Examples of Complex Eigenvalues

```
clear all
```

Class 18 (Monday, October 24) Example

```
A = [2 5/2; −1 3 ]
```

```
A = 2×2
    2.0000    2.5000
   −1.0000    3.0000
```

```
RHS = [.01;.02];
B = rref([A −RHS]);
eqSoln = B(:,end)
```

```
eqSoln = 2×1
    0.0024
   −0.0059
```

```
[X D] = eig(sym(A))
```

X =

$$\begin{pmatrix} \frac{1}{2}+\frac{3}{2}\,\mathrm{i} & \frac{1}{2}-\frac{3}{2}\,\mathrm{i} \\ 1 & 1 \end{pmatrix}$$

D =

$$\begin{pmatrix} \frac{5}{2}-\frac{3}{2}\,\mathrm{i} & 0 \\ 0 & \frac{5}{2}+\frac{3}{2}\,\mathrm{i} \end{pmatrix}$$

```
yBounds = [−5,5]
```

```
yBounds = 1×2
   −5    5
```
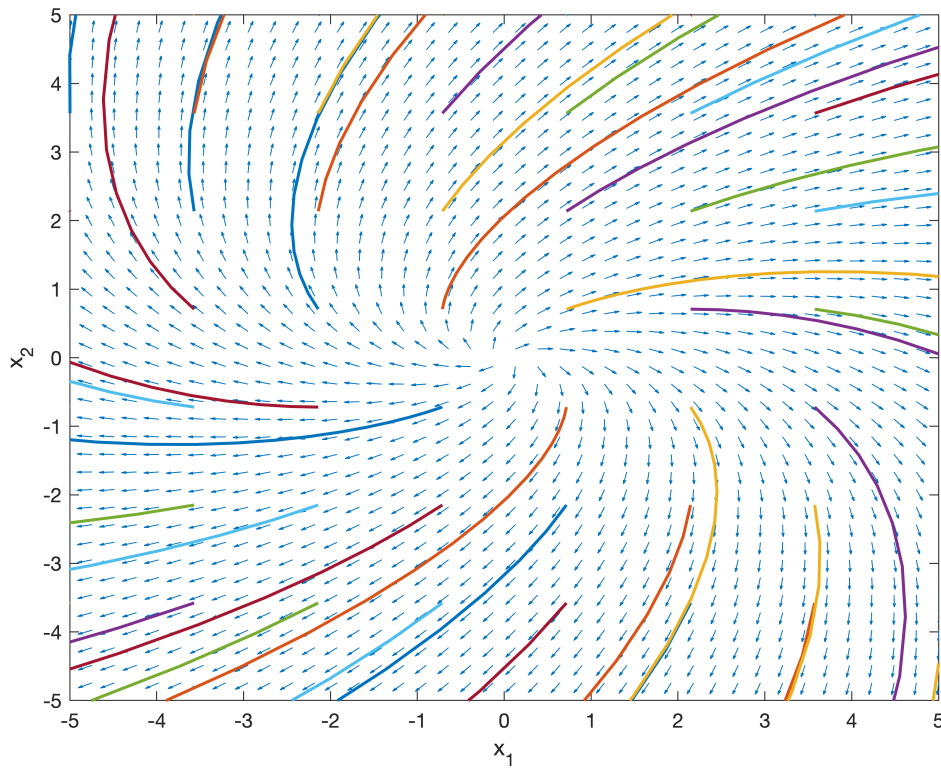
```
tBounds = [0,50]
```

```
tBounds = 1×2
    0    50
```

```
M = 8
```

```
M = 8
```

```
plotPhasePlane(A, yBounds, tBounds,M,RHS,eqSoln)
```

A Complex Eigenvalue Example

```
A = [0 1; -2 0];
RHS = [1;2];
B = rref([A -RHS]);
eqSoln = B(:,end)
```

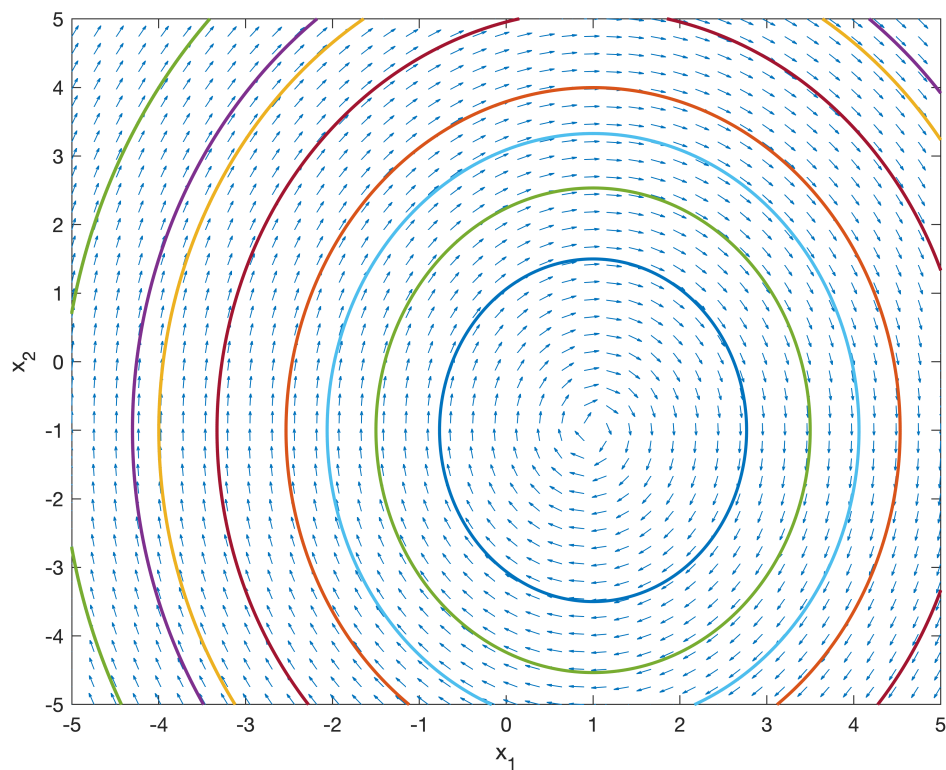eqSoln = 2×1
       1
      -1

```
[X D] = eig(sym(A))
```

X =

$$\begin{pmatrix} \dfrac{\sqrt{2}\,i}{2} & -\dfrac{\sqrt{2}\,i}{2} \\ 1 & 1 \end{pmatrix}$$

D =

$$\begin{pmatrix} -\sqrt{2}\,i & 0 \\ 0 & \sqrt{2}\,i \end{pmatrix}$$

```
M=5
```

```
M = 5
```

```
plotPhasePlane(A, yBounds, tBounds,M,RHS,eqSoln)
```


Exercise 5 from Section 3.4

```
A = [1 −1; 5 −3];
RHS = [1;2];
B = rref([A −RHS]);
eqSoln = B(:,end)
```

```
eqSoln = 2×1
    0.5000
    1.5000
```

```
[X D] = eig(sym(A))
```

```
X =
```

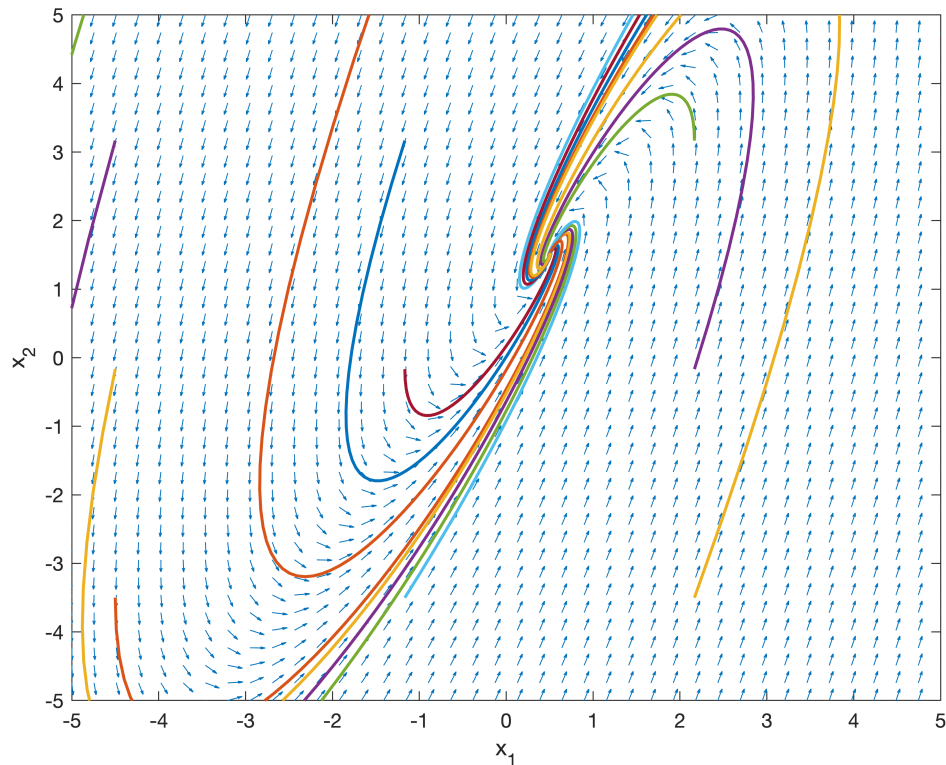$$\begin{pmatrix} \frac{2}{5} - \frac{1}{5}\,i & \frac{2}{5} + \frac{1}{5}\,i \\ 1 & 1 \end{pmatrix}$$

D =

$$\begin{pmatrix} -1-i & 0 \\ 0 & -1+i \end{pmatrix}$$

```
M=4
```

```
M = 4
```

```
plotPhasePlane(A, yBounds, tBounds,M,RHS,eqSoln)
```


Exercise 8 from Section 3.4

```
A = [2 −5; 1 −2];
RHS = [.1;.1];
B = rref([A −RHS]);
eqSoln = B(:,end)
```

```
eqSoln = 2×1
   −0.3000
   −0.1000
```

```
[X D] = eig(sym(A))
```

4

X =

$$\begin{pmatrix} 2-i & 2+i \\ 1 & 1 \end{pmatrix}$$

D =

$$\begin{pmatrix} -i & 0 \\ 0 & i \end{pmatrix}$$

```
M=4
```

```
M = 4
```

```
plotPhasePlane(A, yBounds, tBounds,M,RHS,eqSoln)
```