3

REPRESENTATION OF CURVES IN IMPLICIT FORM

3.1. Functions given in implicit form

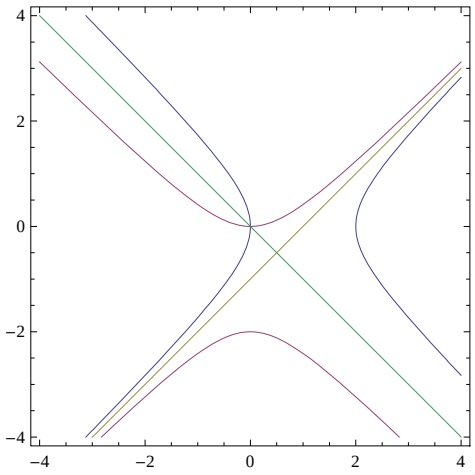
This command is used to make the graphical representation of an implicit function f(x,y)=0 in a rectangular bidimensional system OXY.

▼ ContourPlot

It is possible to make the graphical representation of many functions using the same axes

★ **ContourPlot [{equation1,equation2,....,equationn} , {x,xmin,xmax} , {y,ymin,ymax}]**

```
ContourPlot[{x^2 - y^2 == 2 x, -x^2 + y^2 == -2 y, y == x - 1, y == -x}, {x, -4, 4}, {y, -4, 4}]
```



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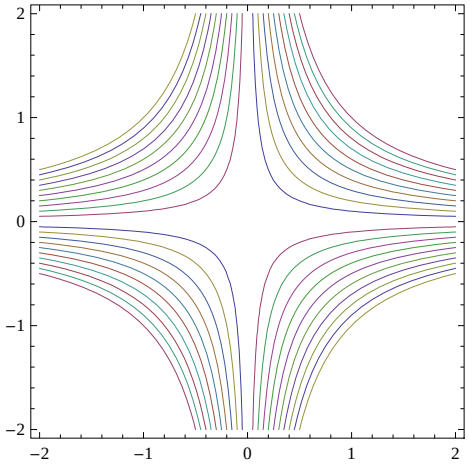
▼ Graph of a family of curves

```
ContourPlot[Evaluate[Table[{x * y == 0.1 * k, x * y == -0.1 * k}, {k, 1, 10}]],
 {x, -2, 2}, {y, -2, 2}]
```

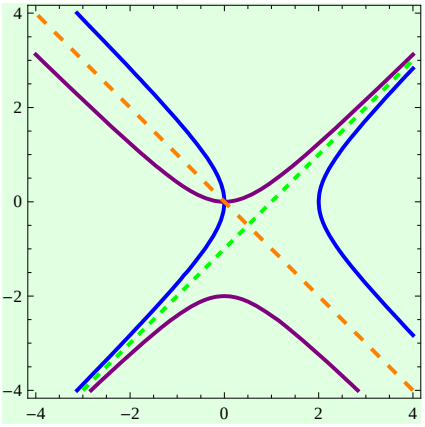


▼ Options of the command ContourPlot

It is possible to change the default values of the command ContourPlot in the same way that it has been explained for Plot. This time ContourStyle has to be used. Remember that in the case of the commad Plot we use PlotStyle.

★ Background style and colour : ContourStyle→ {colour, Thickness[n], Dashing[n]}, Background→colour

```
ContourPlot[{x^2 - y^2 == 2 x, -x^2 + y^2 == -2 y, y == x - 1, y == -x},
 {x, -4, 4}, {y, -4, 4}, ContourStyle → {{Blue, Thickness[0.01]},
   {Purple, Thickness[0.01]}, {Green, Thickness[0.01], Dashing[0.02]},
   {Orange, Thickness[0.01], Dashing[0.03]}}, Background → LightGreen]
```



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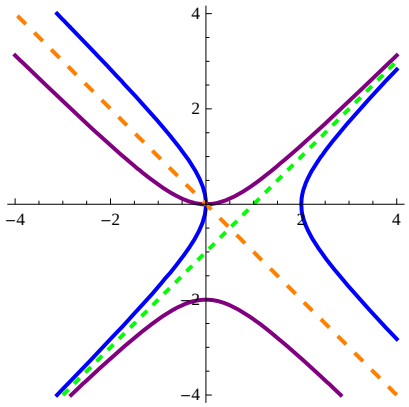
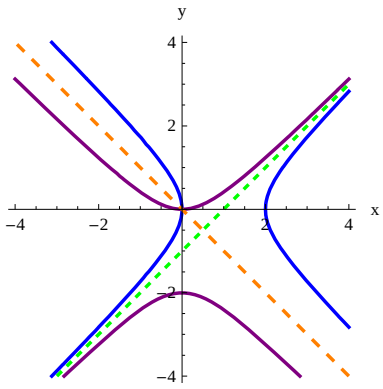
★ Frame and axes

```
ContourPlot[{x^2 - y^2 == 2 x, -x^2 + y^2 == -2 y, y == x - 1, y == -x}, {x, -4, 4},
 {y, -4, 4}, ContourStyle → {{Blue, Thickness[0.01]}, {Purple, Thickness[0.01]},
   {Green, Thickness[0.01], Dashing[0.02]}, {Orange, Thickness[0.01], Dashing[0.03]}},
 Axes → True, Frame → False, AspectRatio → Automatic]
```



★ Labels

```
ContourPlot[{x^2 - y^2 == 2 x, -x^2 + y^2 == -2 y, y == x - 1, y == -x}, {x, -4, 4},
 {y, -4, 4}, ContourStyle → {{Blue, Thickness[0.01]}, {Purple, Thickness[0.01]},
   {Green, Thickness[0.01], Dashing[0.02]}, {Orange, Thickness[0.01], Dashing[0.03]}},
 Axes → True, Frame → False, AxesLabel → {"x", "y"},
 PlotLabel → Style["IMPLICIT FUNCTIONS", 16, Bold, RGBColor[0.2, 0.5, 0.1]],
 AspectRatio → Automatic]
```

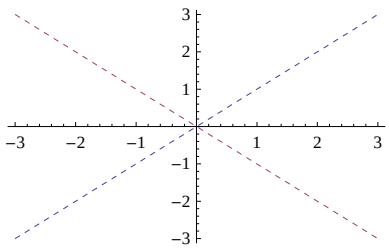


▼ Graph combinations

It is used to make in the same axes the graphical representation of functions that have been defined previously

★ Show [graph1, graph2,...]

```
graph1 = Plot[{x, -x}, {x, -3, 3}, PlotStyle → Dashing[0.015]]
```



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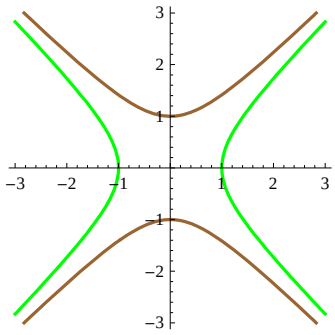
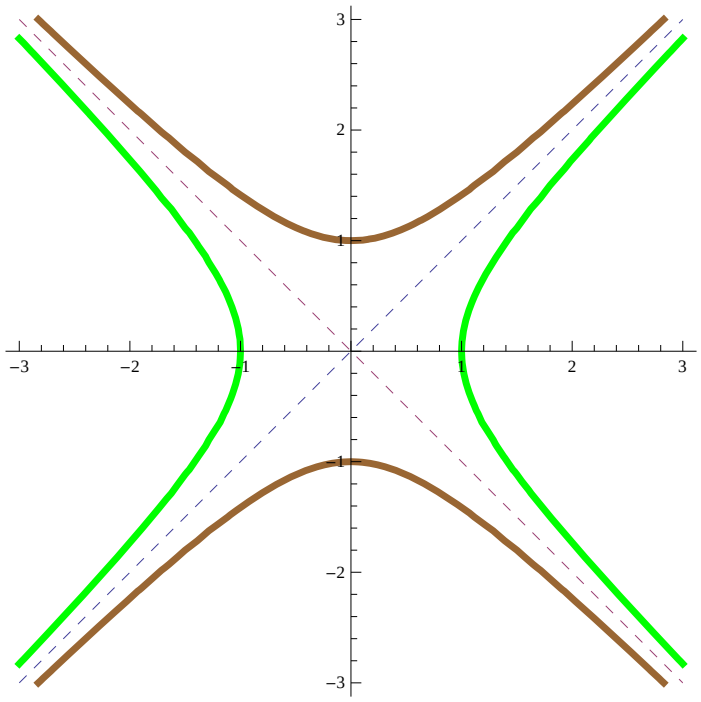
★ Some options to change the style of the graphs

```
graph2 = ContourPlot[{x^2 - y^2 == 1, -x^2 + y^2 == 1}, {x, -3, 3}, {y, -3, 3}, Axes → True,
  Frame → False, ContourStyle → {{Green, Thickness[0.01]}, {Brown, Thickness[0.01]}}]
```




```
Show[graph1, graph2, AspectRatio → Automatic]
```



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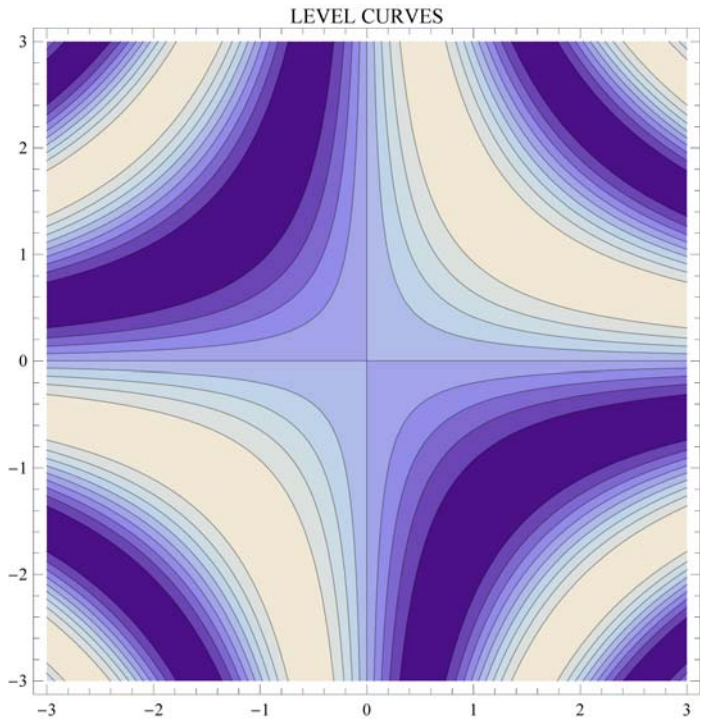
3.2. Level curves of a two variable function

▼ Level curves

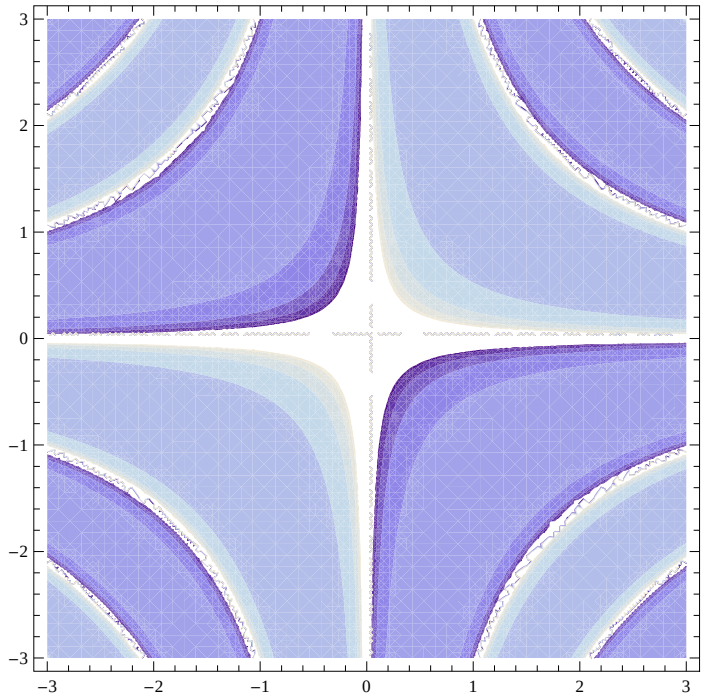
```
ContourPlot[Sin[x * y], {x, -3, 3}, {y, -3, 3}, PlotLabel → "LEVEL CURVES"]
```



▼ Some other options of the command Contourstyle

★ **ContourStyle→None**

```
ContourPlot[1 / Sin[x * y], {x, -3, 3}, {y, -3, 3}, ContourStyle → None]
```



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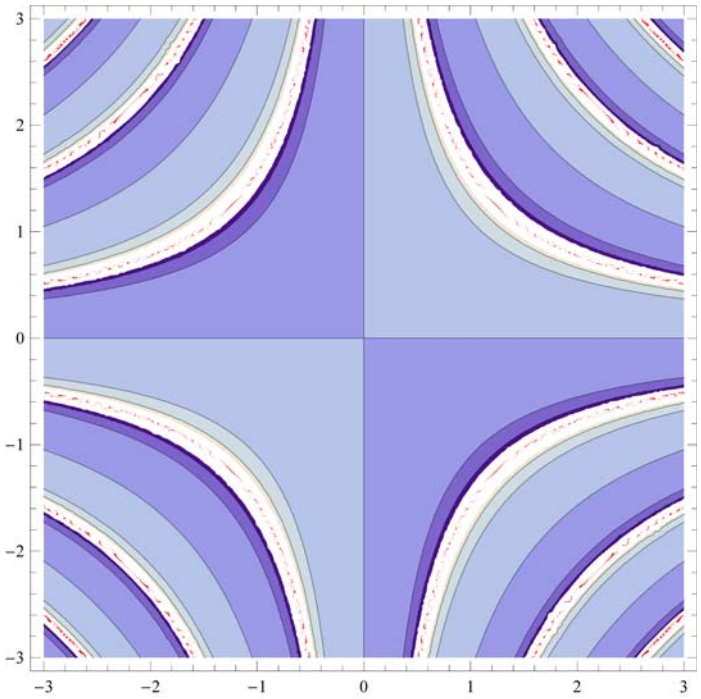
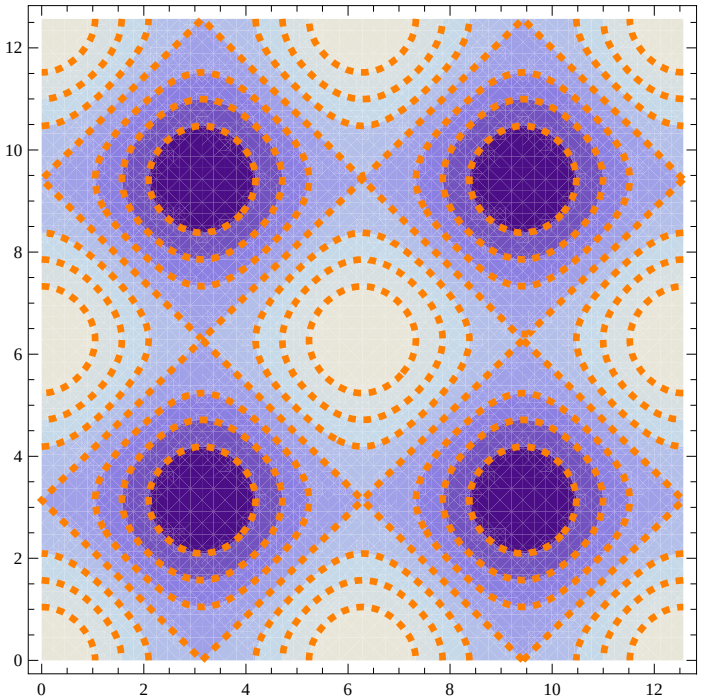
★ **Exclusions**

```
ContourPlot[Tan[x * y], {x, -3, 3}, {y, -3, 3},
 Exclusions → Cos[x * y] == 0, ExclusionsStyle → Red]
```



★ **ContourStyle→Directive[colour, thickness, line style]**

```
ContourPlot[Cos[x] + Cos[y], {x, 0, 4 Pi}, {y, 0, 4 Pi},
 ContourStyle → Directive[Orange, Thickness[0.01], Dashed]]
```



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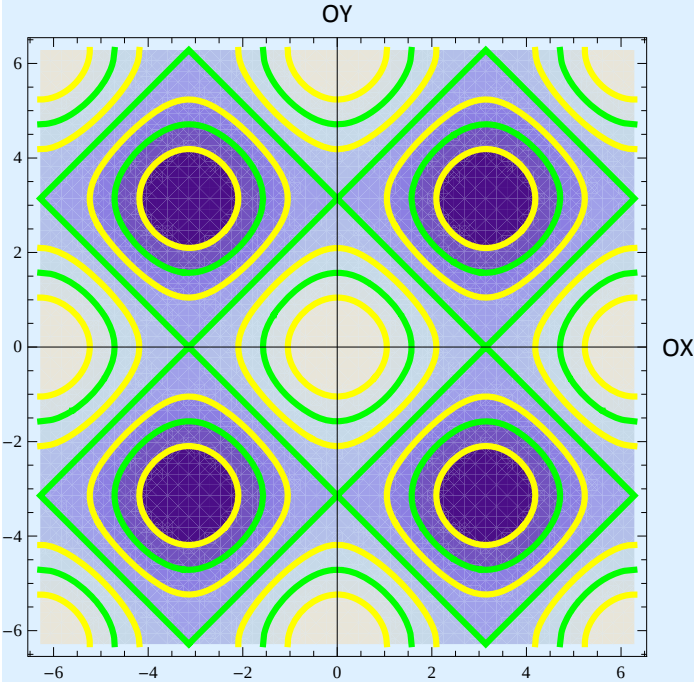
★ Alternating colours in the level curves

```
ContourPlot[Cos[x] + Cos[y], {x, -2 π, 2 π}, {y, -2 π, 2 π},
 ContourStyle → {{Thickness[0.01], Yellow}, {Thickness[0.01], Green}},
 Axes → True, AxesLabel → {"OX", "OY"}, Background → LightBlue]
```



★ PlotRange

```
g1 = ContourPlot[x^2 - y^2, {x, -4, 4}, {y, -4, 4},
   ContourStyle -> {{Thickness[0.01], Red}, {Thickness[0.01], Blue}}, Axes -> True];

g2 = ContourPlot[x^2 - y^2, {x, -4, 4}, {y, -4, 4},
   ContourStyle -> {{Thickness[0.01], Red}, {Thickness[0.01], Blue}},
   Axes -> True, PlotRange → {-2, 2}];
```

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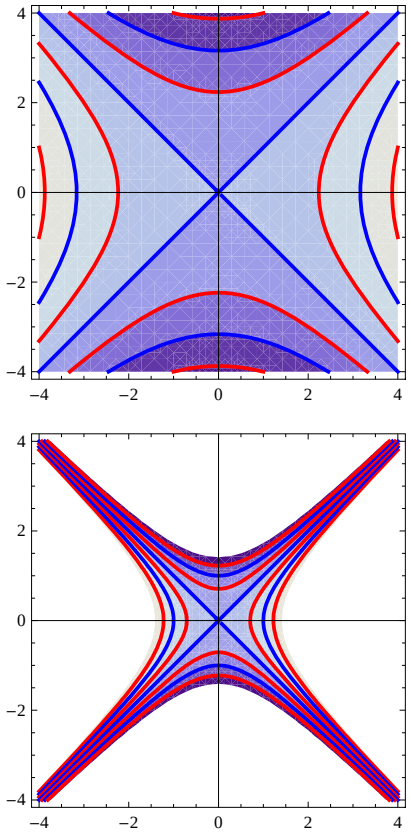
```
GraphicsGrid[{{g1}, {g2}}]
```



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