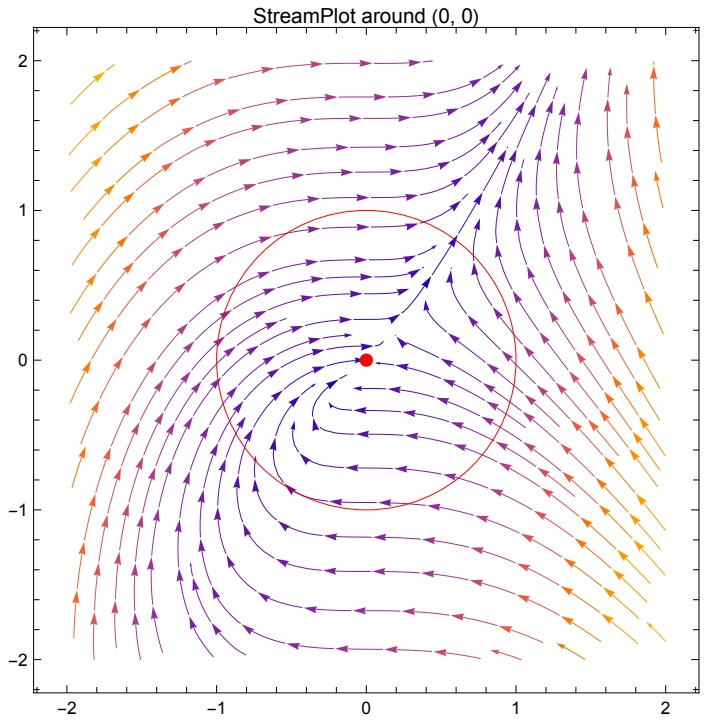
3.1

a)

In[ ]:=
```
fixedPoint = {0, 0};
radius = 1;

StreamPlot[{y - x, x^2}, {x, -2, 2},
 {y, -2, 2}, PlotLabel → "StreamPlot around (0, 0)",
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
```

Out[ ]=

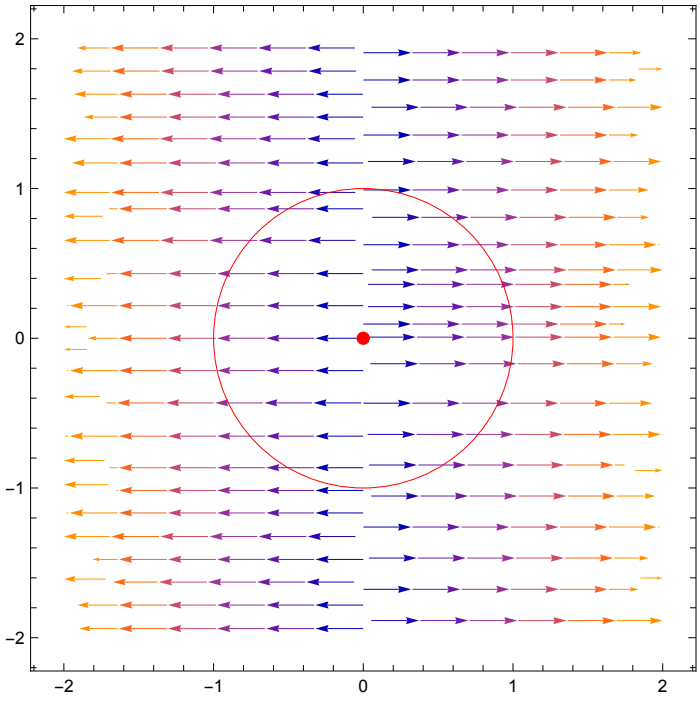


Index =0

b)

In[79]:=
```
h[r_] := a * r; (*Define the function h(r)*)
a = 0.5; (*Define the value of'a'*)

fixedPoint = {0, 0};
radius = 1;

StreamPlot[{h[r], 0}, {r, -2, 2}, {θ, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
```

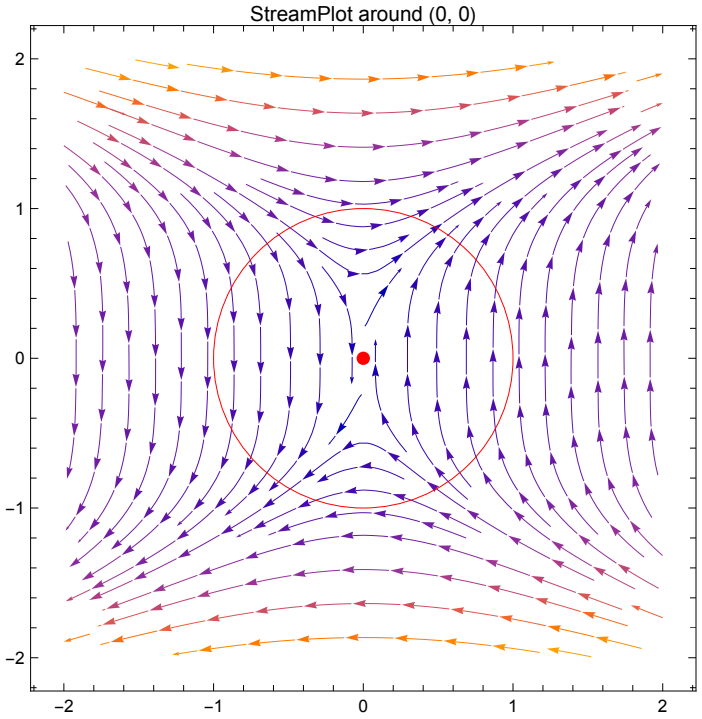
Out[83]=



Index = 1 for b)

In[ ]:=
```
fixedPoint = {0, 0};
radius = 1;

StreamPlot[{y^3, x}, {x, -2, 2},
 {y, -2, 2}, PlotLabel → "StreamPlot around (0, 0)",
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
```

Out[ ]=



Index =-1

d)

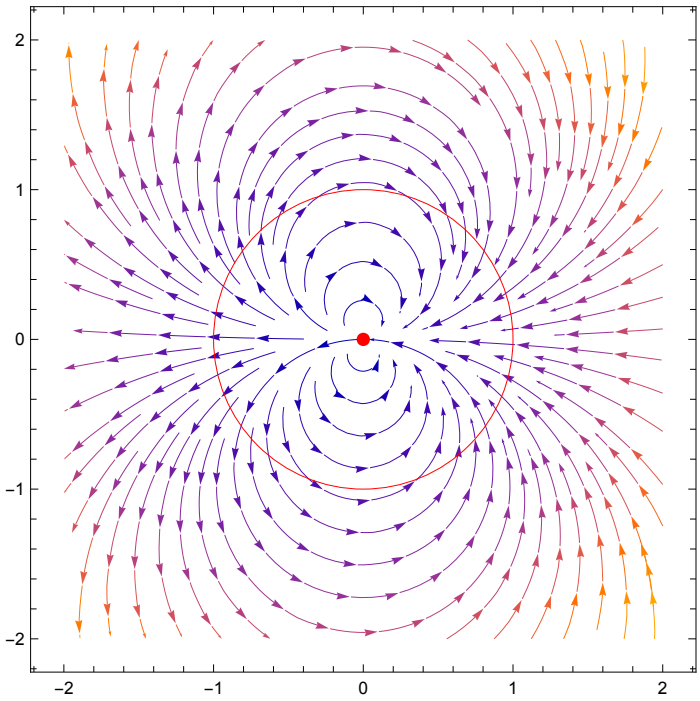
In[ ]:=

```
fixedPoint = {0, 0};
radius = 1;
n = -2
StreamPlot[{(x^2 + y^2) Abs[n] / 2 Cos[n ArcTan[y, x]],
   (x^2 + y^2) Abs[n] / 2 Sin[n ArcTan[y, x]]}, {x, -2, 2}, {y, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
n = -1
StreamPlot[{(x^2 + y^2) Abs[n] / 2 Cos[n ArcTan[y, x]],
   (x^2 + y^2) Abs[n] / 2 Sin[n ArcTan[y, x]]}, {x, -2, 2}, {y, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
n = 1
StreamPlot[{(x^2 + y^2) Abs[n] / 2 Cos[n ArcTan[y, x]],
   (x^2 + y^2) Abs[n] / 2 Sin[n ArcTan[y, x]]}, {x, -2, 2}, {y, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
n = 2; (*Define the value of n*)

StreamPlot[{(x^2 + y^2) Abs[n] / 2 Cos[n ArcTan[y, x]],
   (x^2 + y^2) Abs[n] / 2 Sin[n ArcTan[y, x]]}, {x, -2, 2}, {y, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
n = 3; (*Define the value of n*)

StreamPlot[{(x^2 + y^2) Abs[n] / 2 Cos[n ArcTan[y, x]],
   (x^2 + y^2) Abs[n] / 2 Sin[n ArcTan[y, x]]}, {x, -2, 2}, {y, -2, 2},
 Epilog → {Red, PointSize[0.02], Point[fixedPoint], Circle[fixedPoint, radius]}]
```

Out[ ]=

```
-2
```

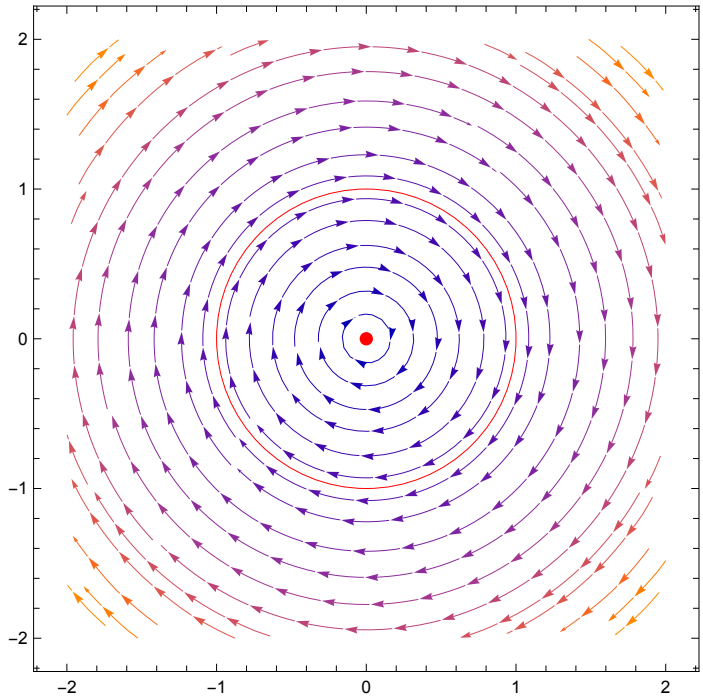
Out[ ]=



Out[ ]=

$$-1$$

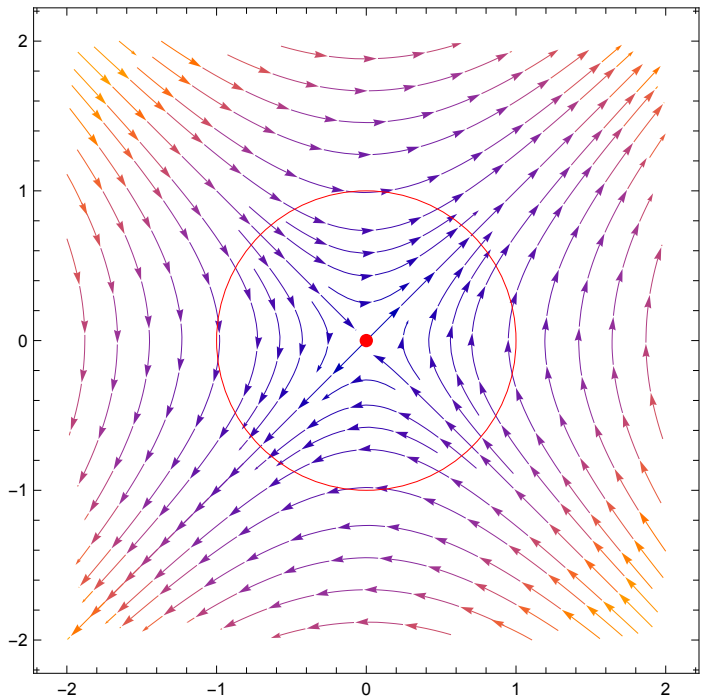
Out[ ]=



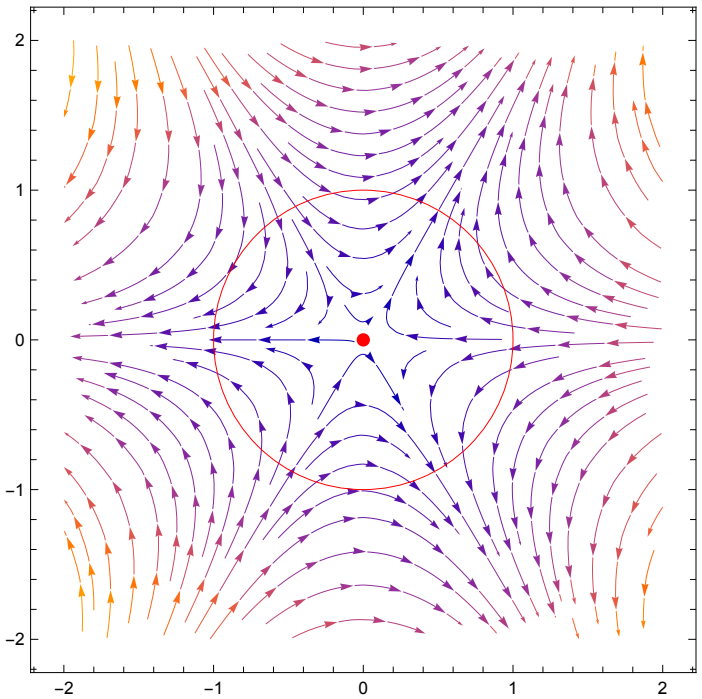
Out[ ]=

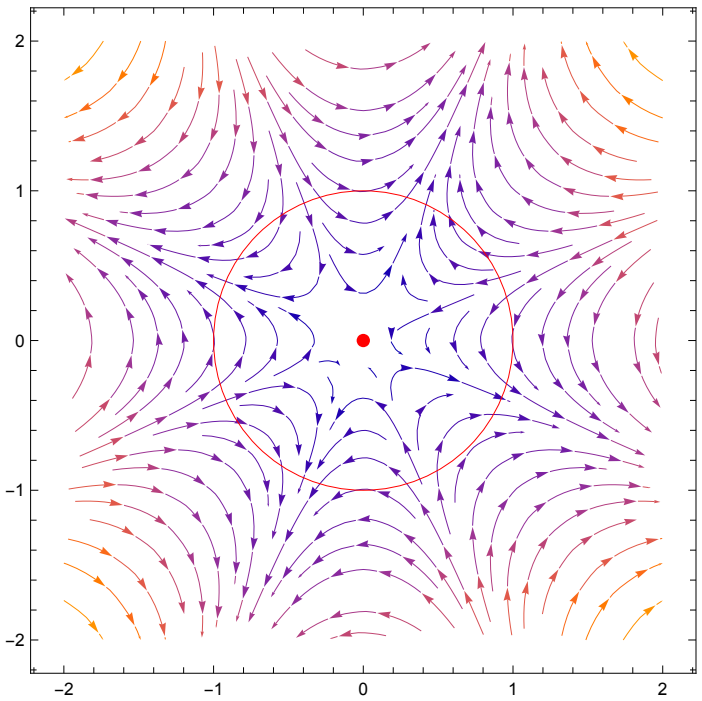
$$1$$

Out[ ]=



Out[ ]=





The index is increases proportional to n. Therefore index = n