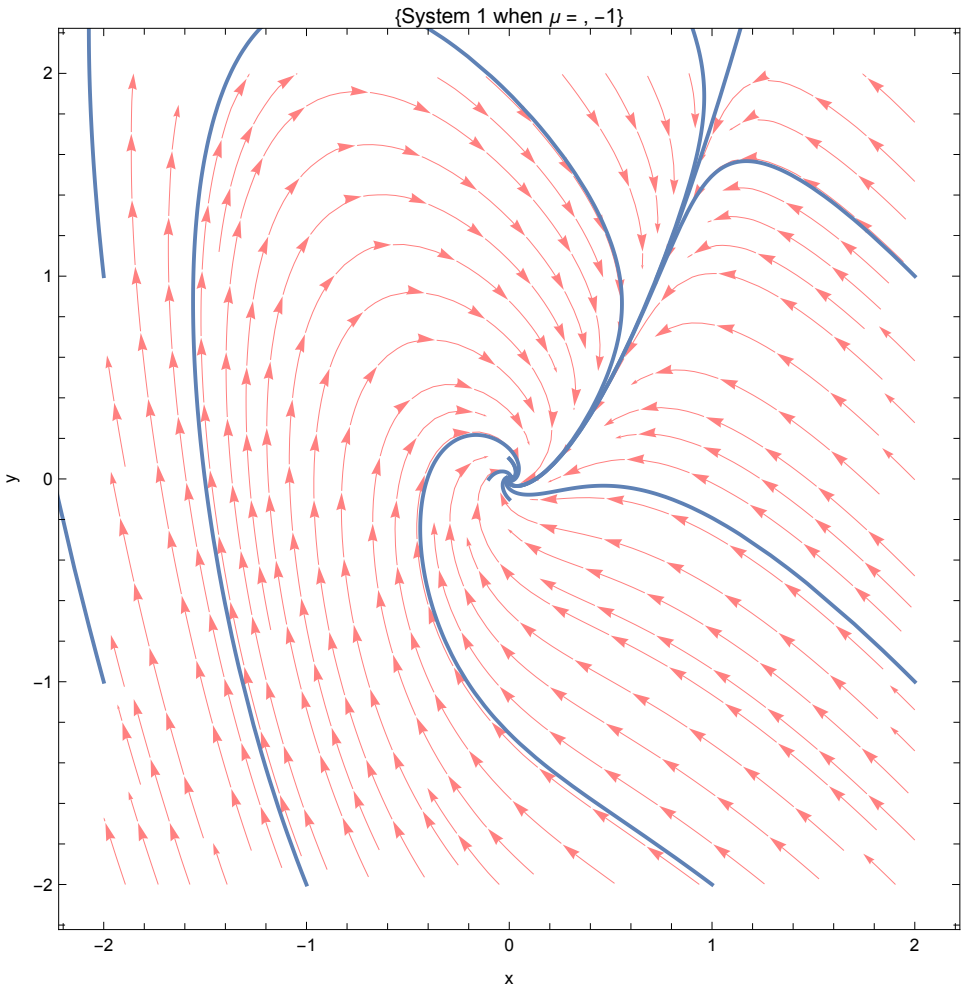
3.3

```
ClearAll["Global`*"]

(*Define systems*)
mu = -1;
eq1 = x'[t] == mu * x[t] + y[t] - x[t]^2;
eq2 = y'[t] == -x[t] + mu * y[t] + 2 * x[t]^2;
system = {eq1, eq2};

startPt = {{x[0] == -2, y[0] == -1}, {x[0] == -2, y[0] == 1},
    {x[0] == 2, y[0] == -1}, {x[0] == 2, y[0] == 1}, {x[0] == -1, y[0] == -2},
    {x[0] == 1, y[0] == -2}, {x[0] == 0, y[0] == -0.1}, {x[0] == 0, y[0] == 0.1},
    {x[0] == -0.1, y[0] == 0}, {x[0] == 0, y[0] == 0.1}};

t0 = 0;
tMax = 10;
sol = Table[NDSolve[{system, mu}, {x, y}, {t, t0, tMax}], {mu, startPt}];
sp = StreamPlot[{mu * x + y - x^2, -x + mu * y + 2 * x^2},
    {x, -2, 2}, {y, -2, 2}, StreamColorFunction → None,
    StreamStyle → Pink, PlotRange → All, ImageSize → 500];
tp = ParametricPlot[Evaluate[{x[t], y[t]} /. #] & /@ sol, {t, t0, tMax}];
Show[sp, tp, FrameLabel → {"x", "y"}, PlotLabel → {"System 1 when μ = ", mu}]
```

ReplaceAll : {#1} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

Out[ ]=



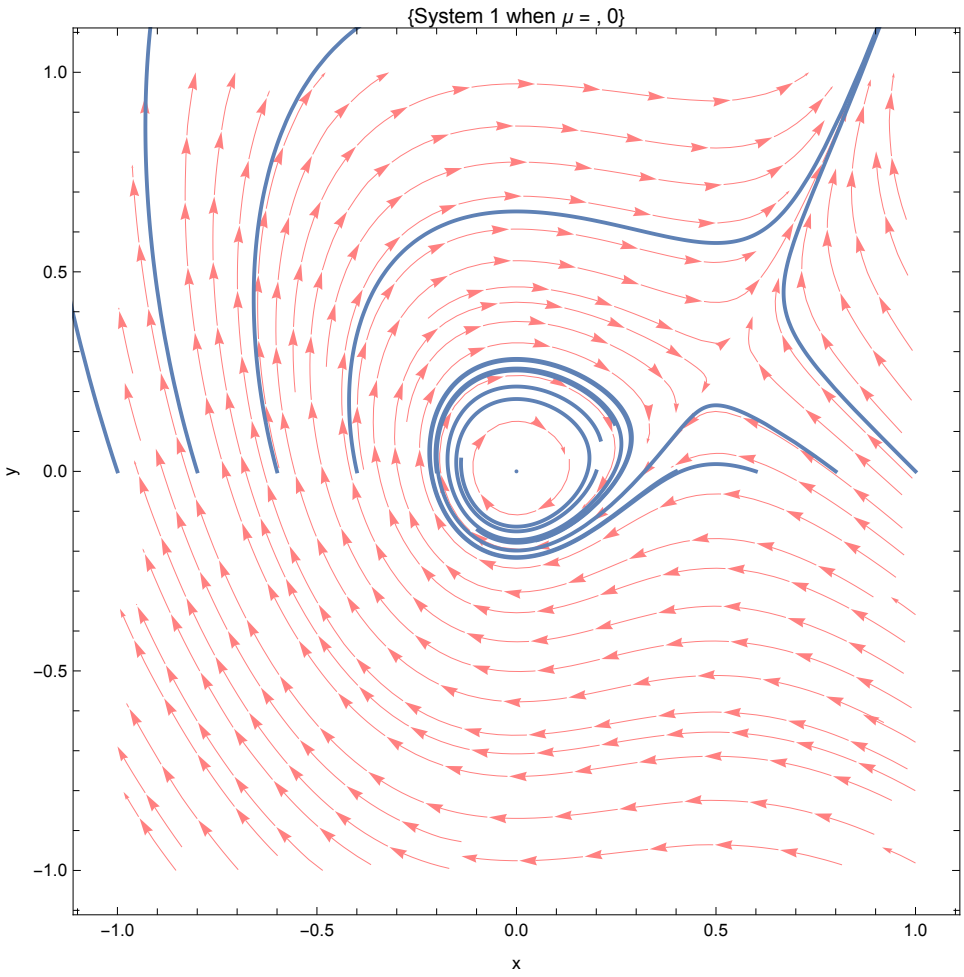
In[65]:=
```
ClearAll["Global`*"]

mu = 0;
eq1 = x'[t] == mu * x[t] + y[t] - x[t]^2;
eq2 = y'[t] == -x[t] + mu * y[t] + 2 * x[t]^2;
system = {eq1, eq2};
nTraj = 10
startPt = Table[{x[0] == -1 + 2 * i / nTraj, y[0] == 0}, {i, 0, nTraj}];
(*startPt={{x[0]==-2,y[0]==-1},{x[0]==-2,y[0]==1},{x[0]==2,y[0]==-1},
   {x[0]==2,y[0]==1},{x[0]==-1,y[0]==-2},{x[0]==1,y[0]==-2},{x[0]==0,y[0]==-0.1},
   {x[0]==0,y[0]==0.1},{x[0]==-0.1,y[0]== 0},{x[0]==0,y[0]==0.1}};*)

t0 = 0;
tMax = 10;
sol = Table[NDSolve[{system, mu}, {x, y}, {t, t0, tMax}], {mu, startPt}];
sp = StreamPlot[{mu * x + y - x^2, -x + mu * y + 2 * x^2},
   {x, -1, 1}, {y, -1, 1}, StreamColorFunction → None,
   StreamStyle → Pink, PlotRange → All, ImageSize → 500];
tp = ParametricPlot[Evaluate[{x[t], y[t]} /. #] & /@ sol, {t, t0, tMax}];
Show[sp, tp, FrameLabel → {"x", "y"}, PlotLabel → {"System 1 when μ = ", mu}]
```

Out[70]=

10

ReplaceAll : {#1} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

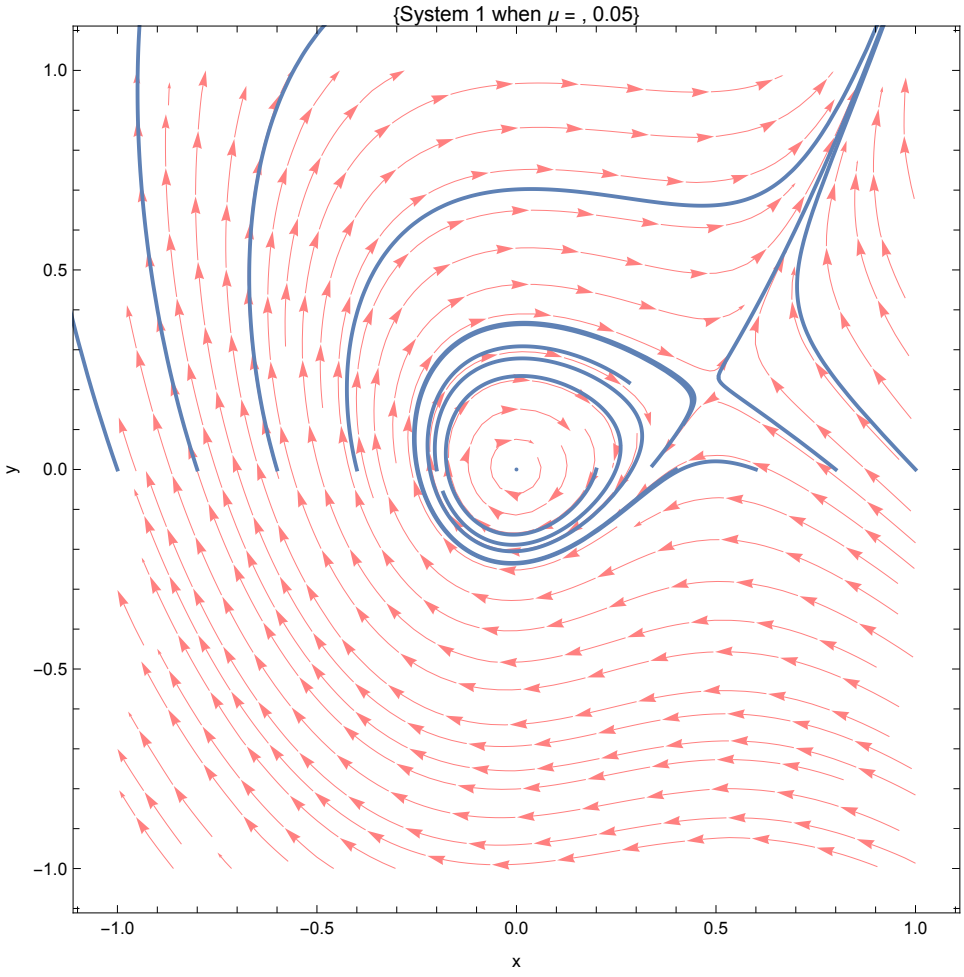
Out[77]=



In[89]:=
```
mu = 0.05;
eq1 = x'[t] == mu * x[t] + y[t] - x[t]^2;
eq2 = y'[t] == -x[t] + mu * y[t] + 2 * x[t]^2;
system = {eq1, eq2};

startPt = Table[{x[0] == -1 + 2 * i / nTraj, y[0] == 0}, {i, 0, nTraj}];
(*startPt={{x[0]==-2,y[0]==-1},{x[0]==-2,y[0]==1},{x[0]==2,y[0]==-1},
   {x[0]==2,y[0]==1},{x[0]==-1,y[0]==-2},{x[0]==1,y[0]==-2},{x[0]==0,y[0]==-0.1},
   {x[0]==0,y[0]==0.1},{x[0]==-0.1,y[0]== 0},{x[0]==0,y[0]==0.1}};*)

t0 = 0;
tMax = 10;
sol = Table[NDSolve[{system, mu}, {x, y}, {t, t0, tMax}], {mu, startPt}];
sp = StreamPlot[{mu * x + y - x^2, -x + mu * y + 2 * x^2},
   {x, -1, 1}, {y, -1, 1}, StreamColorFunction → None,
   StreamStyle → Pink, PlotRange → All, ImageSize → 500];
tp = ParametricPlot[Evaluate[{x[t], y[t]} /. #] & /@ sol, {t, t0, tMax}];
Show[sp, tp, FrameLabel → {"x", "y"}, PlotLabel → {"System 1 when μ = ", mu}]
```

ReplaceAll : {#1} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

Out[99]=

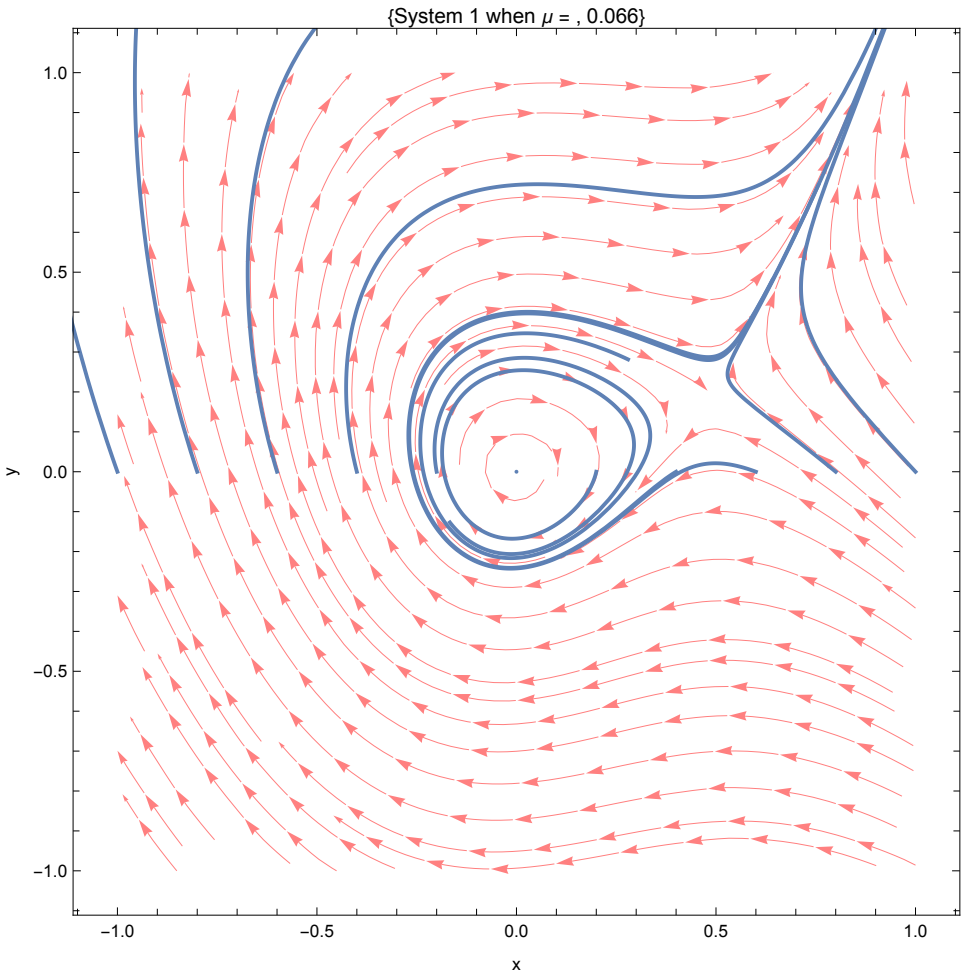


In[100]:=

```
mu = 0.066;
eq1 = x'[t] == mu * x[t] + y[t] - x[t]^2;
eq2 = y'[t] == -x[t] + mu * y[t] + 2 * x[t]^2;
system = {eq1, eq2};

startPt = Table[{x[0] == -1 + 2 * i / nTraj, y[0] == 0}, {i, 0, nTraj}];
(*startPt=
  {{x[0]==-2,y[0]==-1},{x[0]==-2,y[0]==1},{x[0]==2,y[0]==-1},{x[0]==2,y[0]==1},
   {x[0]==-1,y[0]==-2},{x[0]==1,y[0]==-2},{x[0]==0,y[0]==-0.1},{x[0]==0,y[0]==0.1},
   {x[0]==-0.1,y[0]== 0},{x[0]==0,y[0]==0.1},{x[0]==0.2,y[0]==0}};*)

t0 = 0;
tMax = 10;
sol = Table[NDSolve[{system, mu}, {x, y}, {t, t0, tMax}], {mu, startPt}];
sp = StreamPlot[{mu * x + y - x^2, -x + mu * y + 2 * x^2},
   {x, -1, 1}, {y, -1, 1}, StreamColorFunction → None,
   StreamStyle → Pink, PlotRange → All, ImageSize → 500];
tp = ParametricPlot[Evaluate[{x[t], y[t]} /. #] & /@ sol, {t, t0, tMax}];
Show[sp, tp, FrameLabel → {"x", "y"}, PlotLabel → {"System 1 when μ = ", mu}]
```

ReplaceAll : {#1} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

Out[110]=

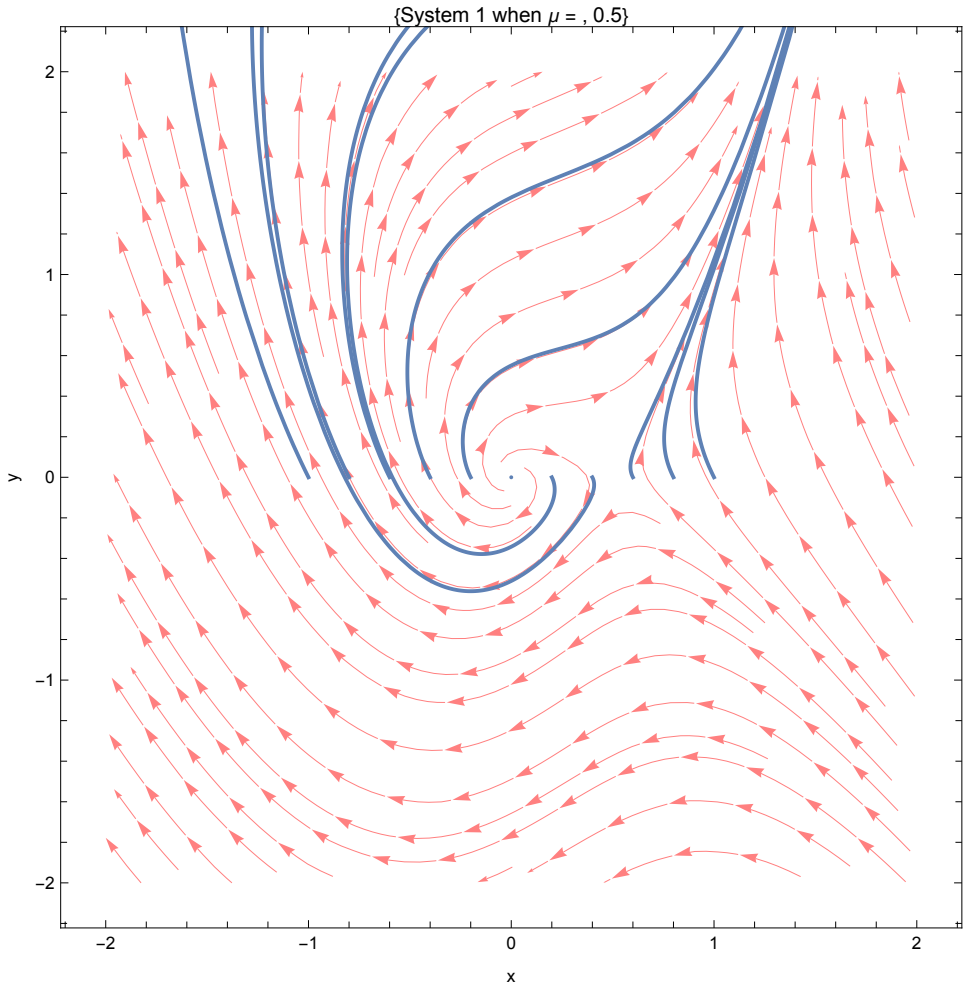


In[111]:=

```
mu = 0.5;
eq1 = x'[t] == mu * x[t] + y[t] - x[t]^2;
eq2 = y'[t] == -x[t] + mu * y[t] + 2 * x[t]^2;
system = {eq1, eq2};
startPt = Table[{x[0] == -1 + 2 * i / nTraj, y[0] == 0}, {i, 0, nTraj}];
(*startPt={{x[0]==-2,y[0]==-1},{x[0]==-2,y[0]==1},{x[0]==2,y[0]==-1},
   {x[0]==2,y[0]==1},{x[0]==-1,y[0]==-2},{x[0]==1,y[0]==-2},{x[0]==0,y[0]==-0.1},
   {x[0]==0,y[0]==0.1},{x[0]==-0.1,y[0]== 0},{x[0]==0,y[0]==0.1}};*)

t0 = 0;
tMax = 10;
sol = Table[NDSolve[{system, mu}, {x, y}, {t, t0, tMax}], {mu, startPt}];
sp = StreamPlot[{mu * x + y - x^2, -x + mu * y + 2 * x^2},
   {x, -2, 2}, {y, -2, 2}, StreamColorFunction → None,
   StreamStyle → Pink, PlotRange → All, ImageSize → 500];
tp = ParametricPlot[Evaluate[{x[t], y[t]} /. #] & /@ sol, {t, t0, tMax}];
Show[sp, tp, FrameLabel → {"x", "y"}, PlotLabel → {"System 1 when μ = ", mu}]
```

ReplaceAll : {#1} is neither a list of replacement rules nor a valid dispatch table, and so cannot be used for replacing.

Out[121]=



c)