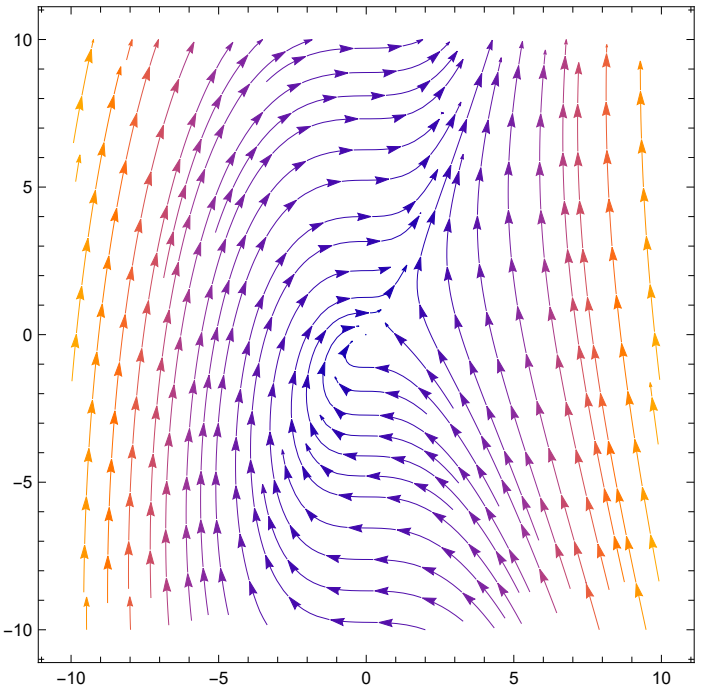
a)

In[ ]:=
```
StreamPlot[{y - x, x^2}, {x, -10, 10}, {y, -10, 10}]
```

Out[ ]=



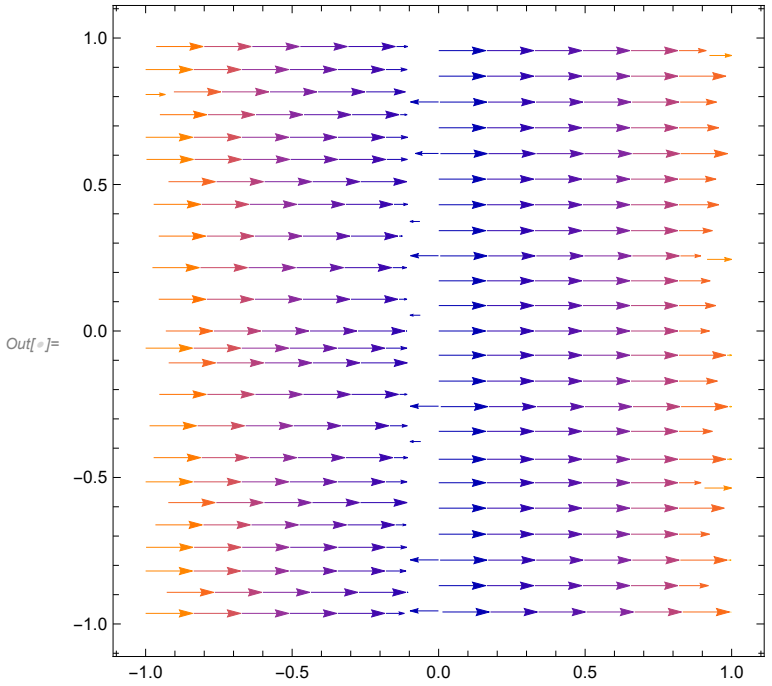
In[201]:=
```
Clear["Global`*"]
 f[x_, y_] := y - x;
g[x_, y_] := x^2;
theta[x_, y_] := ArcTan[g[x, y] / f[x, y]];
Index = (Integrate[D[theta[1, y], y], {y, -1, 1}] +
    Integrate[D[theta[x, -1], x], {x, -1, 1}] +
    Integrate[D[theta[-1, y], y], {y, 1, -1}] +
    Integrate[D[theta[x, 1], x], {x, 1, -1}]) / (2 * π)
```

Out[205]=
```
0
```

b)

In[•]:=
```
StreamPlot[{a * r + r^2, 0} /. {a → 0.1}, {r, -1, 1}, {theta, -1, 1}]
```

Out[•]=



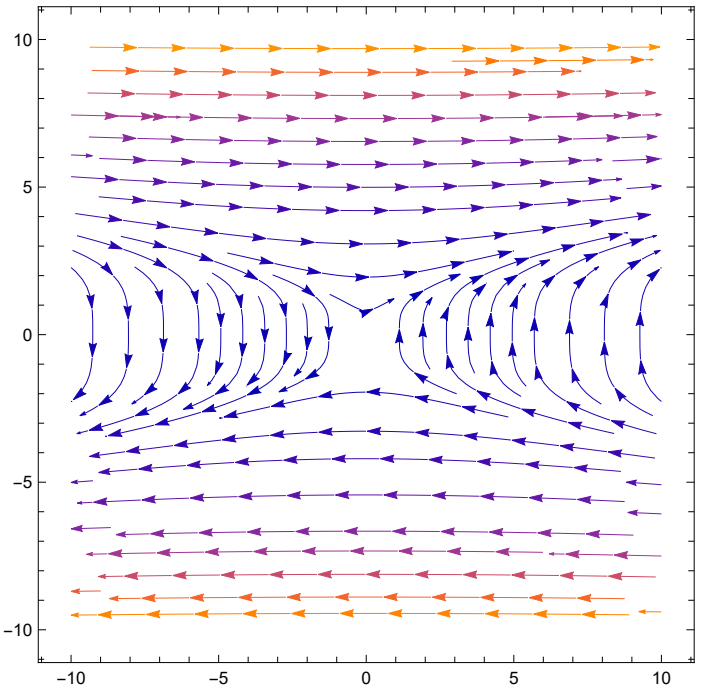
In[217]:=
```
Clear["Global`*"]
f[a_, r_] := a * r + r^2;
g[a_, r_] := 0;
theta[x_, y_] := ArcTan[g[x, y] / f[x, y]];
Index = (Integrate[D[theta[2, y], y], {y, -2, 2}] +
    Integrate[D[theta[x, -2], x], {x, -2, 2}] +
    Integrate[D[theta[-2, y], y], {y, 2, -2}] +
    Integrate[D[theta[x, 2], x], {x, 2, -2}]) / (2 * π)
```

Out[221]=
```
0
```

c)

In[ ]:=
```
StreamPlot[{y^3, x}, {x, -10, 10}, {y, -10, 10}]
```

Out[ ]=



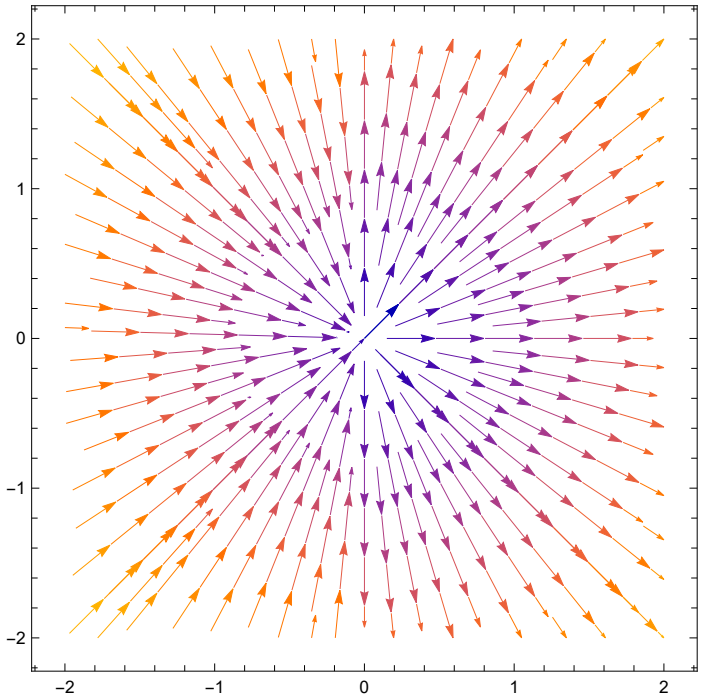
In[206]:=
```
Clear["Global`*"]
f[x_, y_] := y^3;
g[x_, y_] := x;
theta[x_, y_] := ArcTan[g[x, y] / f[x, y]];
index = (Integrate[D[theta[2, y], y], {y, -2, 2}] +
      Integrate[D[theta[x, -2], x], {x, -2, 2}] +
      Integrate[D[theta[-2, y], y], {y, 2, -2}] +
      Integrate[D[theta[x, 2], x], {x, 2, -2}]) / (2 * π);
N[index]
```

Out[211]=
```
-1.
```

d)

In[ ]:=
```
xDot = (x^2 + y^2)^(Abs[n] / 2) * Cos[n * ArcTan[y / x]];
yDot = (x^2 + y^2)^(Abs[n / 2]) * Sin[n * ArcTan[y / x]];
StreamPlot[{xDot, yDot} /. {n → 1}, {x, -2, 2}, {y, -2, 2}]
```

Out[ ]=



In[212]:=
```
Clear["Global`*"]
f[x_, y_] := (x^2 + y^2)^(Abs[n] / 2) * Cos[n * ArcTan[y / x]];
g[x_, y_] := (x^2 + y^2)^(Abs[n / 2]) * Sin[n * ArcTan[y / x]];
theta[x_, y_] := ArcTan[g[x, y] / f[x, y]];
Index = (Integrate[D[theta[2, y], y], {y, -2, 2}] +
    Integrate[D[theta[x, -2], x], {x, -2, 2}] +
    Integrate[D[theta[-2, y], y], {y, 2, -2}] +
    Integrate[D[theta[x, 2], x], {x, 2, -2}]) / (2 * π)
```

Out[216]= n