

```
Clear["Global*"];
```

```
a:=2;
```

```
Remove[ffund, orthDeriv];
```

```
ffund:=Log[(##[[1]]^2 + ##[[2]]^2)^(1/2)]&;
```

```
orthDeriv[f_, xy_-]:={-D[f[{x, y}], y], D[f[{x, y}], x]}/.{x -> xy[[1]], y -> xy[[2]]};
```

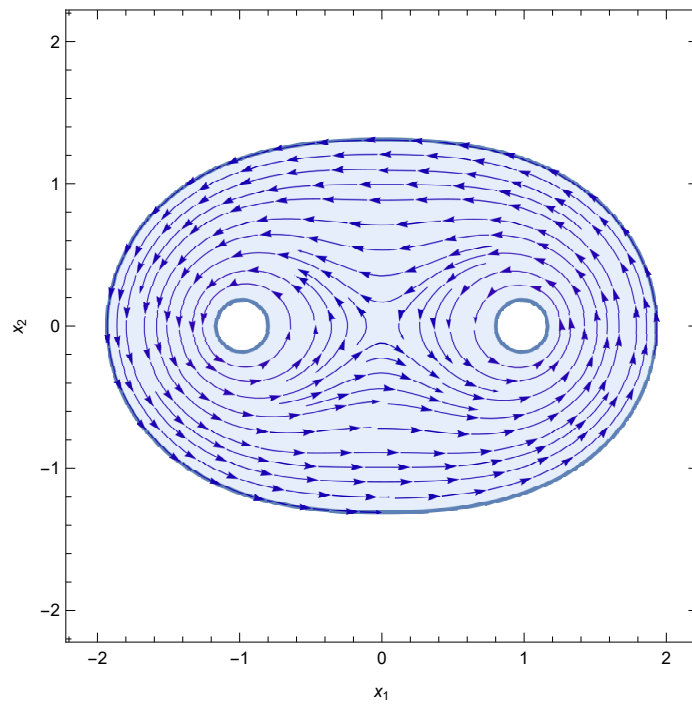
```
e1:={1, 0};
```

```
f1:=ffund[## - e1] + ffund[## + e1]&;
```

```
g1:=orthDeriv[f1, ##]&;
```

```
Remove[x, y];
```

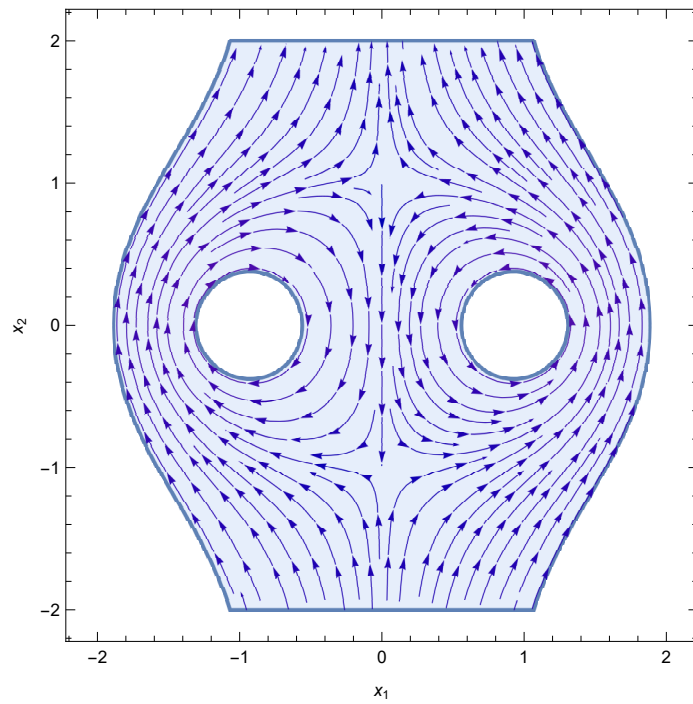
```
StreamPlot[g1[{x, y}], {x, -a, a}, {y, -a, a}, StreamPoints->Fine, FrameLabel->{x1, x2}, RegionFunction->F
```



```
f2:=ffund[## - e1] - ffund[## + e1] + ##[[1]]&;
```

```
g2:=orthDeriv[f2, ##]&
```

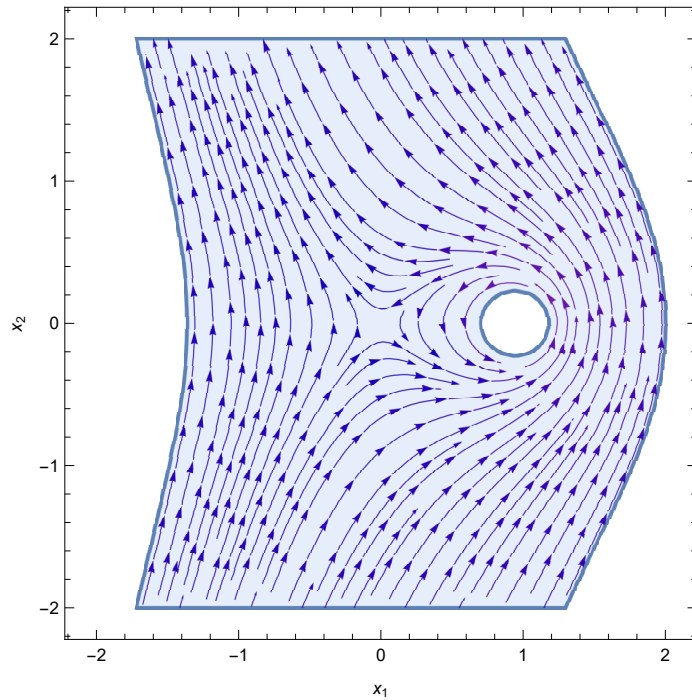
```
StreamPlot[g2[{x, y}], {x, -a, a}, {y, -a, a}, StreamPoints->Fine, FrameLabel->{x1, x2}, RegionFunction->F
```



```
f3:=ffund[## - e1] + ##[[1]]&
```

```
g3:=orthDeriv[f3, ##]&
```

```
StreamPlot[g3[{x, y}], {x, -a, a}, {y, -a, a}, StreamPoints->Fine, FrameLabel->{x1, x2}, RegionFunction->F
```



```

Animate[StreamPlot[(1 - lambda) * g1[{x, y}] + lambda * g2[{x, y}], {x, -a, a}, {y, -a, a}, FrameLabel->{x1,
AnimationRate -> .05]

```



```

Animate[VectorPlot[(1 - lambda) * g1[{x, y}]4 + lambda * g2[{x, y}], {x, -a, a}, {y, -a, a}, FrameLabel->{x1,
AnimationRate -> .05]

```



```

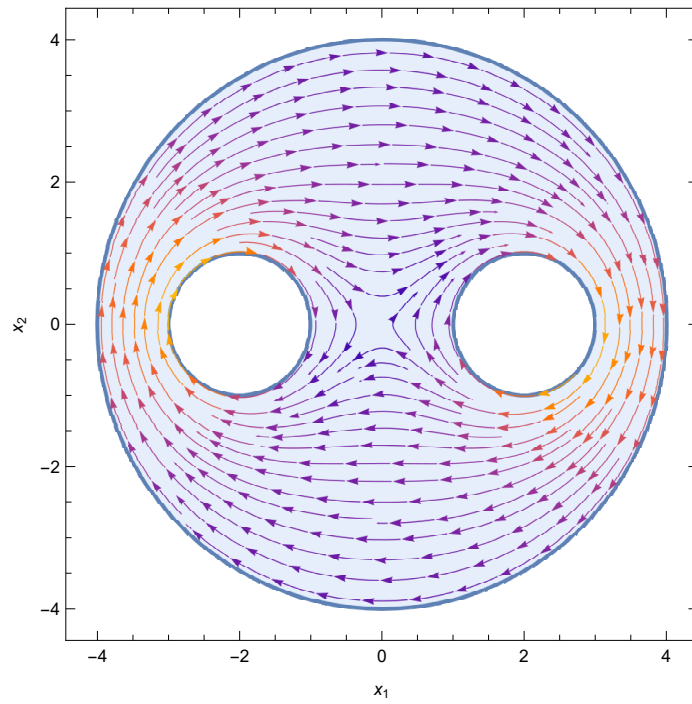
regionOmega = RegionDifference[Disk[{0, 0}, 4], RegionUnion[Disk[{-2, 0}, 1], Disk[{2, 0}, 1]]];
solveDirichlet[uBoundary_]:=Module[{uval},
LaplaceEquation2D = {Laplacian[u[x, y], {x, y}]==0, DirichletCondition[u[x, y]==uBoundary[x, y], True]};
(*Dsolve[LaplaceEquation2D, u[x, y], x, y]*)

```

```

uval = NDSolveValue[LaplaceEquation2D, u, {x, y} ∈ regionOmega][#[[1]], #[[2]]]&; uval]
uBoundary = If[#1^2 + #2^2 > 15, 0, 1]&;
f4 = solveDirichlet[uBoundary];
g4:=orthDeriv[f4, #]&;
StreamPlot[Evaluate[g4[{x, y}]], {x, y} ∈ regionOmega, FrameLabel-> {x1, x2}, StreamPoints->Fine]

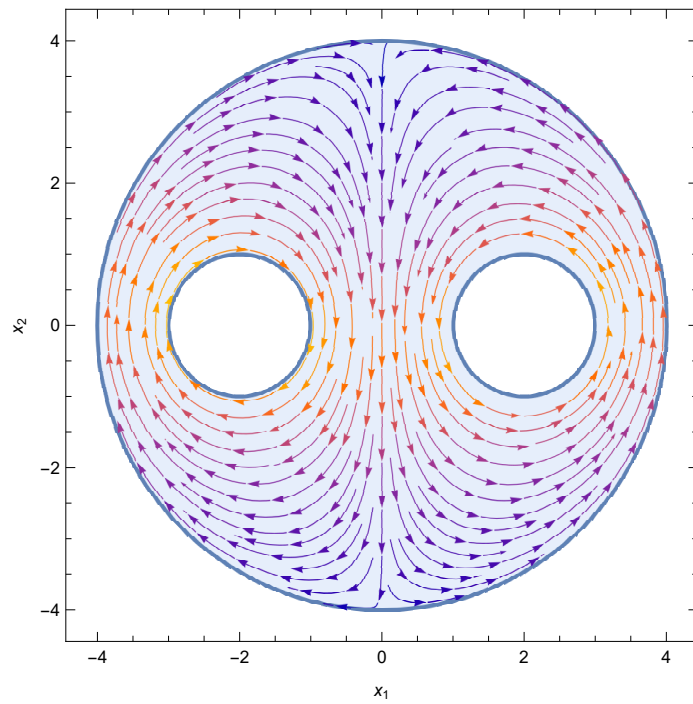
```



```

uBoundary = If[#1^2 + #2^2 > 15, 0, If[#1 > 0, -1, 1]]&;
f5 = solveDirichlet[uBoundary];
g5:=orthDeriv[f5, #]&;
StreamPlot[Evaluate[g5[{x, y}]], {x, y} ∈ regionOmega, FrameLabel-> {x1, x2}, StreamPoints->Fine]

```



**Animate [StreamPlot [Evaluate[(1 - lambda) * g4[{x, y}] + lambda * g5[{x, y}]], {x, y} ∈ regionOmega, FrameL
 AnimationRunning->False, AnimationRate → .05]**

