7

REPRESENTATION OF FUNCTIONS OF SEVERAL VARIABLES

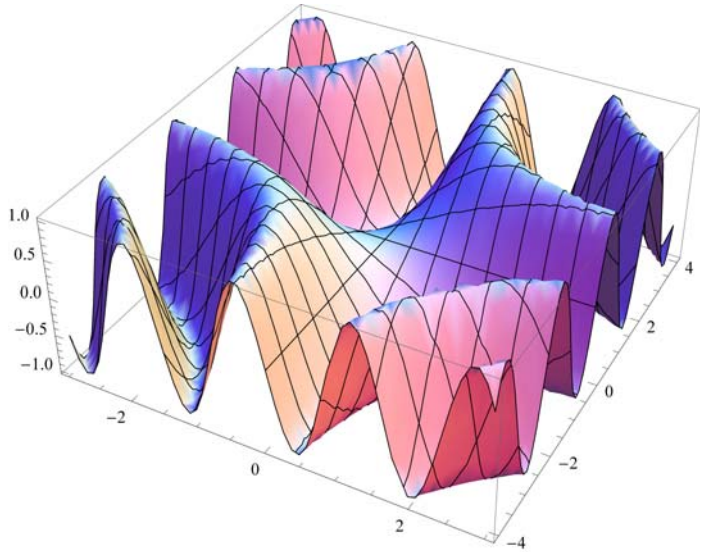
7.1. Representation of functions of two variables

▼ Plot3D[ ]

⋆ Plot [function , {x, xmin, xmax},{y, ymin, ymax}]

Representation of a function of two variables

```
Clear["Global`*"]
Plot3D[Sin[x * y], {x, -3, 3}, {y, -4, 4}]
```



Representation of two functions of two variables

```
z1[x_, y_] = 18 - x^2 - 9 y^2
```

$18 - x^2 - 9\,y^2$

```
z2[x_, y_] = x^2 + 9 y^2
```

$x^2 + 9\,y^2$

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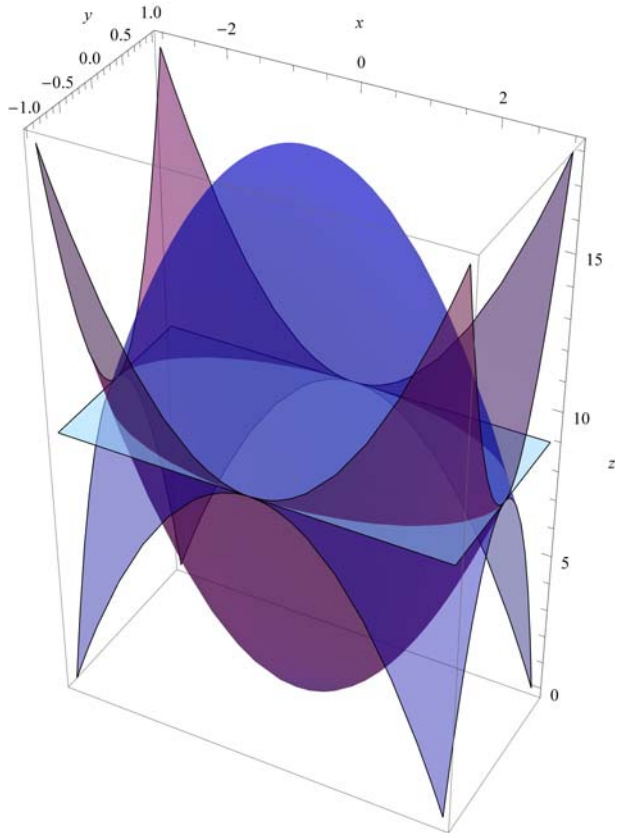
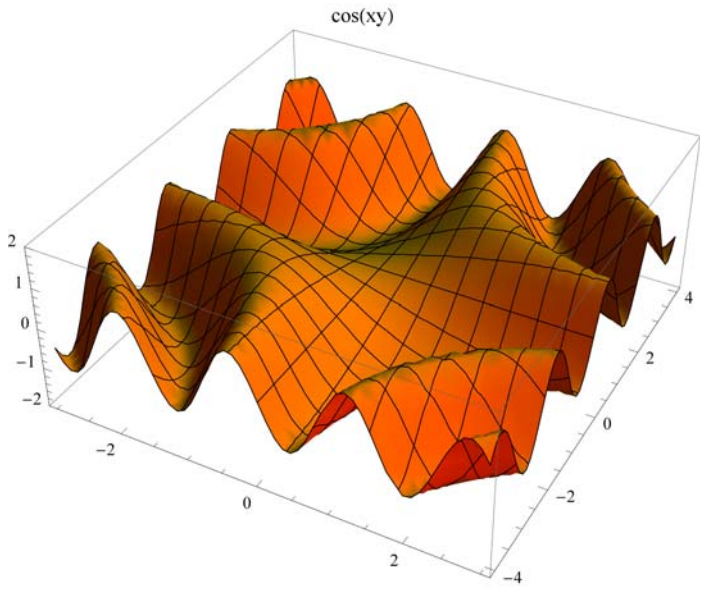
```
Plot3D[{z1[x, y], z2[x, y], 9}, {x, -3, 3}, {y, -1, 1}, BoxRatios → {2, 1, 3},
 Mesh → False, AxesLabel → {x, y, z}, PlotStyle → {Directive[Blue, Opacity[0.4]],
   Directive[Purple, Opacity[0.5]], Directive[LightGreen, Opacity[0.5]]}]
```



▼ Options of the command Plot3D[ ]

⋆ Colour, labels, etc.

```
Plot3D[Sin[x * y], {x, -3, 3}, {y, -4, 4},
 PlotRange → {-2, 2}, PlotLabel → "cos(xy)", PlotStyle → Orange]
```



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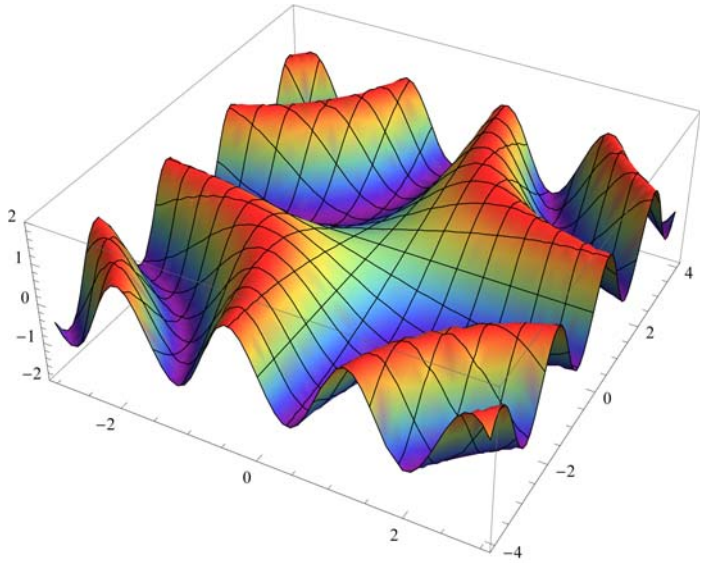
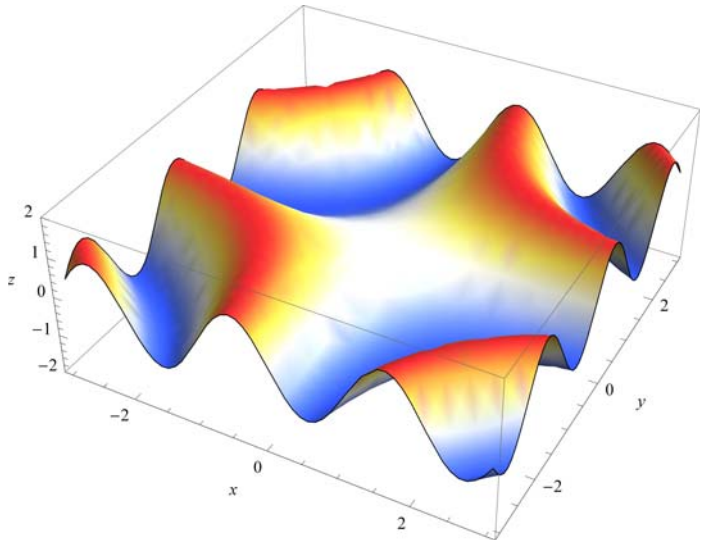
```
Plot3D[Sin[x * y], {x, -3, 3}, {y, -4, 4}, PlotRange → {-2, 2}, ColorFunction → "Rainbow"]
```




```
Plot3D[Sin[x * y], {x, -3, 3}, {y, -3, 3}, PlotRange → {-2, 2},
 ColorFunction → "TemperatureMap", Mesh → False, AxesLabel → {x, y, z}]
```

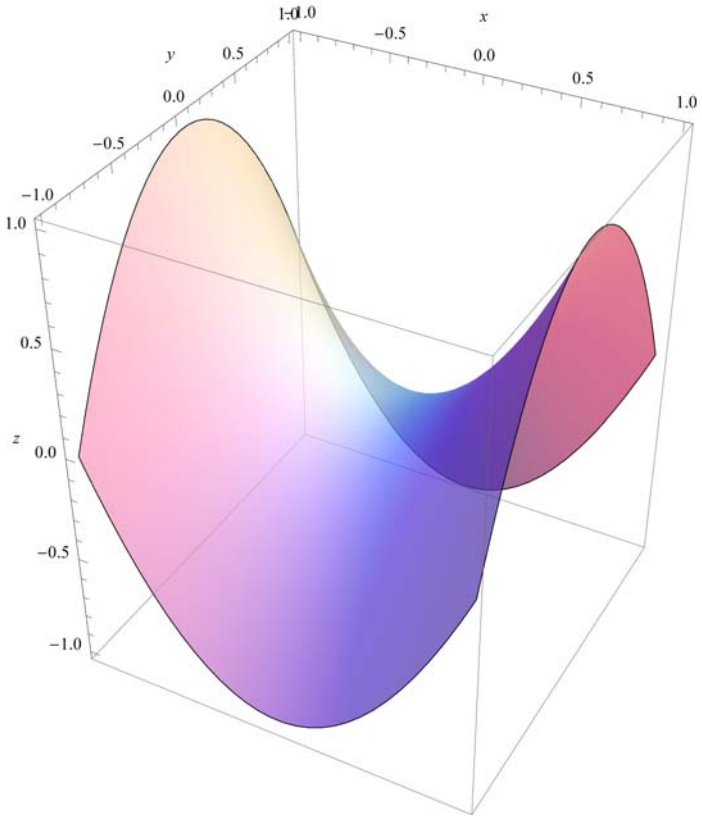


⋆ Proportionality and transparency of the axes (Opacity)

```
h[x_, y_] = x^2 - y^2
```

$x^2 - y^2$

```
Plot3D[h[x, y], {x, -1, 1}, {y, -1, 1}, PlotStyle → Directive[Opacity[0.7]],
 PlotPoints → 30, Mesh → False, BoxRatios → {1, 1, 1.2`}, AxesLabel → {x, y, z}]
```

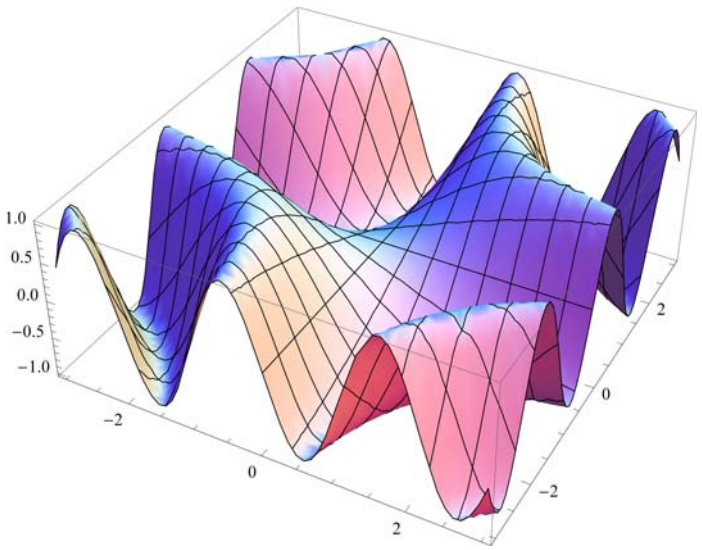


7.2. Level curves

▼ ContourPlot[ ]

⋆ ContourPlot [function , {x, xmin, xmax},{y, ymin, ymax}]

```
Plot3D[Sin[x * y], {x, -3, 3}, {y, -3, 3}]
```



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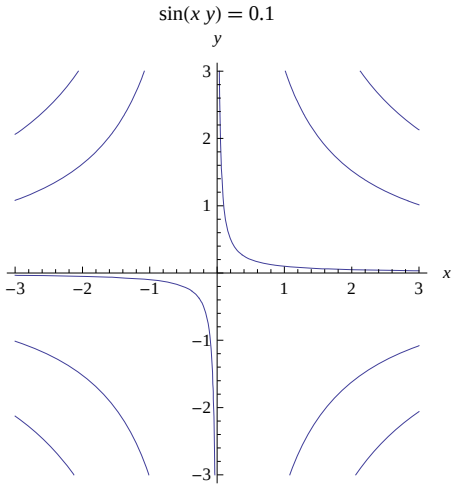
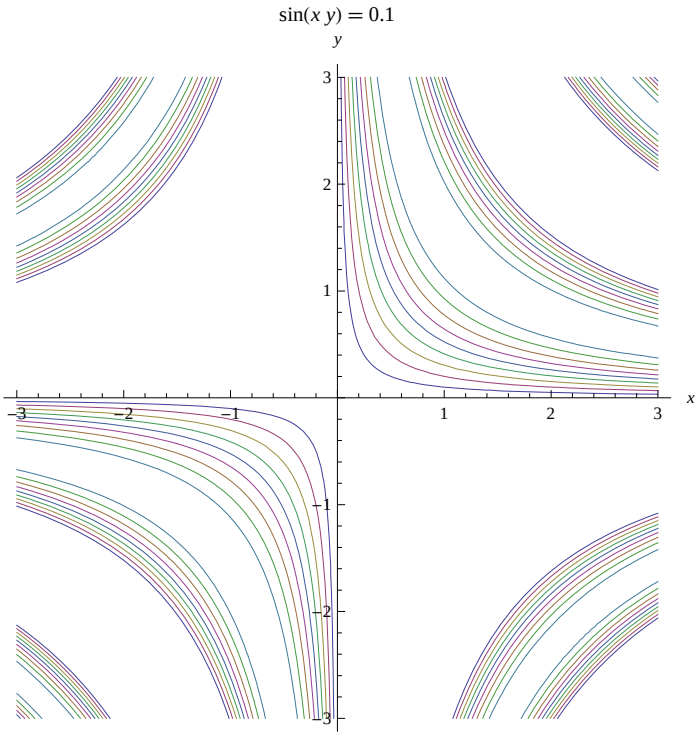
★ ContourPlot [equation , {x, xmin, xmax},{y, ymin, ymax}]

```
ContourPlot[Sin[x * y] == 0.1, {x, -3, 3}, {y, -3, 3}, Frame → False,
 Axes → True, AxesLabel → {x, y}, PlotLabel → Sin[x y] == 0.1]
```



★ ContourPlot [{equation 1, equation 2}, {x, xmin, xmax},{y, ymin, ymax}]

```
ContourPlot[Evaluate[Table[Sin[x * y] == 0.1 * k, {k, 1, 10}]], {x, -3, 3}, {y, -3, 3},
 Frame → False, Axes → True, AxesLabel → {x, y}, PlotLabel → Sin[x y] == 0.1]
```



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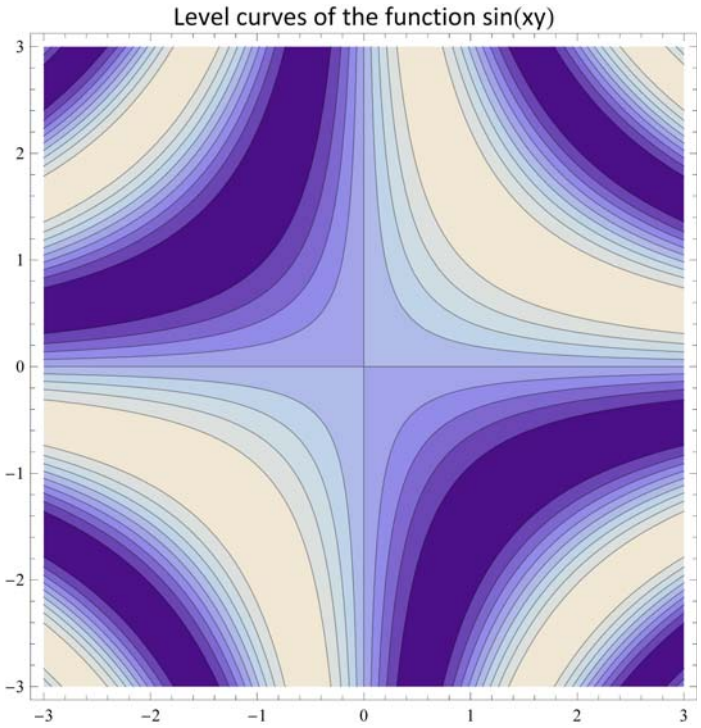
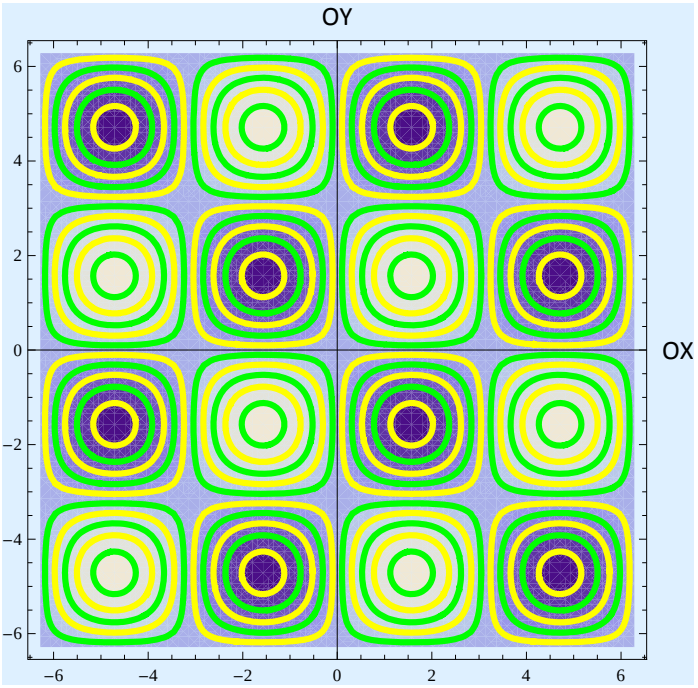
▼ Options of the command ContourPlot[ ]

```
ContourPlot[Sin[x * y], {x, -3, 3},
 {y, -3, 3}, PlotLabel → "Level curves of the function sin(xy)"]
```




```
ContourPlot[{Sin[x] * Sin[y] - 0.5}, {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]
```



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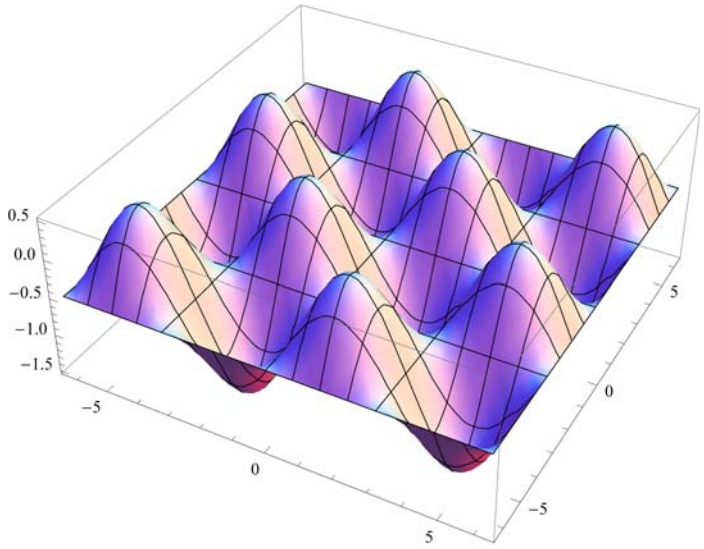
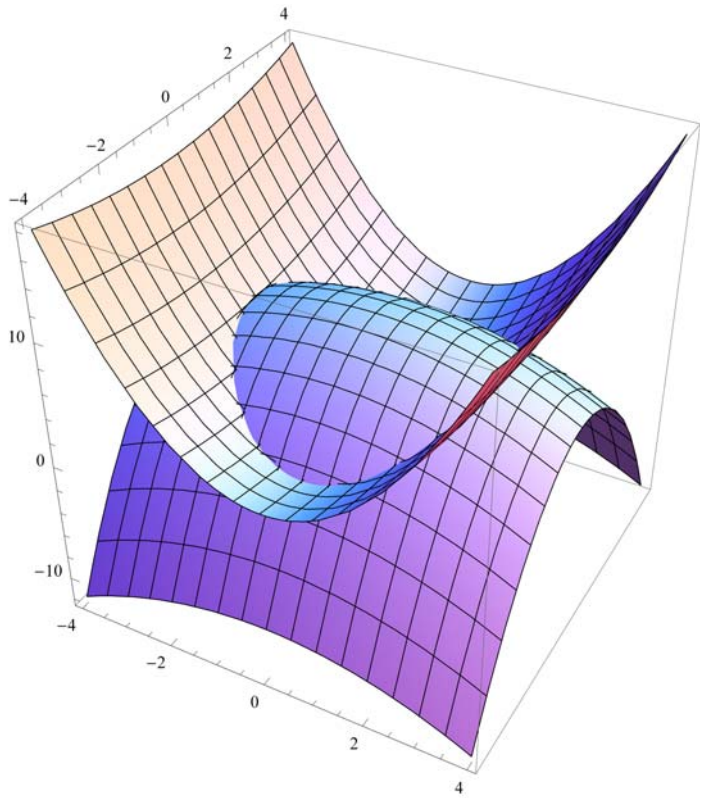
```
Plot3D[{Sin[x] * Sin[y] - 0.5}, {x, -2 π, 2 π}, {y, -2 π, 2 π}]
```

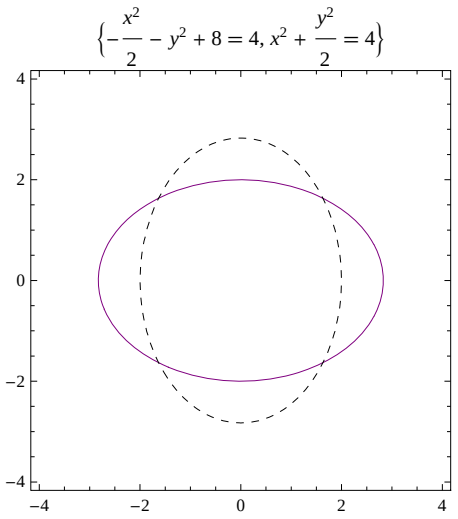


7.3. Region delimited by two surfaces

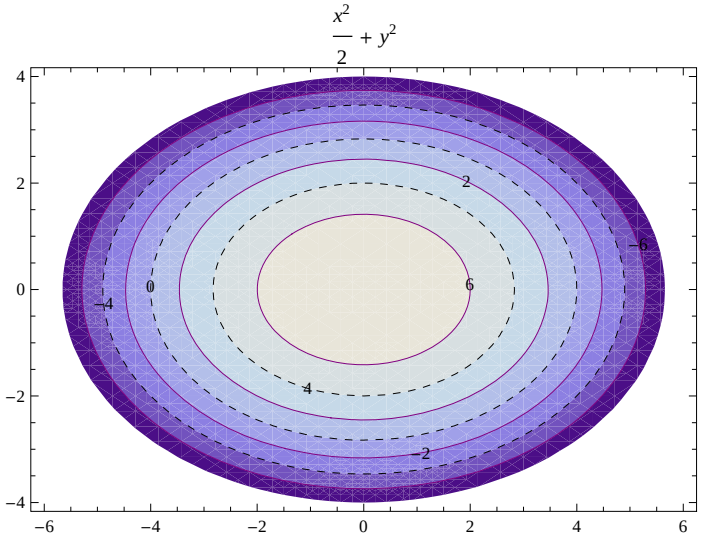
```
Plot3D[{8 - (x^2 / 4 + y^2), (x^2 + y^2 / 8)}, {x, -4, 4}, {y, -4, 4}, BoxRatios → {1, 1, 1}]
```



```
ContourPlot[{8 - (x^2 / 2 + y^2) == 4, (x^2 + y^2 / 2) == 4},
 {x, -4, 4}, {y, -4, 4}, ContourStyle → {Purple, Dashed},
 PlotLabel → {8 - (x^2 / 2 + y^2) == 4 , (x^2 + y^2 / 2) == 4},
 AspectRatio → Automatic, ContourLabels → True]
```




```
ContourPlot[8 - (x^2 / 2 + y^2), {x, -6, 6}, {y, -4, 4},
 ContourStyle → {Purple, Dashed}, PlotLabel → x^2 / 2 + y^2,
 AspectRatio → Automatic, ContourLabels → True, PlotRange → {-8, 8}]
```



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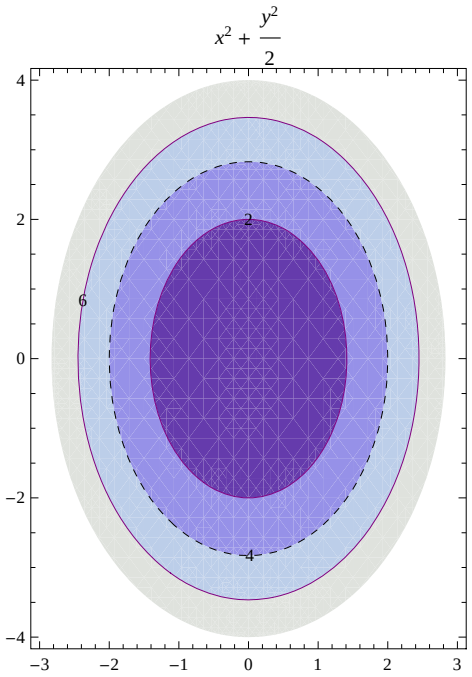
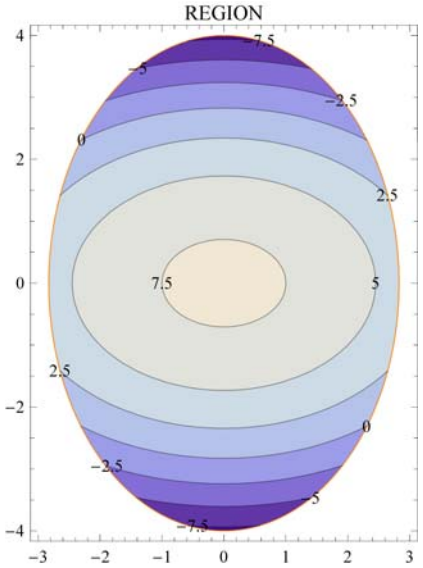
```
ContourPlot[x^2 + y^2 / 2, {x, -3, 3}, {y, -4, 4},
 ContourStyle → {Purple, Dashed}, PlotLabel → x^2 + y^2 / 2,
 AspectRatio → Automatic, ContourLabels → True, PlotRange → {-8, 8}]
```




```
ContourPlot[8 - (x^2 / 2 + y^2), {x, -3, 3}, {y, -4, 4}, PlotLabel → "REGION",
 ContourLabels → True, RegionFunction → Function[{x, y, z}, 0 < x^2 + y^2 / 2 < 8],
 BoundaryStyle → Orange, AspectRatio → Automatic]
```



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```
Plot3D[8 - (x^2 / 2 + y^2), {x, -3, 3}, {y, -4, 4}, PlotLabel → "REGION",
 RegionFunction → Function[{x, y, z}, 0 < x^2 + y^2 / 2 < 8],
 BoundaryStyle → Orange, AspectRatio → Automatic]
```