Phase Plane: Complex Eigenvalues

For the system
\[
\begin{pmatrix}
3 & -5 \\
5 & -3
\end{pmatrix} \mathbf{x},
\]
the solution is
\[
\mathbf{x} = c_1 \begin{pmatrix}
5 \cos 4t \\
3 \cos 4t + 4 \sin 4t
\end{pmatrix} + c_2 \begin{pmatrix}
5 \sin 4t \\
3 \sin 4t - 4 \cos 4t
\end{pmatrix}.
\]

Since there are no real eigenvectors, all trajectories spin about the origin. Since the real part of the eigenvalues is zero, the origin is a center, as shown below:
For the system
\[ \dot{x} = \begin{pmatrix} -2 & -6 \\ 3 & 4 \end{pmatrix} x, \]
the solution is
\[ x = c_1 e^{t \begin{pmatrix} -\cos 3t - \sin 3t \\ \cos 3t \end{pmatrix}} + c_2 e^{t \begin{pmatrix} \cos 3t - \sin 3t \\ \sin 3t \end{pmatrix}}. \]
Since the real part of the eigenvalues is positive, we have an unstable spiral, as shown below.

Phase plane of (2).