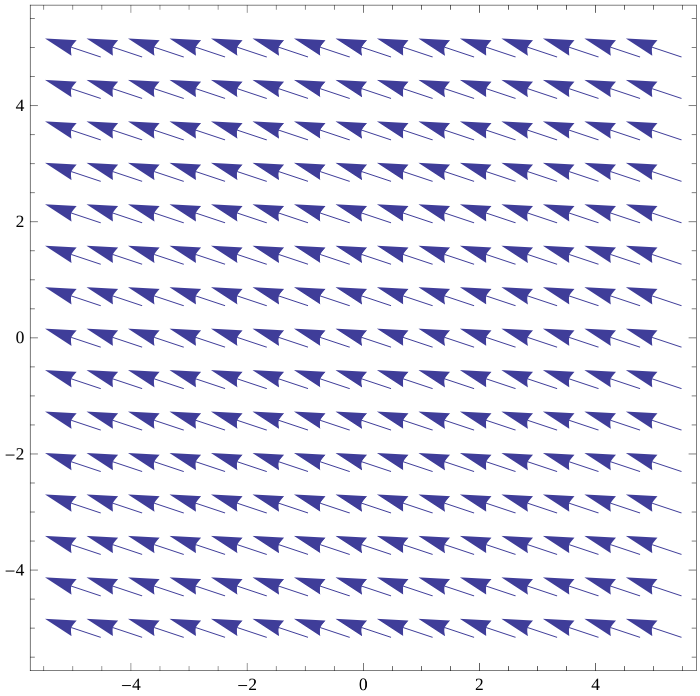
```
In[7]:= (* Infi 4 - Problem set 1 - Solutions *)

In[8]:= (* question 1 *)

In[16]:= (* 1 *)

In[9]:= F = {-3, 1}

Out[9]= {-3, 1}

In[11]:= VectorPlot[F, {x, -5, 5}, {y, -5, 5}]
```

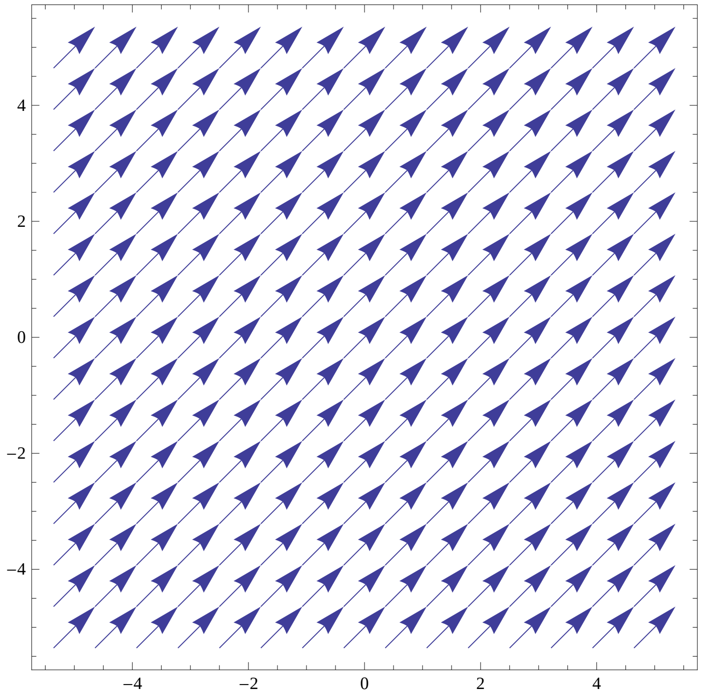
Out[11]=



```
In[17]:= (* 2 *)

In[13]:= F = {1, 1}

Out[13]= {1, 1}
```

In[14]:= `VectorPlot[F, {x, -5, 5}, {y, -5, 5}]`

Out[14]=



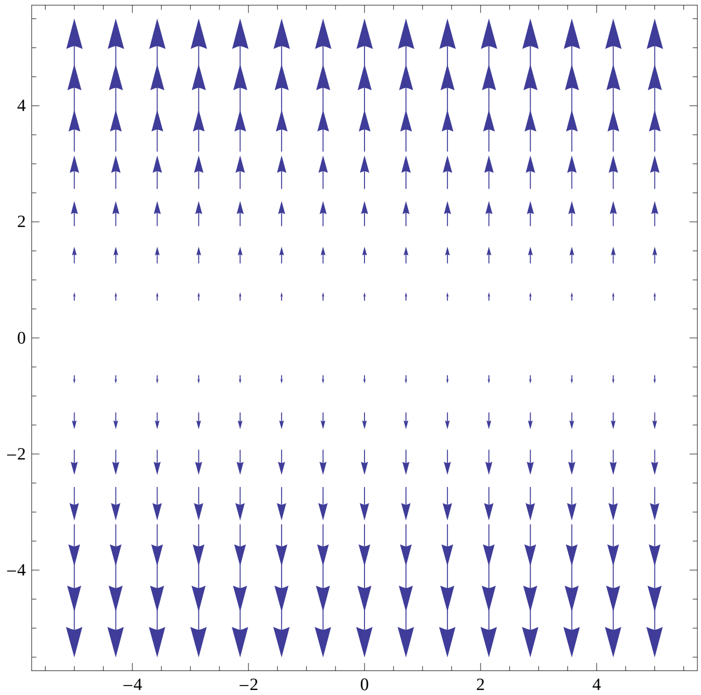
In[18]:= `(* 3 *)`

In[19]:= `F = {0, y}`

Out[19]= `{0, y}`

In[20]:= `VectorPlot[F, {x, -5, 5}, {y, -5, 5}]`

Out[20]=



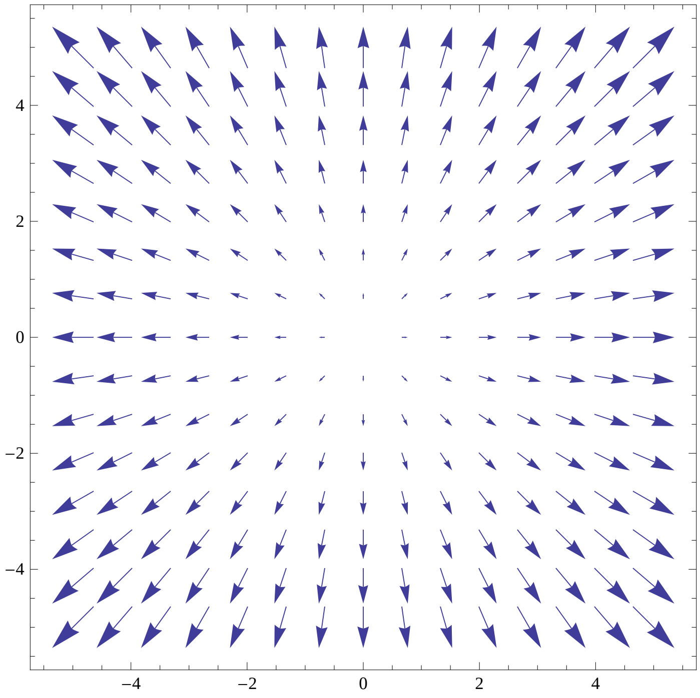
In[21]:= `(* 4 *)`

In[22]:= `F = {x, y}`

Out[22]= `{x, y}`

In[23]:= `VectorPlot[F, {x, -5, 5}, {y, -5, 5}]`

Out[23]=

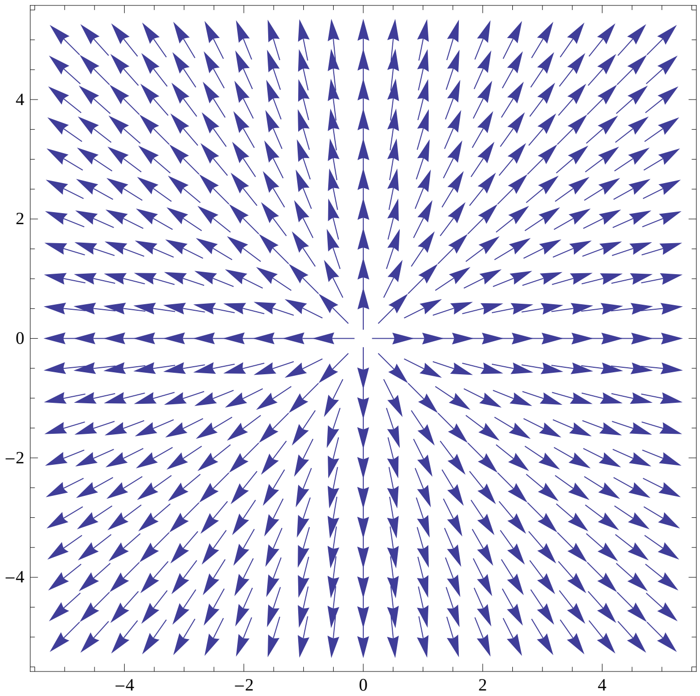


In[24]:= `(* 5 *)`

In[25]:= $F = \left\{\frac{x}{\sqrt{x^2 + y^2}}, \frac{y}{\sqrt{x^2 + y^2}}\right\}$

Out[25]= $\left\{\frac{x}{\sqrt{x^2 + y^2}}, \frac{y}{\sqrt{x^2 + y^2}}\right\}$

In[29]:= `VectorPlot[F, {x, -5, 5}, {y, -5, 5}, VectorPoints → {21, 21}]`

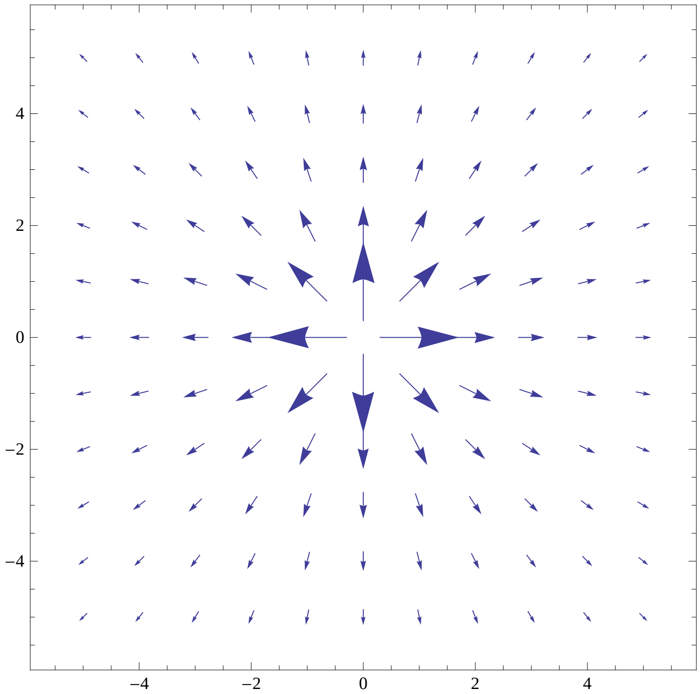


In[30]:= `(* 6 *)`

In[31]:= $F = \left\{\frac{x}{x^2 + y^2}, \frac{y}{x^2 + y^2}\right\}$

Out[31]= $\left\{\frac{x}{x^2 + y^2}, \frac{y}{x^2 + y^2}\right\}$

In[36]:=
```
VectorPlot[F, {x, -5, 5}, {y, -5, 5}, VectorPoints → {11, 11}]
```



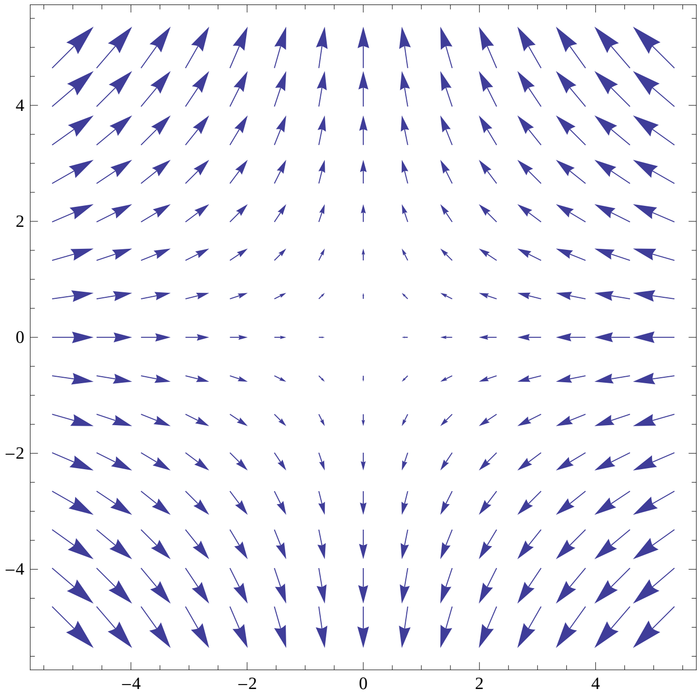
In[37]:=
```
(* 7 *)
```

In[38]:=
```
F = {-x, y}
```

Out[38]= {-x, y}

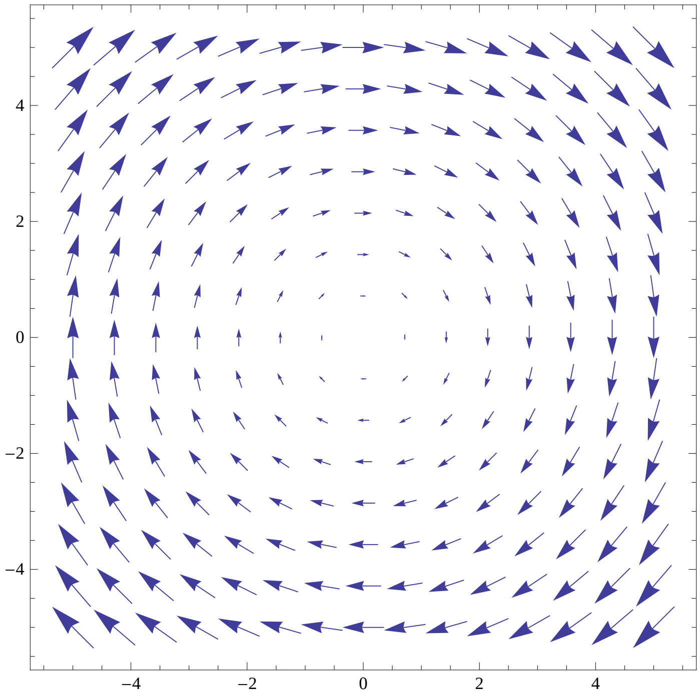
In[39]:=
```
VectorPlot[F, {x, -5, 5}, {y, -5, 5}]
```

Out[39]=



```
In[40]:= (* 8 *)

In[41]:= F = {2 y, -2 x}

Out[41]= {2 y, -2 x}

VectorPlot[F, {x, -5, 5}, {y, -5, 5}]
```

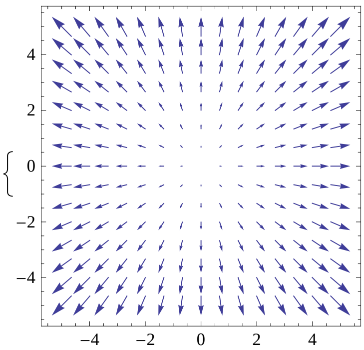
Out[42]=



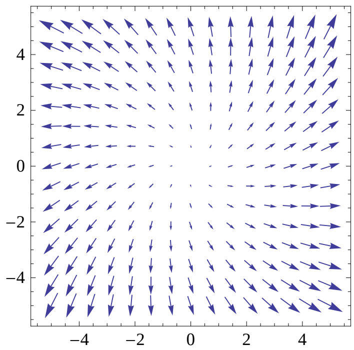
```
In[43]:= (* 9 *)

In[44]:= F = {x Cos[α] - y Sin[α], x Sin[α] + y Cos[α]}

Out[44]= {x Cos[α] - y Sin[α], y Cos[α] + x Sin[α]}
```

In[46]:= Table[VectorPlot[F, {x, -5, 5}, {y, -5, 5}], {α, 0, 2 π, $\frac{\pi}{10}$}]

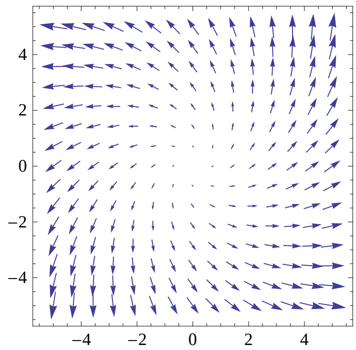
Out[46]= {



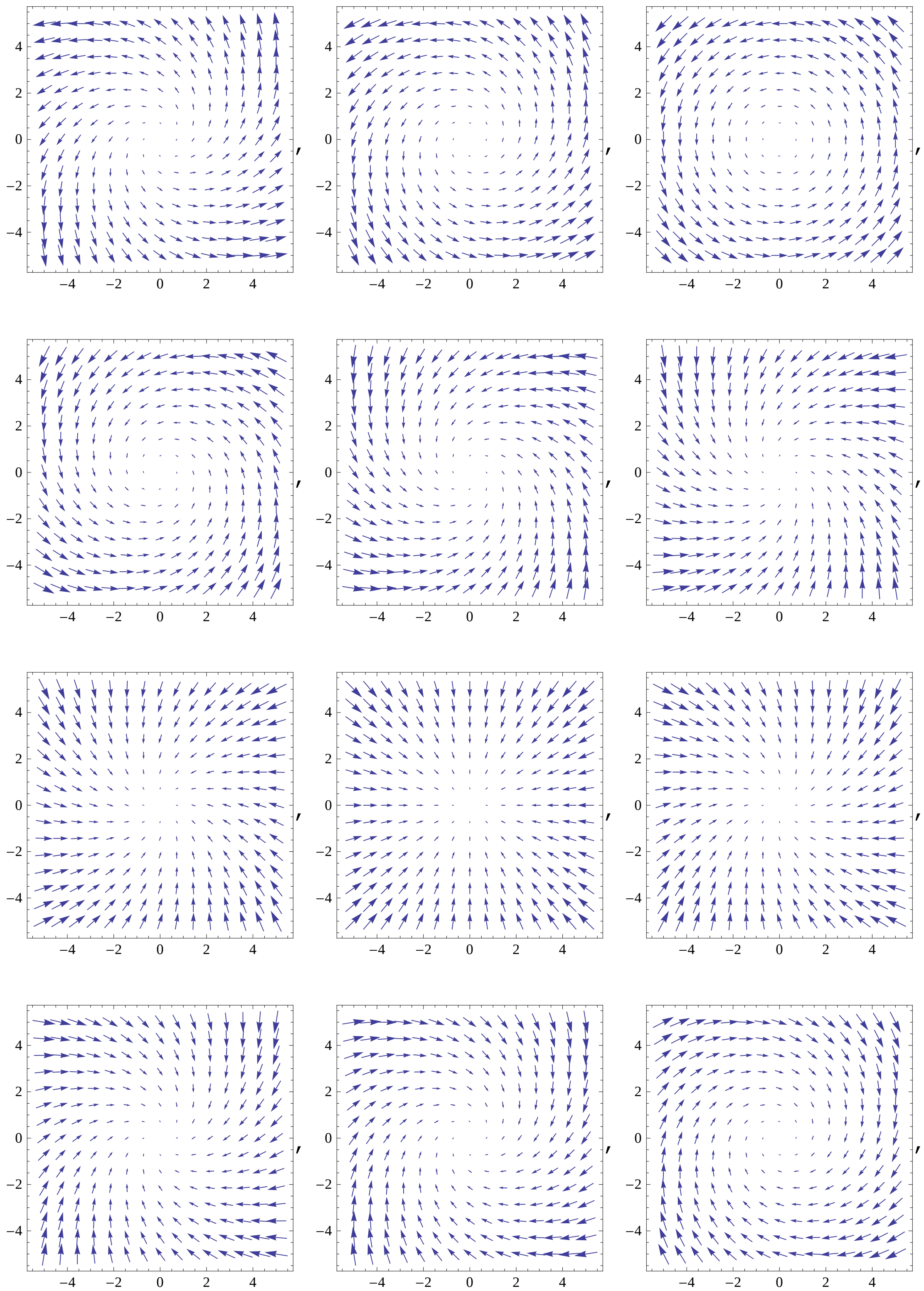
,



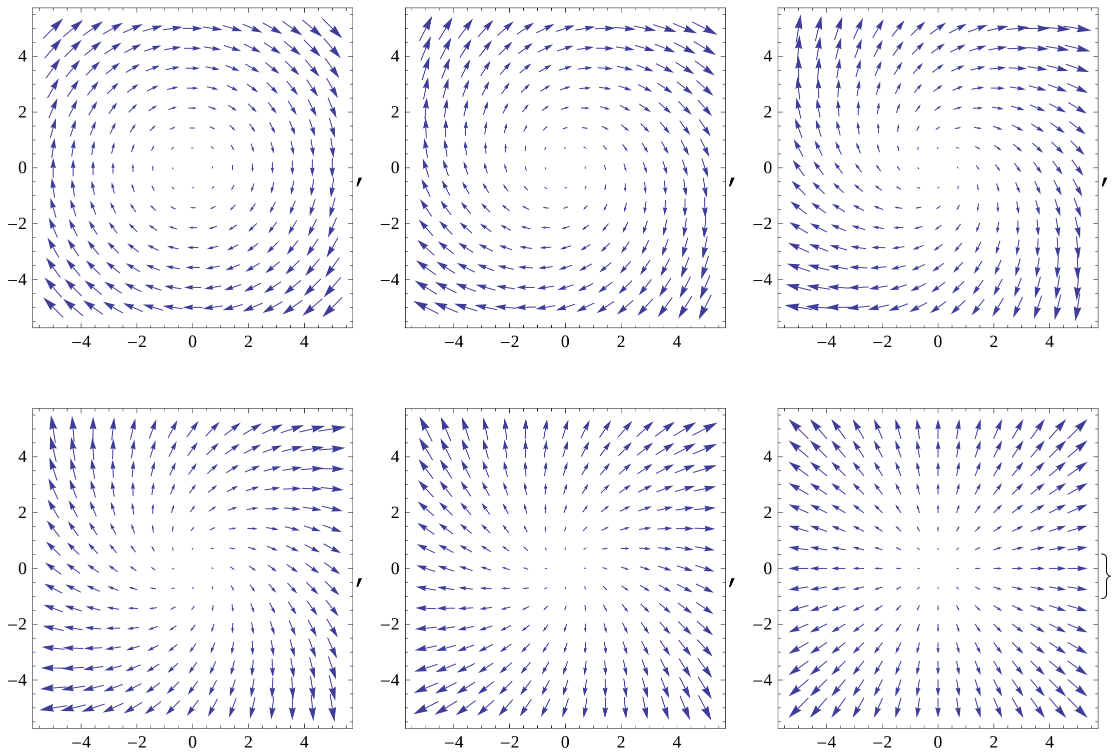
,



,



4
2
0
−2
−4
−4 −2 0 2 4



In[102]:=
```
(* for the
 checkers: it's impossible to draw this field because of the parameter
  α. here we drew the field only for some selected values of α. a
  clear explaination in words with 1 picture is good enough *)
```

In[53]:=
```
(* 1 *)
```

In[49]:=
```
u = 5
```

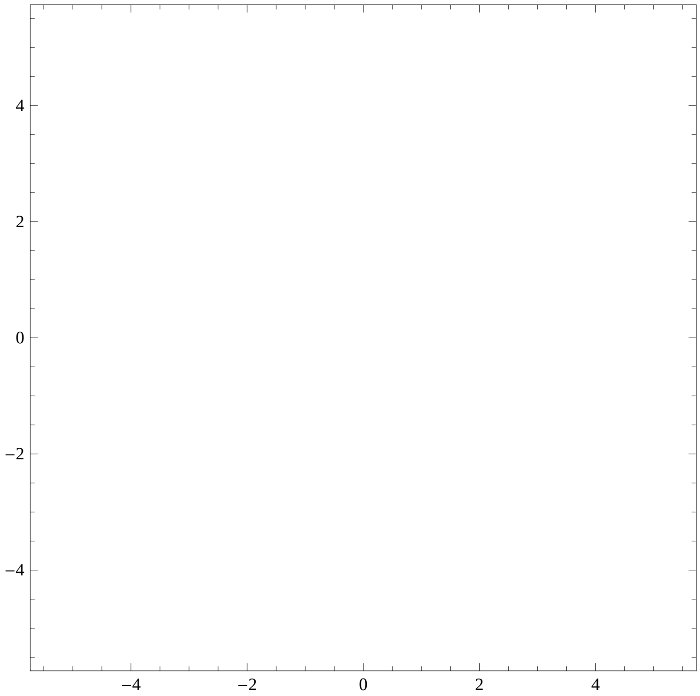
Out[49]= 5

In[50]:=
```
∇u = D[u, {{x, y}}]
```

Out[50]= {0, 0}

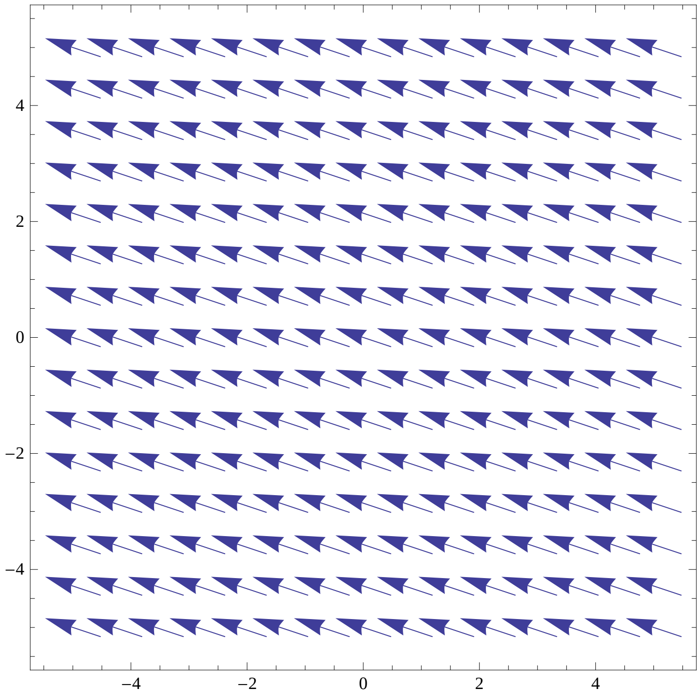
```
VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, -5, 5}]
```

Out[62]=




```
In[100]:= (* zero vectors everywhere. a picture
           with points everywhere is also acceptable *)

In[54]:= (* 2 *)

In[55]:= u = -3 x + y

Out[55]= -3 x + y

In[69]:= ∇u = D[u, {{x, y}}]

Out[69]= {-3, 1}

In[71]:= VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, -5, 5}]
```

Out[71]=



In[72]:= (* 3 *)

In[73]:= $u = -x^2 - y^2$

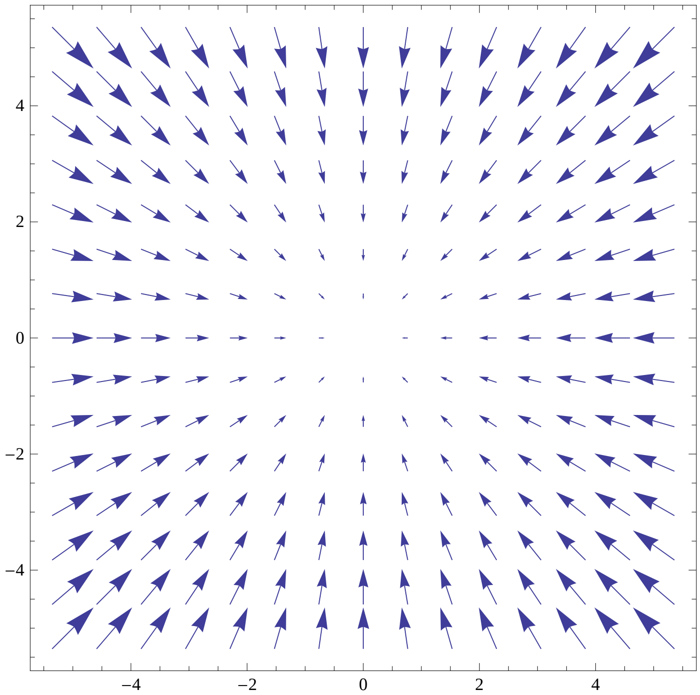
Out[73]= $-x^2 - y^2$

In[74]:= ∇u = D[u, {{x, y}}]

Out[74]= $\{-2x, -2y\}$

In[76]:= VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, -5, 5}]

Out[76]=



In[77]:= (* 4 *)

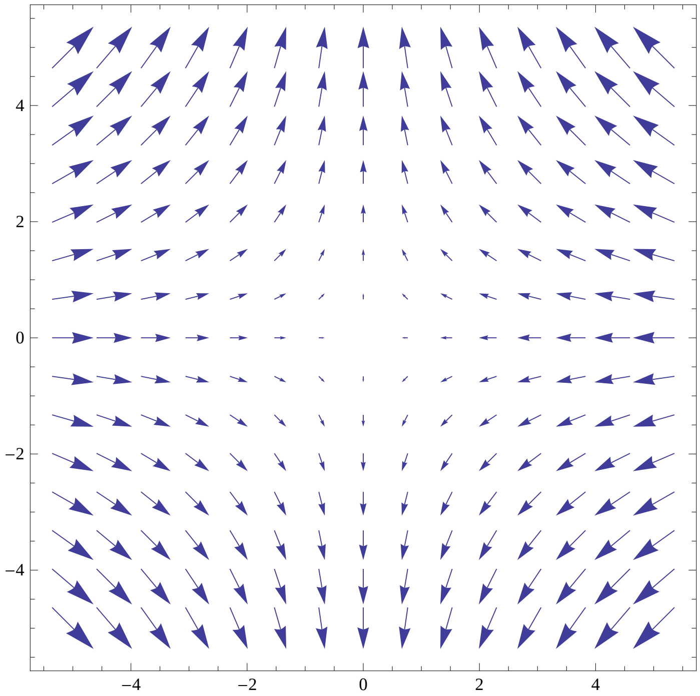
In[78]:= $u = -\frac{1}{2} x^2 + \frac{1}{2} y^2$

Out[78]= $-\frac{x^2}{2} + \frac{y^2}{2}$

In[79]:= ∇u = D[u, {{x, y}}]

Out[79]= $\{-x, y\}$

In[86]:=
```
VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, -5, 5}]
```

Out[86]=


In[87]:=
```
(* 5 *)
```

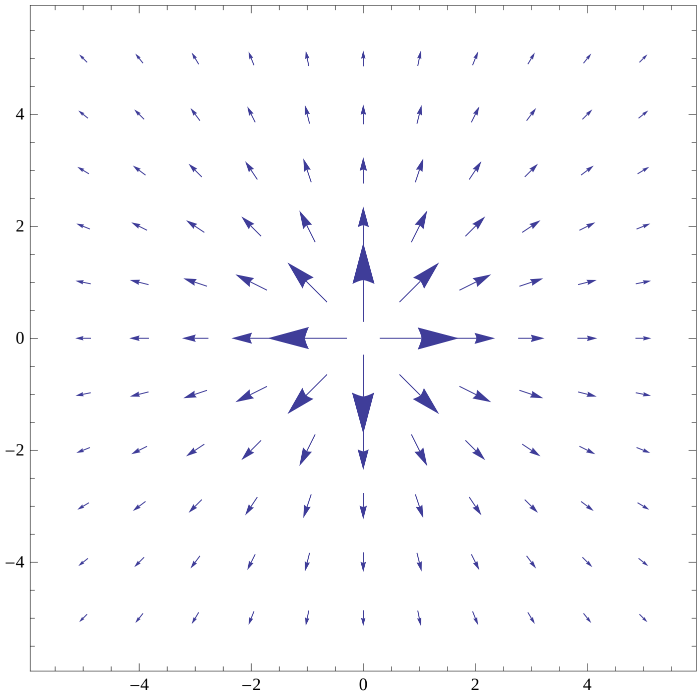
In[89]:= $u = \text{Log}[x^2 + y^2]$

Out[89]= $\text{Log}[x^2 + y^2]$

In[90]:=
```
∇u = D[u, {{x, y}}]
```

Out[90]= $\left\{\frac{2\,x}{x^2+y^2}, \frac{2\,y}{x^2+y^2}\right\}$

In[92]:=
```
VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, -5, 5}, VectorPoints → {11, 11}]
```



In[101]:=
```
(* 6 *)
```

In[103]:= **u = ArcTan[$\frac{y}{x}$]**

Out[103]= ArcTan[$\frac{y}{x}$]

In[104]:= **∇u = D[u, {{x, y}}]**

Out[104]= $\left\{-\frac{y}{x^2\left(1+\frac{y^2}{x^2}\right)}, \frac{1}{x\left(1+\frac{y^2}{x^2}\right)}\right\}$

In[105]:= **Simplify[%]**

Out[105]= $\left\{-\frac{y}{x^2+y^2}, \frac{x}{x^2+y^2}\right\}$

In[110]:= **VectorPlot[Evaluate[∇u], {x, -5, 5}, {y, 0, 10}, VectorPoints → {10, 10}]**

Out[110]=