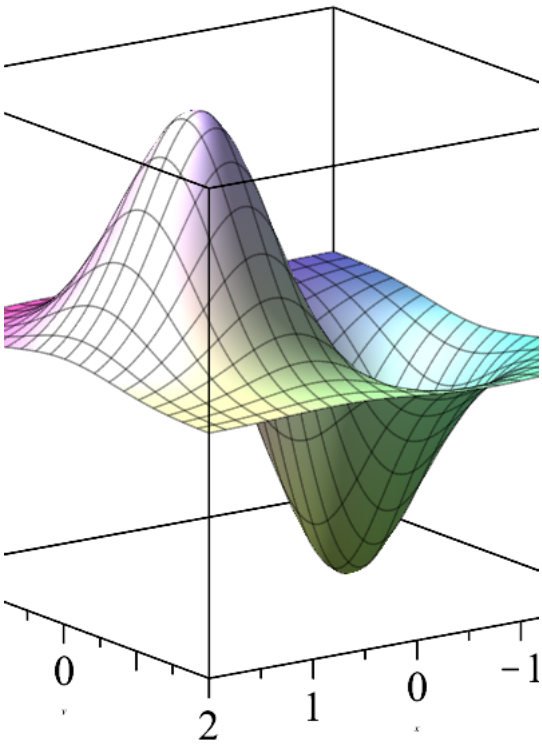
>


$-\frac{\pi}{4}$
$\frac{\pi}{2}$
π
$\frac{\pi}{2}$
0

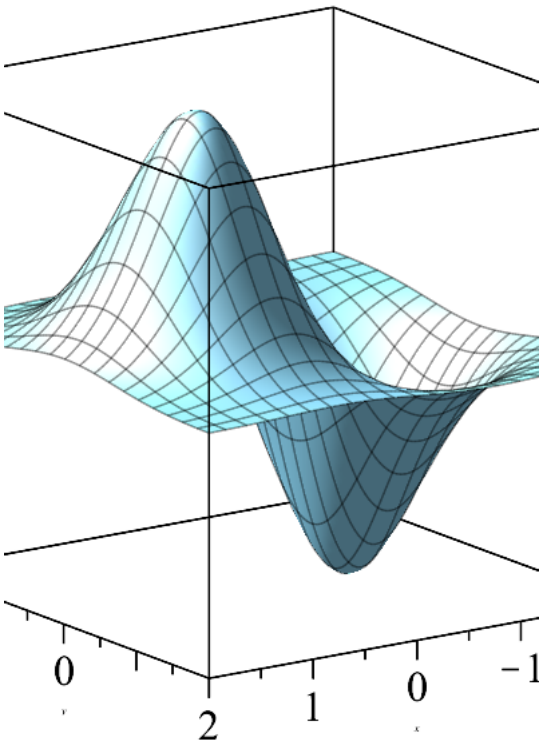
>


$-\frac{\pi}{4}$
$\frac{\pi}{2}$
π
$\frac{\pi}{2}$
0

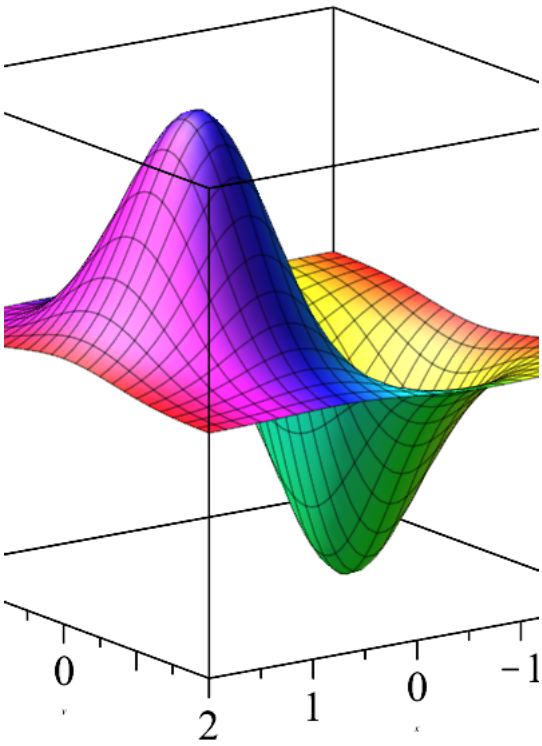
>


0
2
1
0
−1

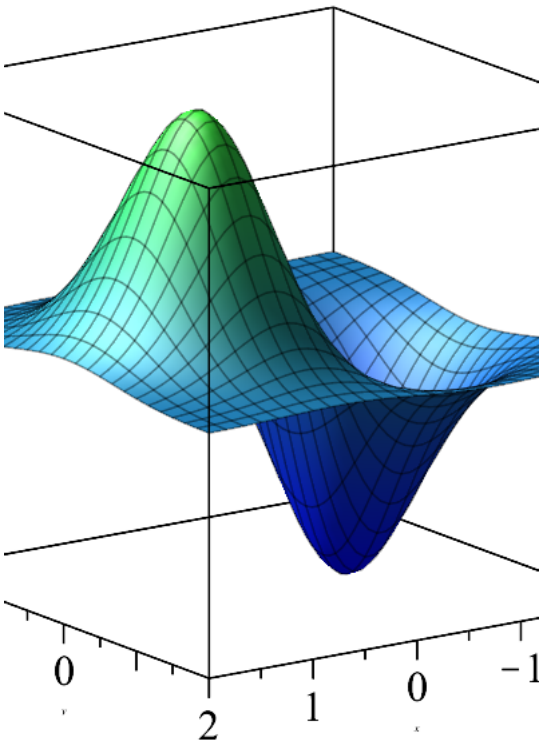
>


0
2
1
0
−1

>


0
2
1
0
−1

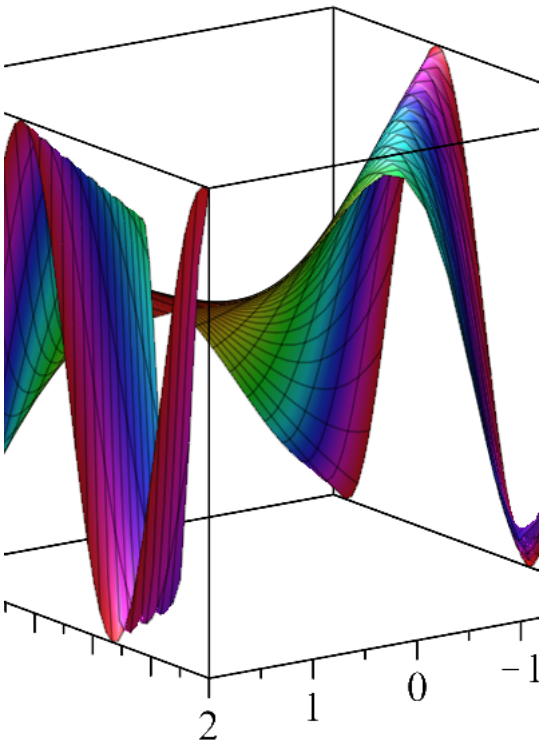
>


0
2
1
0
−1

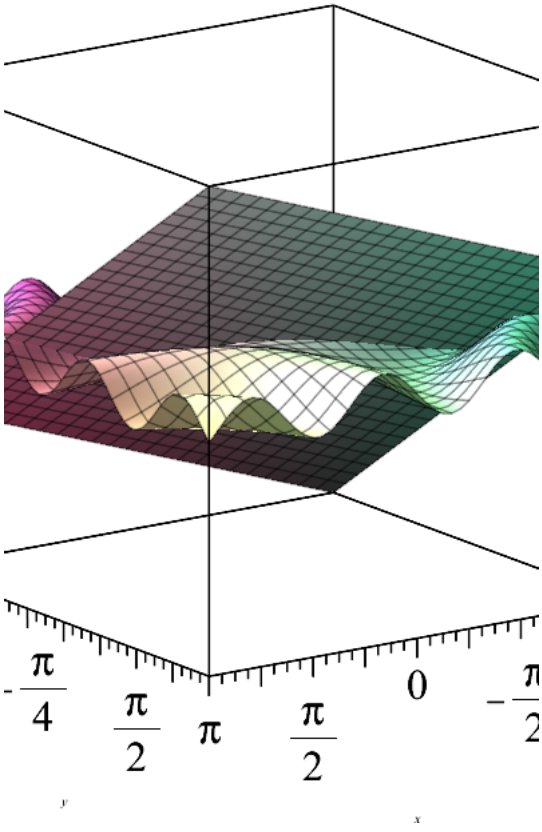
>

>

>


2
1
0
−1

>


$-\frac{\pi}{4}$
$\frac{\pi}{2}$
π
$\frac{\pi}{2}$
0
$-\frac{\pi}{2}$

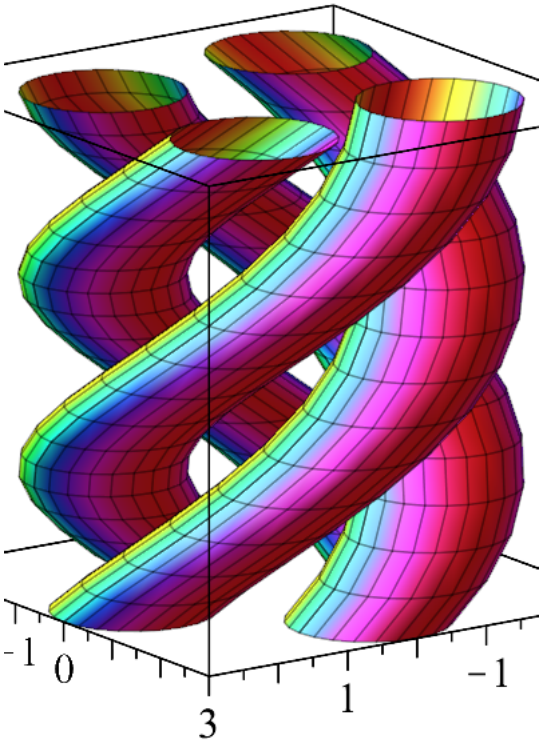
>

>

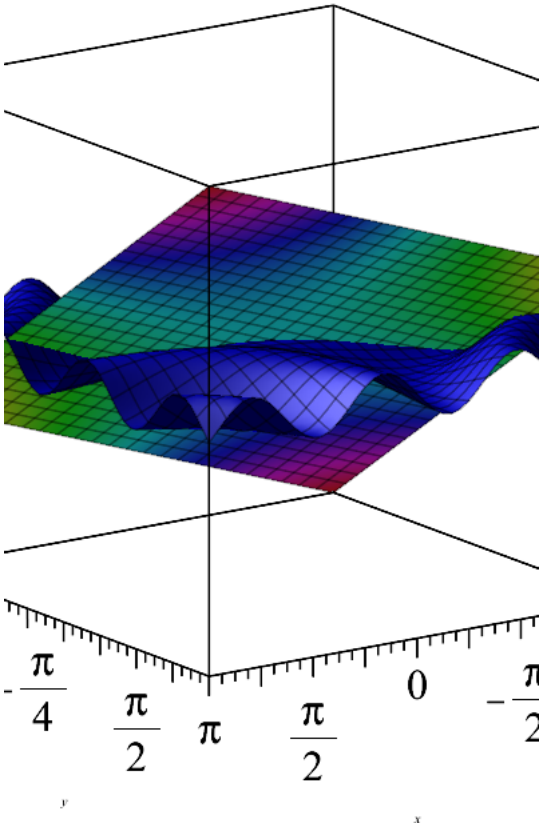
>

>

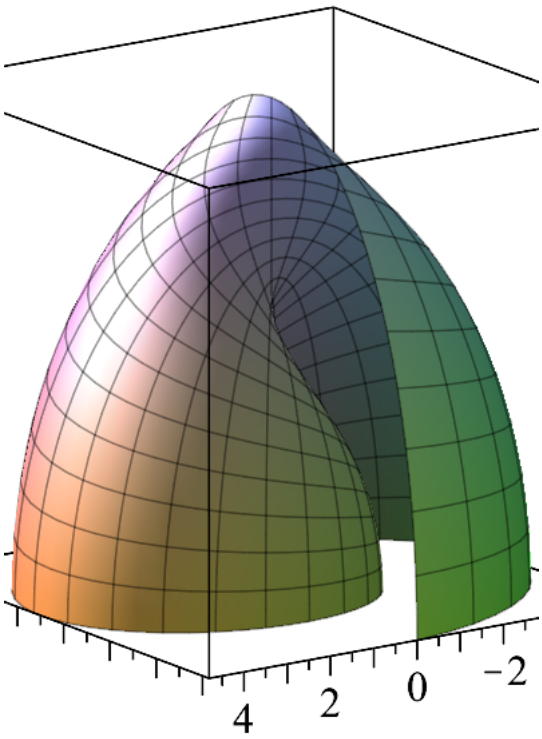
>


-1
0
3
1
-1

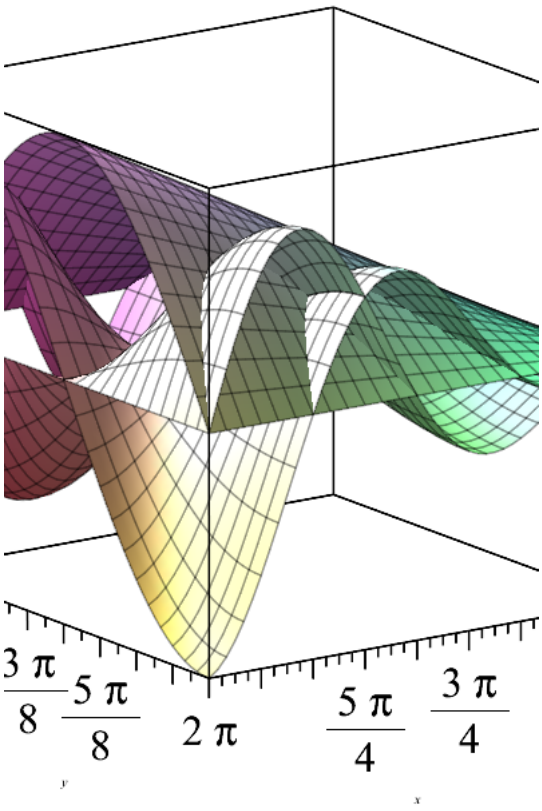
>


$-\frac{\pi}{4}$
$\frac{\pi}{2}$
π
$\frac{\pi}{2}$
0
$-\frac{\pi}{2}$

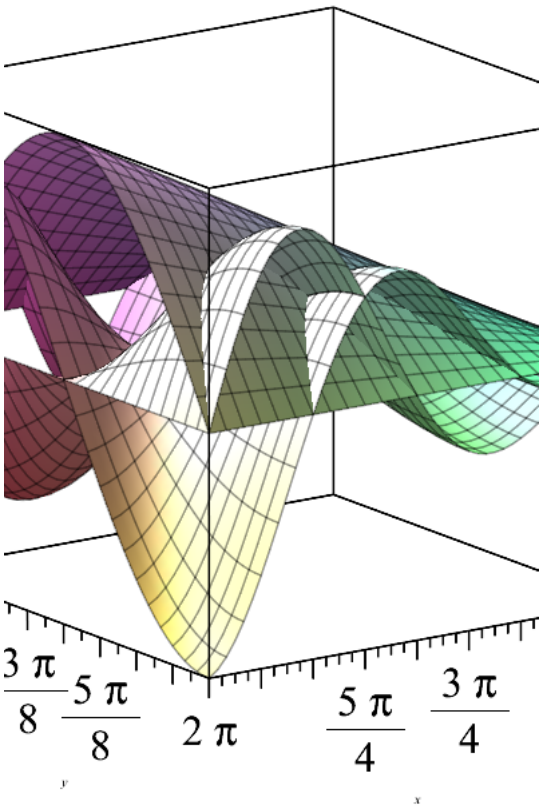
>


4
2
0
−2

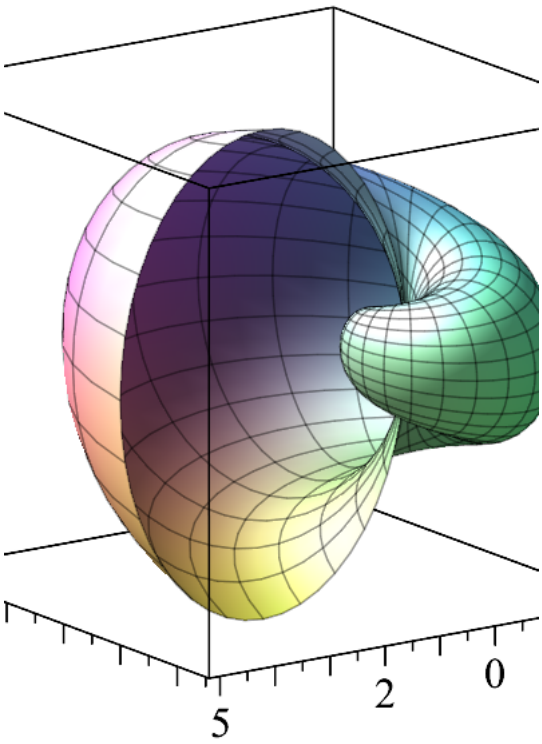
>


3 π
8
5 π
8
2 π
5 π
4
3 π
4

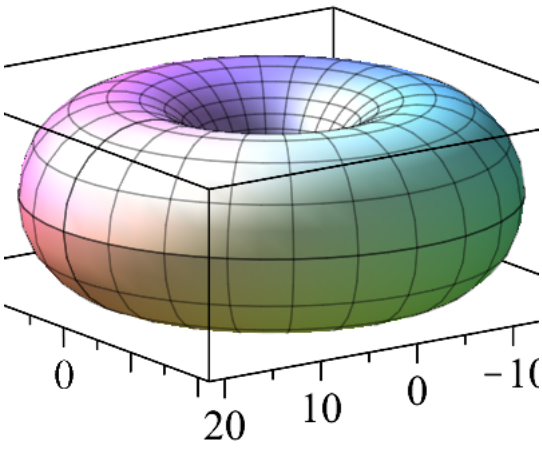
>


3 π
8
5 π
8
2 π
5 π
4
3 π
4

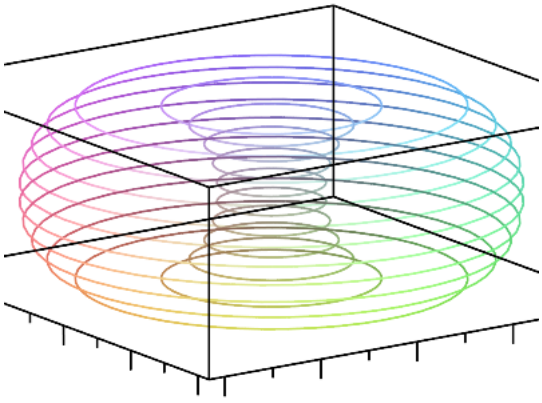
>


5
2
0

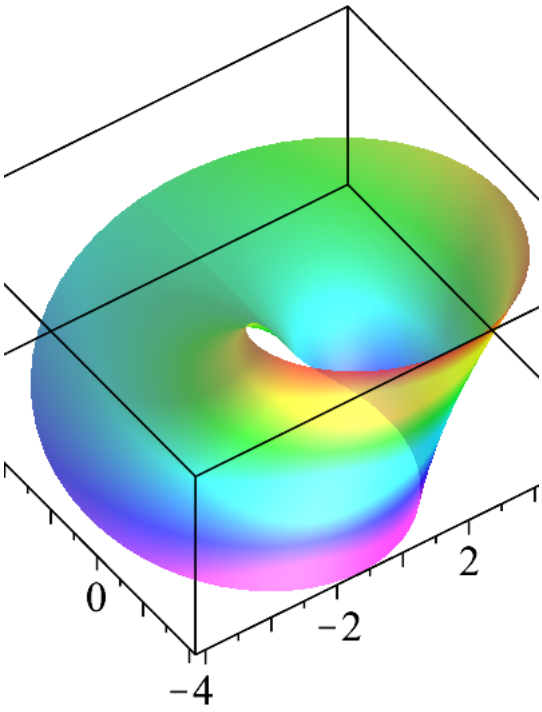
>


0
20
10
0
-10

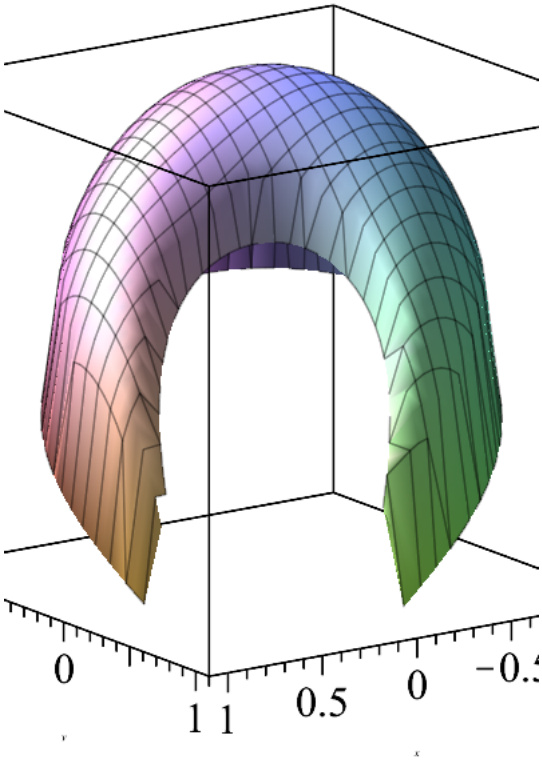
>



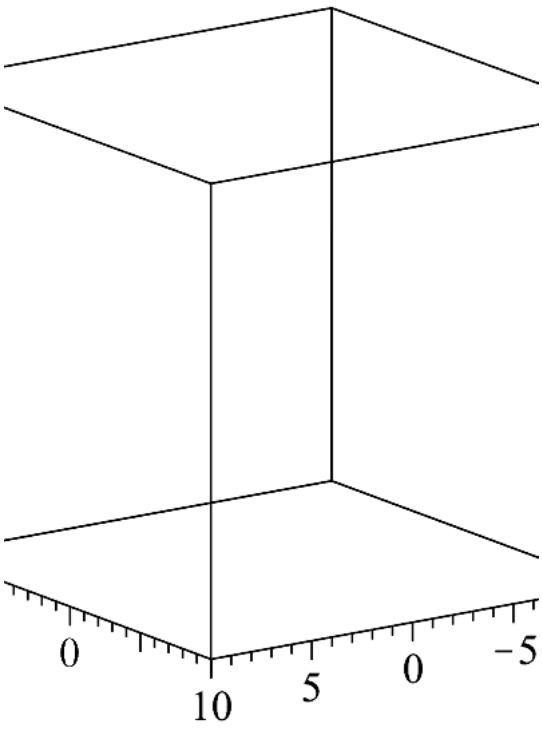
>


0
−2
2
−4

>


0
1 1
0.5
0

>


0
10
5
0
−5

>

•