3. As we computed in Exercise 3 of Section 3.2, the
eigenvalues are \( \lambda_1 = -3 \) and \( \lambda_2 = -6 \). The eigenvectors \((x_1, y_1)\) for the
eigenvalue \( \lambda_1 = -3 \) satisfy
\( y_1 = -x_1 \), and the eigenvectors for \( \lambda_2 = -6 \) satisfy
\( x_2 = 2y_2 \). The equilibrium point at the origin is a sink.

4. As we computed in Exercise 6 of Section 3.2, the
eigenvalues are \( \lambda_1 = -4 \) and \( \lambda_2 = 9 \). The eigenvectors \((x_1, y_1)\) for the eigenvalue \( \lambda_1 = -4 \) satisfy
\( 9x_1 = -4y_1 \), and the eigenvectors \((x_2, y_2)\) for \( \lambda_2 = 9 \) satisfy
the equation \( y_2 = x_2 \). The equilibrium point at the origin is a saddle.

5. As we computed in Exercise 7 of Section 3.2, the
eigenvalues are \( \lambda_1 = -1 \) and \( \lambda_2 = 4 \). The eigenvectors \((x_1, y_1)\) for the eigenvalue \( \lambda_1 = -1 \) satisfy
\( y_1 = -x_1 \), and the eigenvectors \((x_2, y_2)\) for \( \lambda_2 = 4 \) satisfy
\( x_2 = 4y_2 \). The equilibrium point at the origin is a saddle.

6. As we computed in Exercise 8 of Section 3.2, the
eigenvalues are

\[
\lambda_1 = \frac{3 + \sqrt{5}}{2} \quad \text{and} \quad \lambda_2 = \frac{3 - \sqrt{5}}{2}.
\]

The eigenvectors \((x_1, y_1)\) for the eigenvalue \( \lambda_1 \) satisfy
\( y_1 = (1 - \sqrt{5})x_1/2 \), and the eigenvectors \((x_2, y_2)\) for
the eigenvalue \( \lambda_2 \) satisfy \( y_2 = (1 + \sqrt{5})x_2/2 \). The
equilibrium point at the origin is a source.
As we computed in Exercise 9 of Section 3.2, the eigenvalues are
\[ \lambda_1 = \frac{3 + \sqrt{5}}{2} \quad \text{and} \quad \lambda_2 = \frac{3 - \sqrt{5}}{2}. \]

The eigenvectors \((x_1, y_1)\) for the eigenvalue \(\lambda_1\) satisfy \(y_1 = (-1 + \sqrt{5})x_1/2\), and the eigenvectors \((x_2, y_2)\) for \(\lambda_2\) satisfy \(y_2 = (-1 - \sqrt{5})x_2/2\). The equilibrium point at the origin is a source.

As we computed in Exercise 10 of Section 3.2, the eigenvalues are \(\lambda_1 = -2\) and \(\lambda_2 = -3\). The eigenvectors \((x_1, y_1)\) for the eigenvalue \(\lambda_1 = -2\) satisfy \(x_1 = 2y_1\), and the eigenvectors \((x_2, y_2)\) for \(\lambda_2 = -3\) satisfy \(x_2 = y_2\). The equilibrium point at the origin is a sink.

As we computed in Exercise 11 of Section 3.2, the eigenvalues are \(\lambda_1 = 2\) and \(\lambda_2 = -3\). The eigenvectors \((x_1, y_1)\) for the eigenvalue \(\lambda_1 = 2\) satisfy \(y_1 = -2x_1\), and the eigenvectors for the eigenvalue \(\lambda_2 = -3\) satisfy \(x_1 = 2y_1\). The equilibrium point at the origin is a saddle. The solution curves in the phase plane for the initial conditions \((1, 0)\), \((0, 1)\), and \((1, -2)\) are shown in the figure on the right.

(a) The solution with initial condition \((1, 0)\) is asymptotic to the line \(y = -2x\) in the fourth quadrant as \(t \to \infty\) and to the line \(x = 2y\) in the first quadrant as \(t \to -\infty\).