

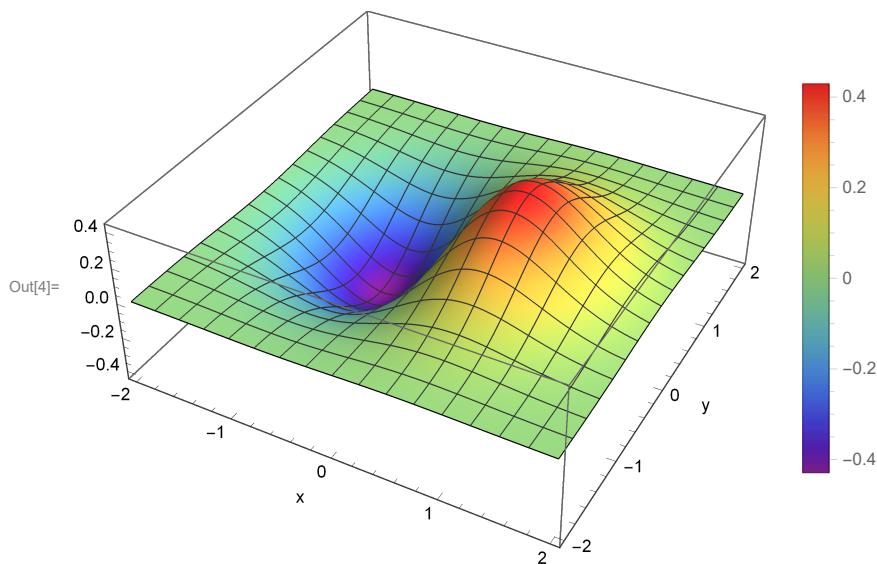
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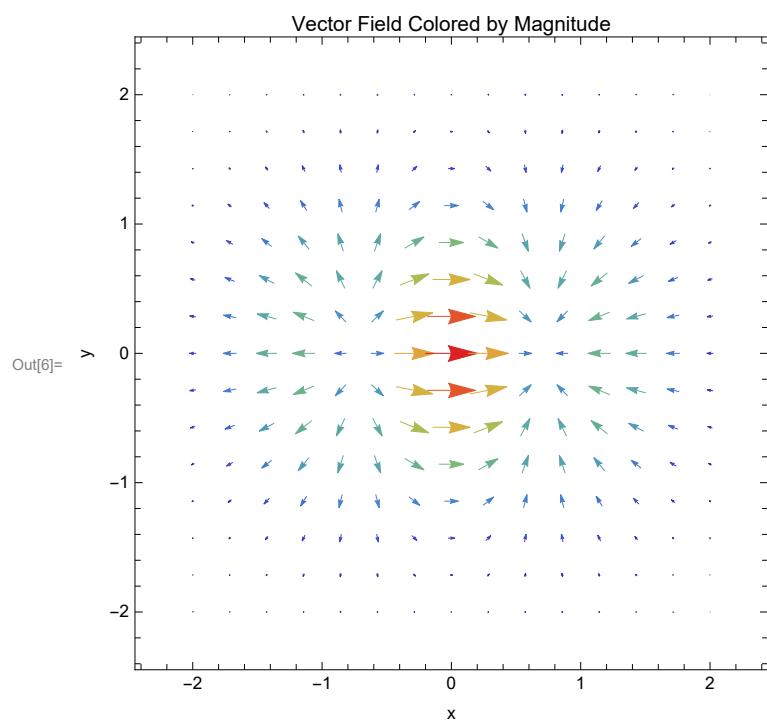
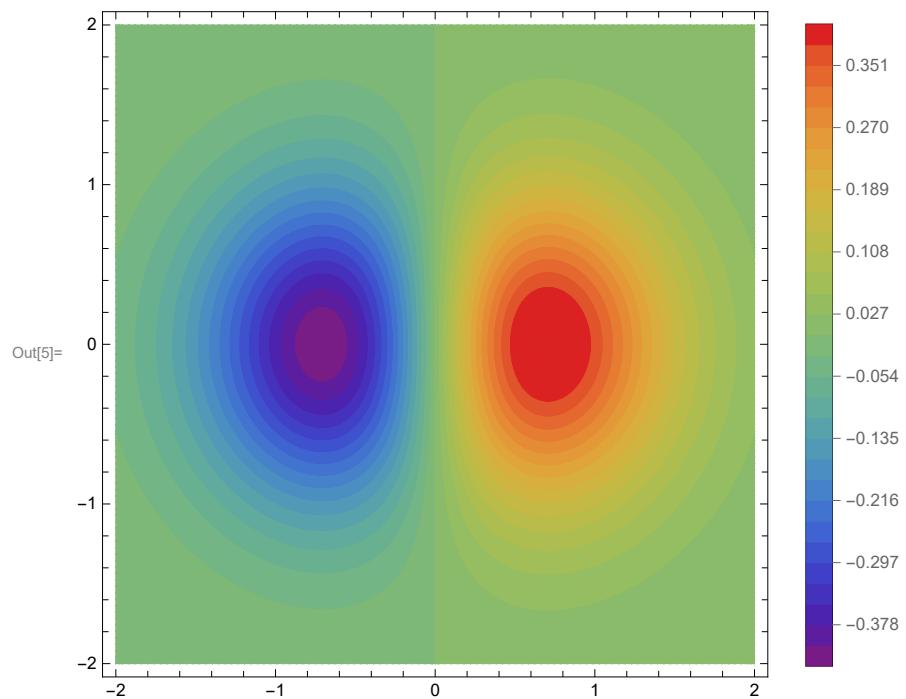
In[1]:= f[x_, y_] := x Exp[-(x^2 + y^2)];
A[x_, y_] = D[f[x, y], x]
B[x_, y_] = D[f[x, y], y]
Plot3D[f[x, y], {x, -2, 2}, {y, -2, 2}, PlotPoints → 100,
PlotLegends → Automatic, ColorFunction → "Rainbow", AxesLabel → {"x", "y"}]
ContourPlot[f[x, y], {x, -2, 2}, {y, -2, 2}, PlotPoints → 100, Contours → 30,
ContourStyle → None, PlotLegends → Automatic, ColorFunction → "Rainbow"]
VectorPlot[{A[x, y], B[x, y]}, {x, -2, 2}, {y, -2, 2},
VectorColorFunction → Function[{x, y, u, v, norm}, ColorData["Rainbow"] [norm]],
VectorColorFunctionScaling → True, FrameLabel → {"x", "y"}, PlotLabel → "Vector Field Colored by Magnitude"]

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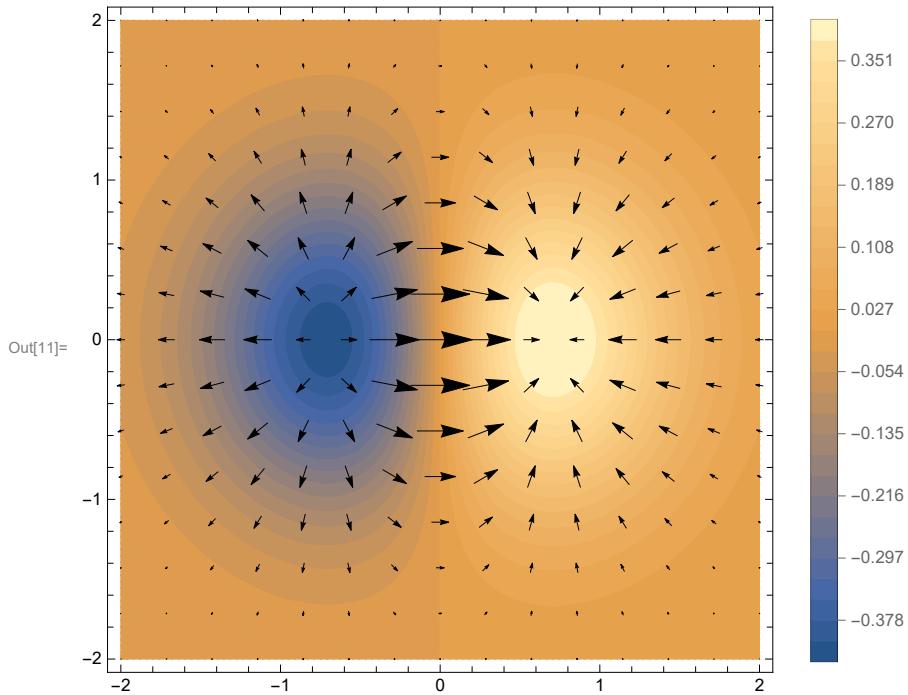
Out[2]= $e^{-x^2-y^2} - 2 e^{-x^2-y^2} x^2$

Out[3]= $-2 e^{-x^2-y^2} x y$

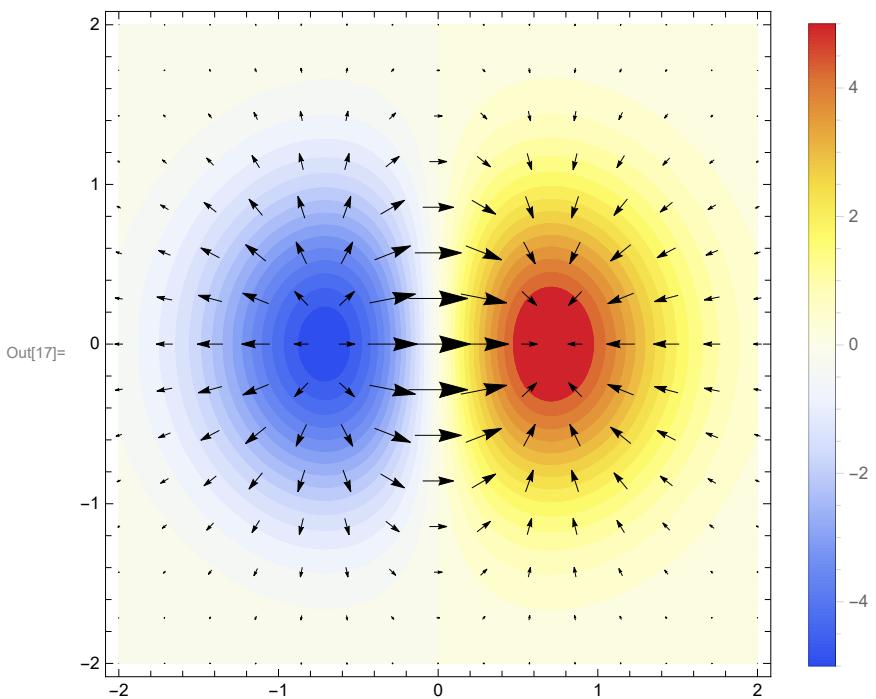




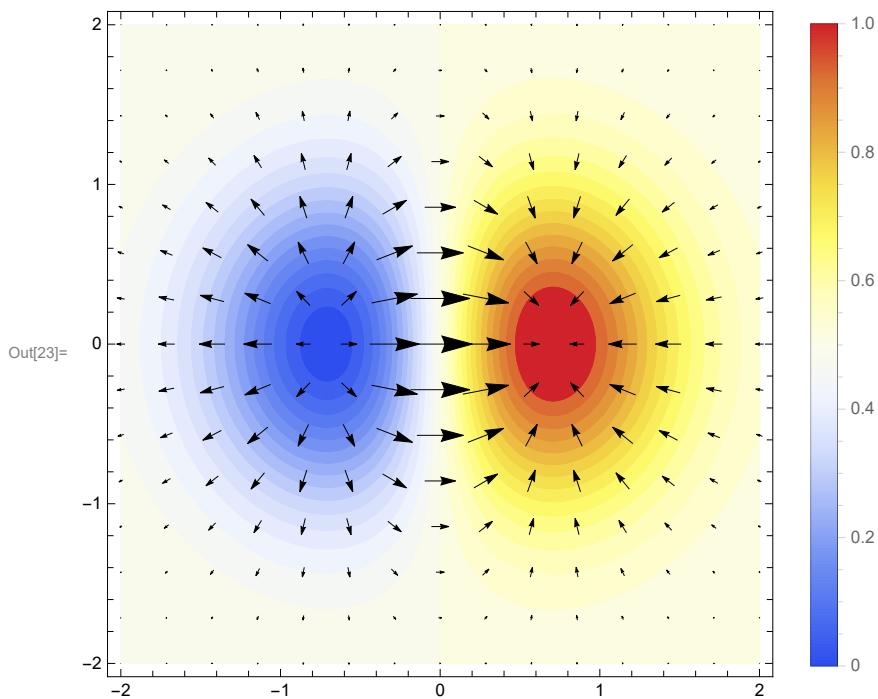
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In[7]:= f[x_, y_] := x Exp[-(x^2 + y^2)];  
grad[x_, y_] = Grad[f[x, y], {x, y}];  
plot1 = ContourPlot[f[x, y], {x, -2, 2}, {y, -2, 2},  
  PlotPoints → 100, Contours → 30, ContourStyle → None, PlotLegends → Automatic];  
plot2 = VectorPlot[grad[x, y], {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];  
Show[plot1, plot2]  
  
Out[8]= {e^-x^2-y^2 - 2 e^-x^2-y^2 x^2, - 2 e^-x^2-y^2 x y}
```



```
In[12]:= f[x_, y_] := x Exp[-(x^2 + y^2)];
A = D[f[x, y], x]
B = D[f[x, y], y]
plot1 = ContourPlot[f[x, y], {x, -2, 2}, {y, -2, 2}, PlotPoints → 100, Contours → 30,
ContourStyle → None, PlotLegends → BarLegend[{"TemperatureMap", {-5, 5}}],
ColorFunction → "TemperatureMap"];
plot2 = VectorPlot[{A, B}, {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];
Show[plot1, plot2]
Out[13]=  $e^{-x^2-y^2} - 2 e^{-x^2-y^2} x^2$ 
Out[14]=  $-2 e^{-x^2-y^2} x y$ 
```



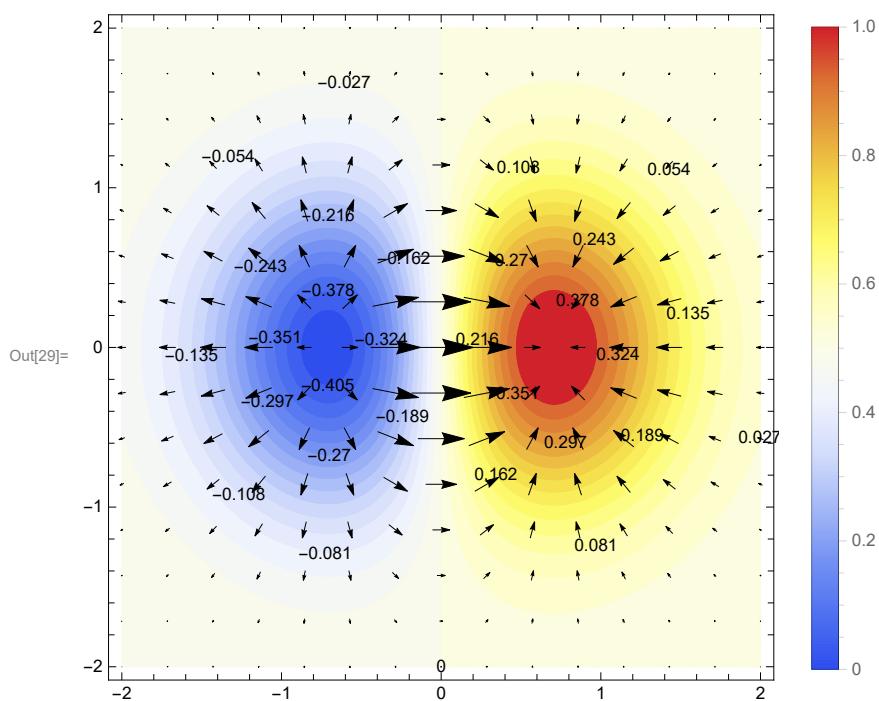
```
In[18]:= f[x_, y_] := x Exp[-(x^2 + y^2)];
A = D[f[x, y], x]
B = D[f[x, y], y]
plot1 = ContourPlot[f[x, y], {x, -2, 2},
{y, -2, 2}, PlotPoints → 100, Contours → 30, ContourStyle → None,
PlotLegends → BarLegend[{"TemperatureMap", {0, 1}}], ColorFunction → "TemperatureMap"];
plot2 = VectorPlot[{A, B}, {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];
Show[plot1, plot2]
Out[19]=  $e^{-x^2-y^2} - 2 e^{-x^2-y^2} x^2$ 
Out[20]=  $-2 e^{-x^2-y^2} x y$ 
```



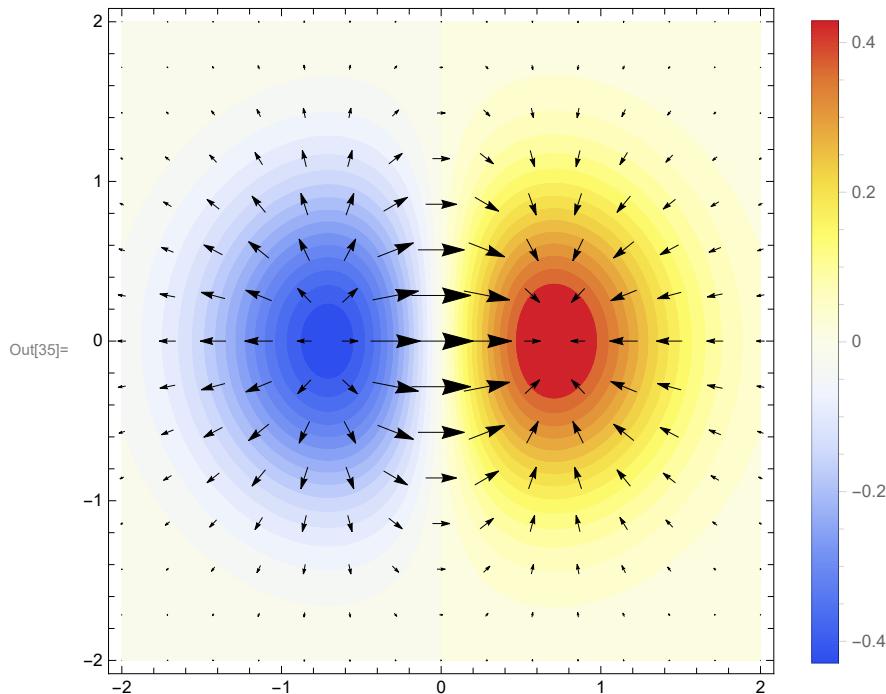
```
In[24]:= f[x_, y_] := x Exp[-(x^2 + y^2)];
A = D[f[x, y], x]
B = D[f[x, y], y]
plot1 = ContourPlot[f[x, y], {x, -2, 2}, {y, -2, 2},
  PlotPoints → 100, Contours → 30, ContourStyle → None, ContourLabels → True,
  PlotLegends → BarLegend[{"TemperatureMap", {0, 1}}], (*Setting range in legend
  may show wrong data from the plot*)ColorFunction → "TemperatureMap"];
plot2 = VectorPlot[{A, B}, {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];
Show[plot1, plot2]

Out[25]= e-x2-y2 - 2 e-x2-y2 x2

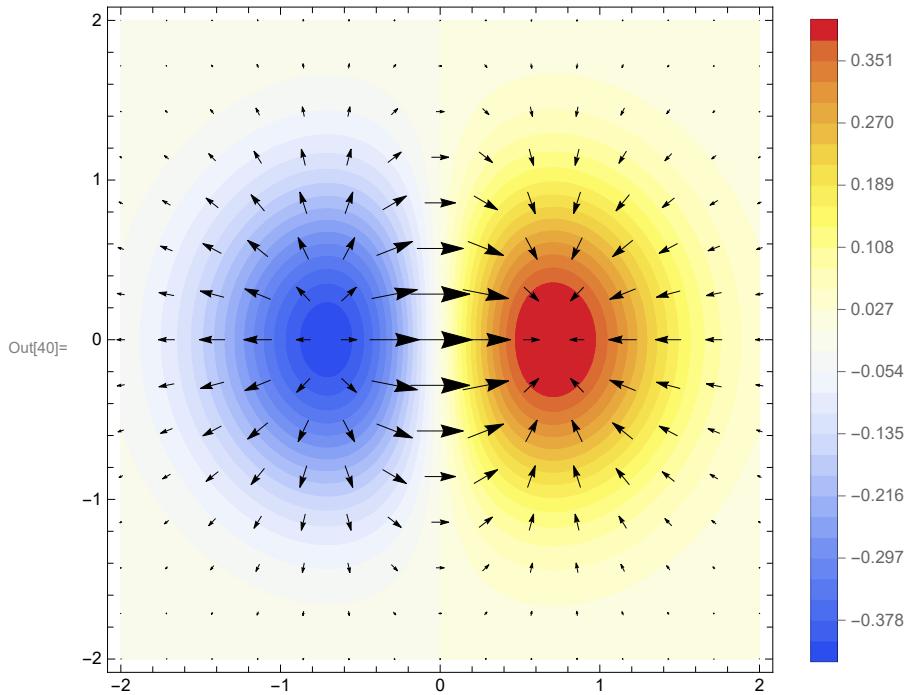
Out[26]= -2 e-x2-y2 x y
```



```
In[30]:= f[x_, y_] := x Exp[-(x^2 + y^2)];
A = D[f[x, y], x]
B = D[f[x, y], y]
plot1 = ContourPlot[f[x, y], {x, -2, 2},
{y, -2, 2}, PlotPoints → 100, Contours → 30, ContourStyle → None,
PlotLegends → BarLegend[Automatic, None], ColorFunction → "TemperatureMap"];
plot2 = VectorPlot[{A, B}, {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];
Show[plot1, plot2]
Out[31]= e-x2-y2 - 2 e-x2-y2 x2
Out[32]= -2 e-x2-y2 x y
```

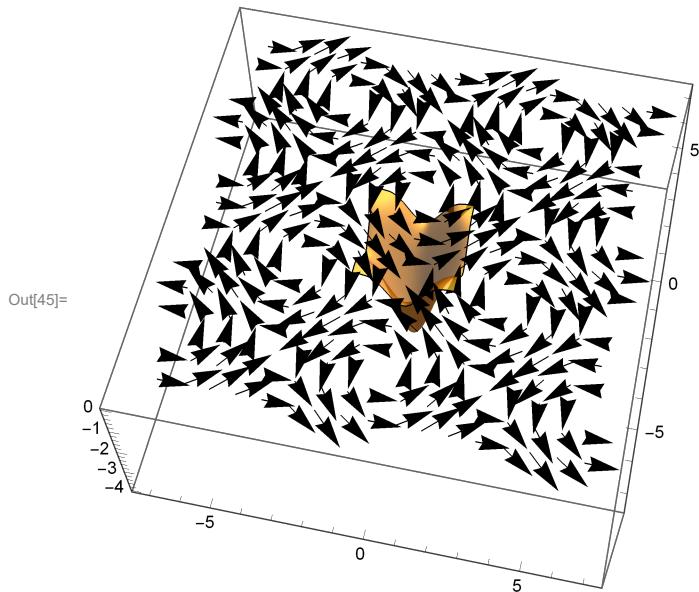


```
In[36]:= f[x_, y_] := x Exp[-(x^2 + y^2)];  
grad[x_, y_] = Grad[f[x, y], {x, y}];  
plot1 = ContourPlot[f[x, y], {x, -2, 2}, {y, -2, 2}, PlotPoints → 100, Contours → 30,  
ContourStyle → None, PlotLegends → Automatic, ColorFunction → "TemperatureMap"];  
plot2 = VectorPlot[grad[x, y], {x, -2, 2}, {y, -2, 2}, VectorStyle → Black];  
Show[plot1, plot2]  
Out[37]= {e^-x^2-y^2 - 2 e^-x^2-y^2 x^2, - 2 e^-x^2-y^2 x y}
```



```
In[41]:= f[x_, y_] := -((Cos[x])^2 + (Cos[y])^2)^2;
grad[x_, y_] = Grad[f[x, y], {x, y}];
surface = Plot3D[f[x, y], {x, -Pi/2, Pi/2},
{y, -Pi/2, Pi/2}, PlotStyle -> Opacity[0.7], Mesh -> None];
vectorField = Graphics3D[Table[Arrow[{{x, y, 0}, {x + Cos[y], y + Sin[x], 0}}],
{x, -2 Pi, 2 Pi, Pi/4}, {y, -2 Pi, 2 Pi, Pi/4}]];
Show[surface, vectorField, Boxed -> True]

Out[42]= {4 Cos[x] (Cos[x]^2 + Cos[y]^2) Sin[x], 4 Cos[y] (Cos[x]^2 + Cos[y]^2) Sin[y]}
```



```
In[46]:= f[x_, y_] := -((Cos[x])^2 + (Cos[y])^2)^2;
grad[x_, y_] = Grad[f[x, y], {x, y}]
surface = Plot3D[f[x, y], {x, -Pi/2, Pi/2}, {y, -Pi/2, Pi/2}, PlotStyle -> Opacity[0.7],
    MeshFunctions -> {#3 &}, MeshStyle -> {{Thick, Gray}}, AxesLabel -> {"x", "y", "f(x, y)"}];
vectorField = VectorPlot[grad[x, y], {x, -Pi/2, Pi/2},
    {y, -Pi/2, Pi/2}, Axes -> False, Frame -> False];

Show[surface,
Graphics3D[{Inset[vectorField, {0, 0, 0}, {Center, Center}, {6, 6}]}], Boxed -> True]
```

Out[47]= $\{4 \cos[x] (\cos[x]^2 + \cos[y]^2) \sin[x], 4 \cos[y] (\cos[x]^2 + \cos[y]^2) \sin[y]\}$

