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# TASK 3

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### init

```
clear, clc
```

### b

```
syms sigma

M = [ sigma+3, 4; -9/4, sigma-3 ];
[V, D] = eig(M);
fprintf('The eigenvalues are [%s, %s].\n', diag(D))
normalizedV = -V/norm(V);
fprintf('The eigenvector is [%s, %s].\n', normalizedV)
inverseM = inv(M);
fprintf('The inverse matrix is [%s, %s ; %s, %s]. \n\n',
    inverseM(1,1), inverseM(1,2), inverseM(2,1), inverseM(2,2))
```

### c

```
syms c d
eq1 = sigma - c*d == sigma + 3;
eq2 = d^2 == 4;
eq3 = -c^2 == -(9/4);
eq4 = sigma + c*d == sigma - 3;

eq = [eq1; eq2; eq3; eq4];
S = solve(eq);
I = find(S.c > 0);
fprintf('The variable c = %s, d = %s. \n', S.c(I), S.d(I))

M = [sigma - c*d, d^2; -c^2, sigma + c*d];
[V, D] = eig(M);
fprintf('The eigenvalues are [%s, %s].\n', diag(D))
fprintf('The eigenvector is [%s, %s]/%s.\n', V, norm(V))
inverseM = inv(M);
fprintf('The inverse matrix is [%s, %s ; %s, %s]. \n', inverseM(1,1),
    inverseM(1,2), inverseM(2,1), inverseM(2,2))
```

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```

In[591]:= sigma0 = -1;
StreamPlot[
  {(sigma + 3) * x + 4 y, -9/4 x + (sigma - 3) y} /. {sigma -> sigma0},
  {x, -10, 10},
  {y, -10, 10},
  StreamStyle -> {Red},
  PlotLabel -> StringJoin["σ = ", ToString[N[sigma0]]],
  FrameLabel -> {Style["x", Black, Medium], Style["y", Black, Medium]},
  Epilog -> {{PointSize[Large], Point[{0, 0}]},
    Text[Style["Stable fixed point", Medium, Bold], {0, -1}]},
  LabelStyle -> Directive[FontSize -> 15]
]

sigma0 = 0;
StreamPlot[
  {(sigma + 3) * x + 4 y, -9/4 x + (sigma - 3) y} /. {sigma -> sigma0},
  {x, -10, 10},
  {y, -10, 10},
  StreamStyle -> {Red},
  PlotLabel -> StringJoin["σ = ", ToString[N[sigma0]]],
  FrameLabel -> {Style["x", Black, Medium], Style["y", Black, Medium]},
  Epilog -> {{PointSize[Large], Point[{0, 0}]},
    Text[Style["Unstable fixed point", Medium, Bold], {0, -1}]},
  LabelStyle -> Directive[FontSize -> 15]
]

sigma0 = 1;
StreamPlot[
  {(sigma + 3) * x + 4 y, -9/4 x + (sigma - 3) y} /. {sigma -> sigma0},
  {x, -10, 10},
  {y, -10, 10},
  StreamStyle -> {Red},
  PlotLabel -> StringJoin["σ = ", ToString[N[sigma0]]],
  FrameLabel -> {Style["x", Black, Medium], Style["y", Black, Medium]},
  Epilog -> {{PointSize[Large], Point[{0, 0}]},
    Text[Style["Unstable fixed point", Medium, Bold], {0, -1}]},
  LabelStyle -> Directive[FontSize -> 15]
]

```



