# The Phase Plane Of Linear Systems

Math 527, Fall 2016

The slides which follows are phase portraits, produced by Maple, of the linear systems that we analyized in class on October 12 and October 17, as well as a couple of others. They represent most of the basic types: a saddle point, a stable and an unstable node, an unstable focus, and a center.

Unfortunately, Maple will not draw arrows on curves. However, these slides include the direction field—light green arrows that give the direction of flow at many points—and from this one can recover the flow direction on the trajectories.
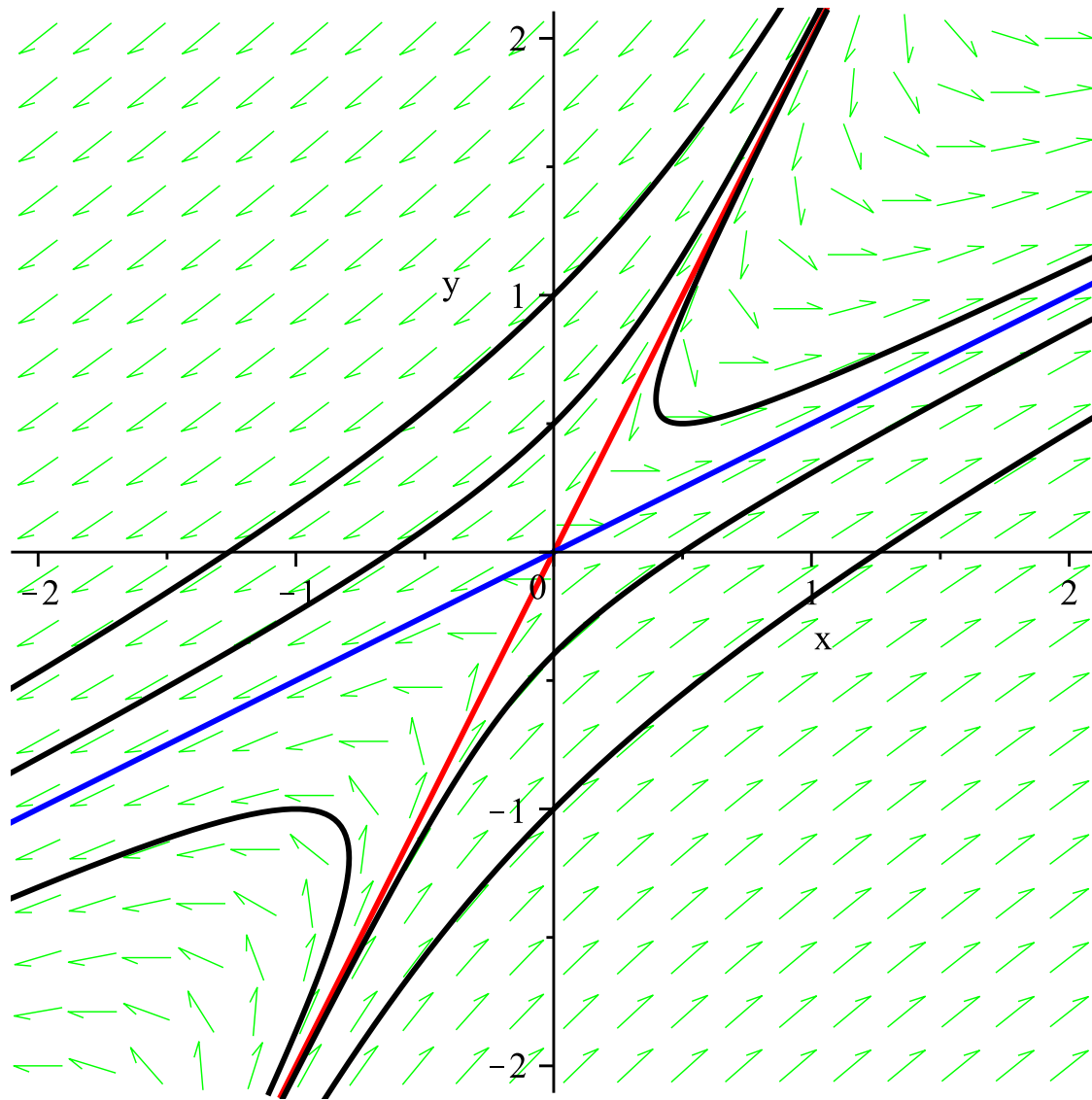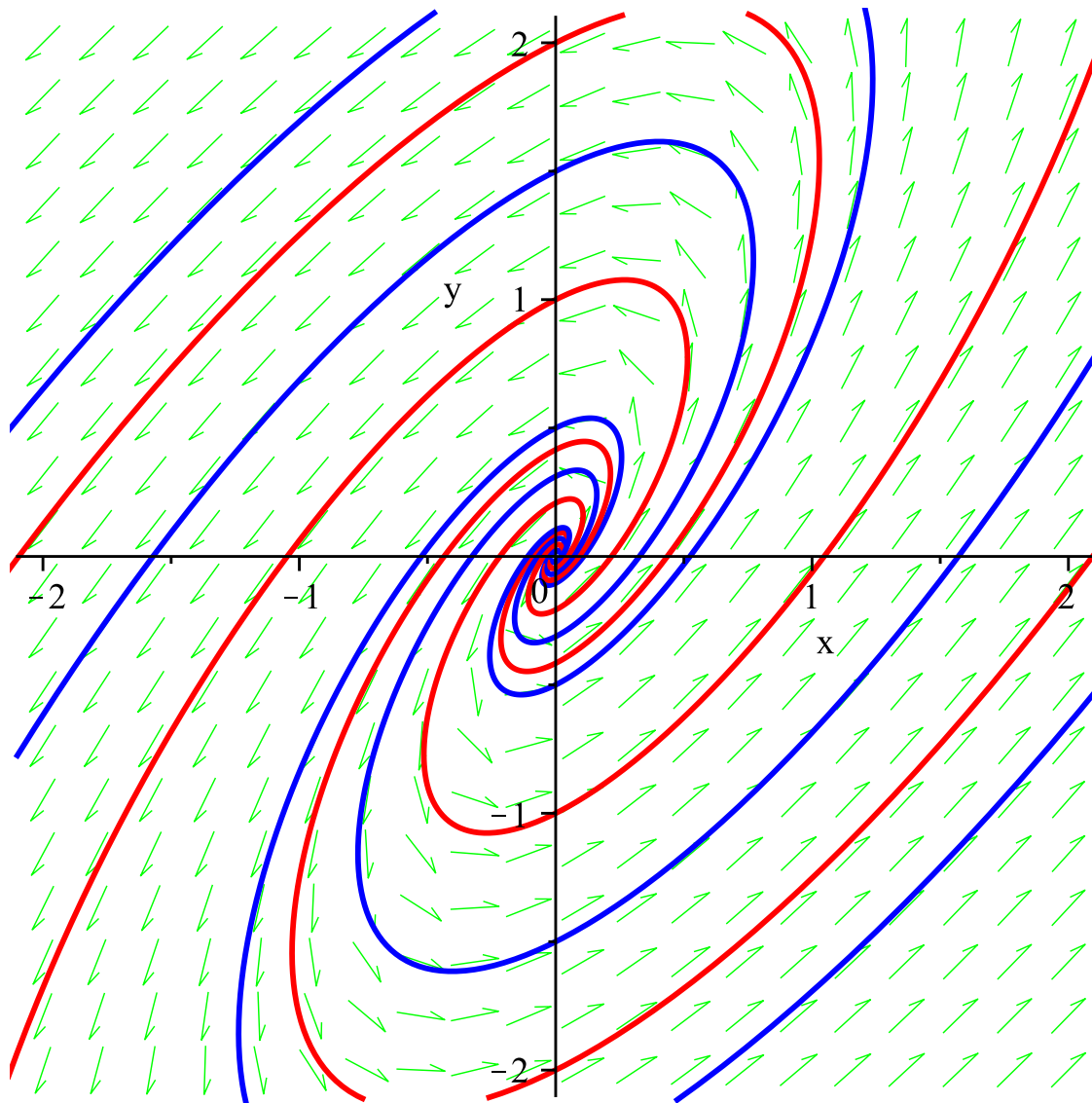
A saddle point: The system $\begin{pmatrix} x \\ y \end{pmatrix}' = \begin{pmatrix} 3 & -2 \\ 2 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$.
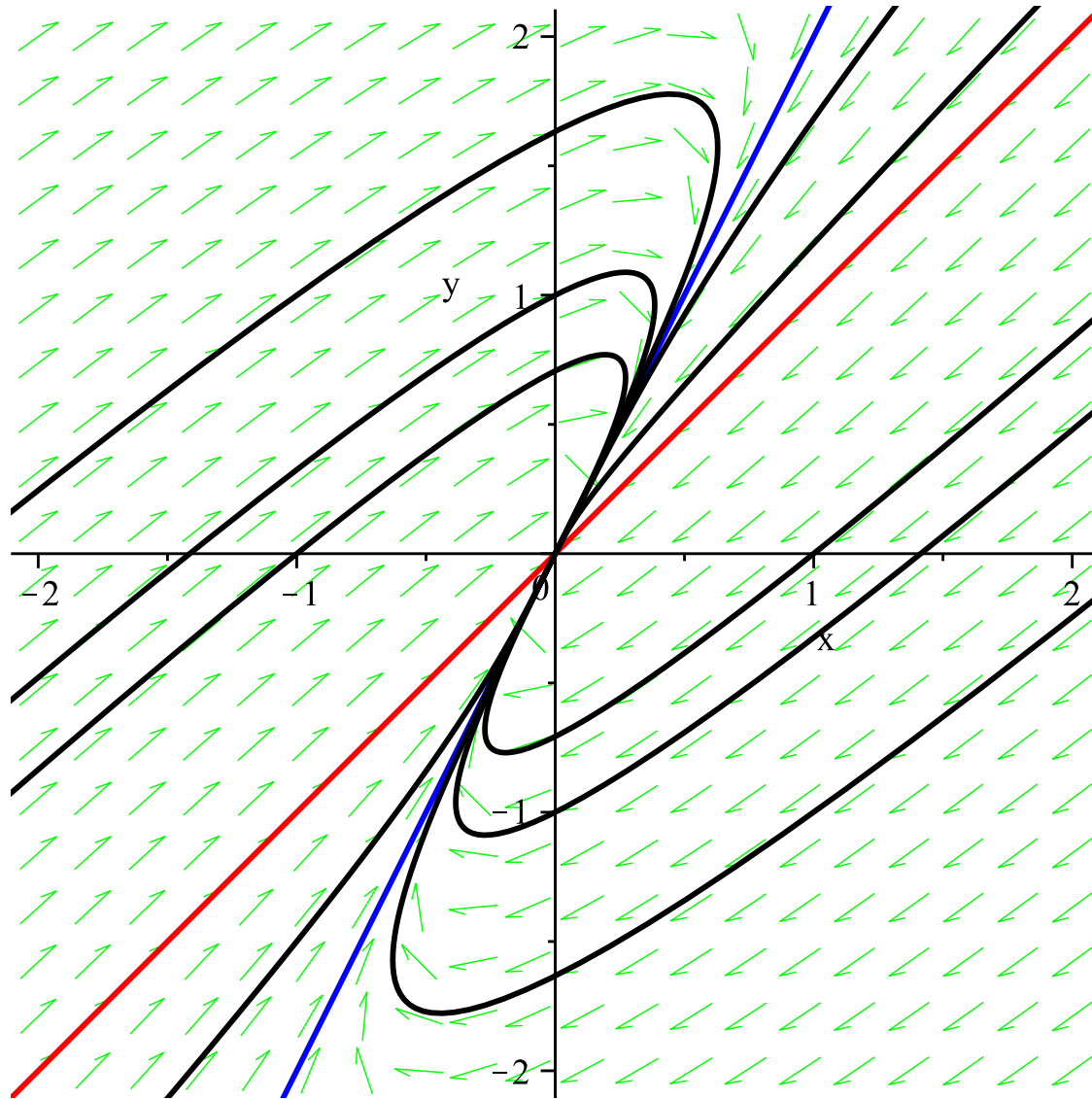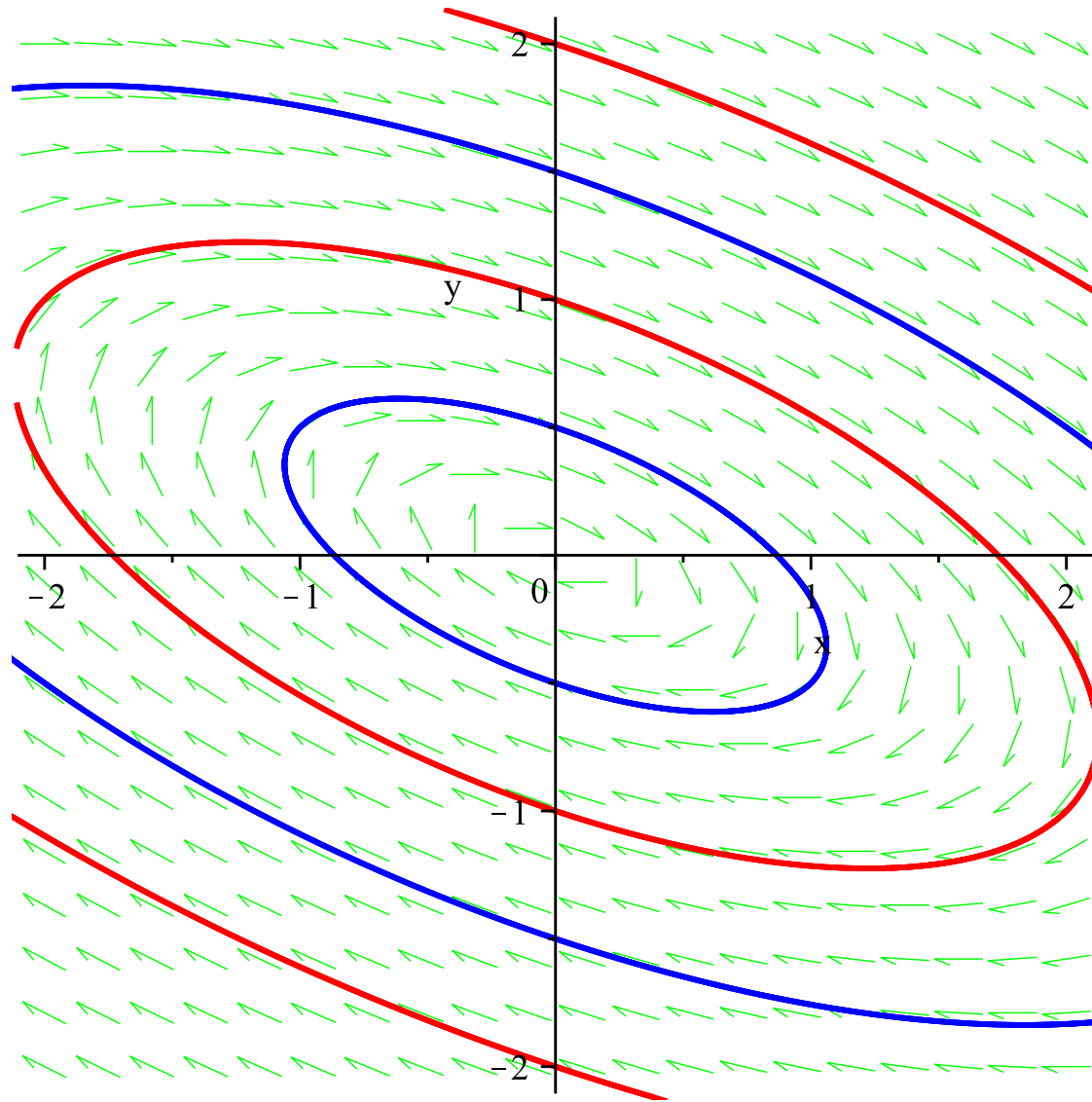
A stable node: The system $\begin{pmatrix} x \\ y \end{pmatrix}' = \begin{pmatrix} -5 & 2 \\ -4 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}.$
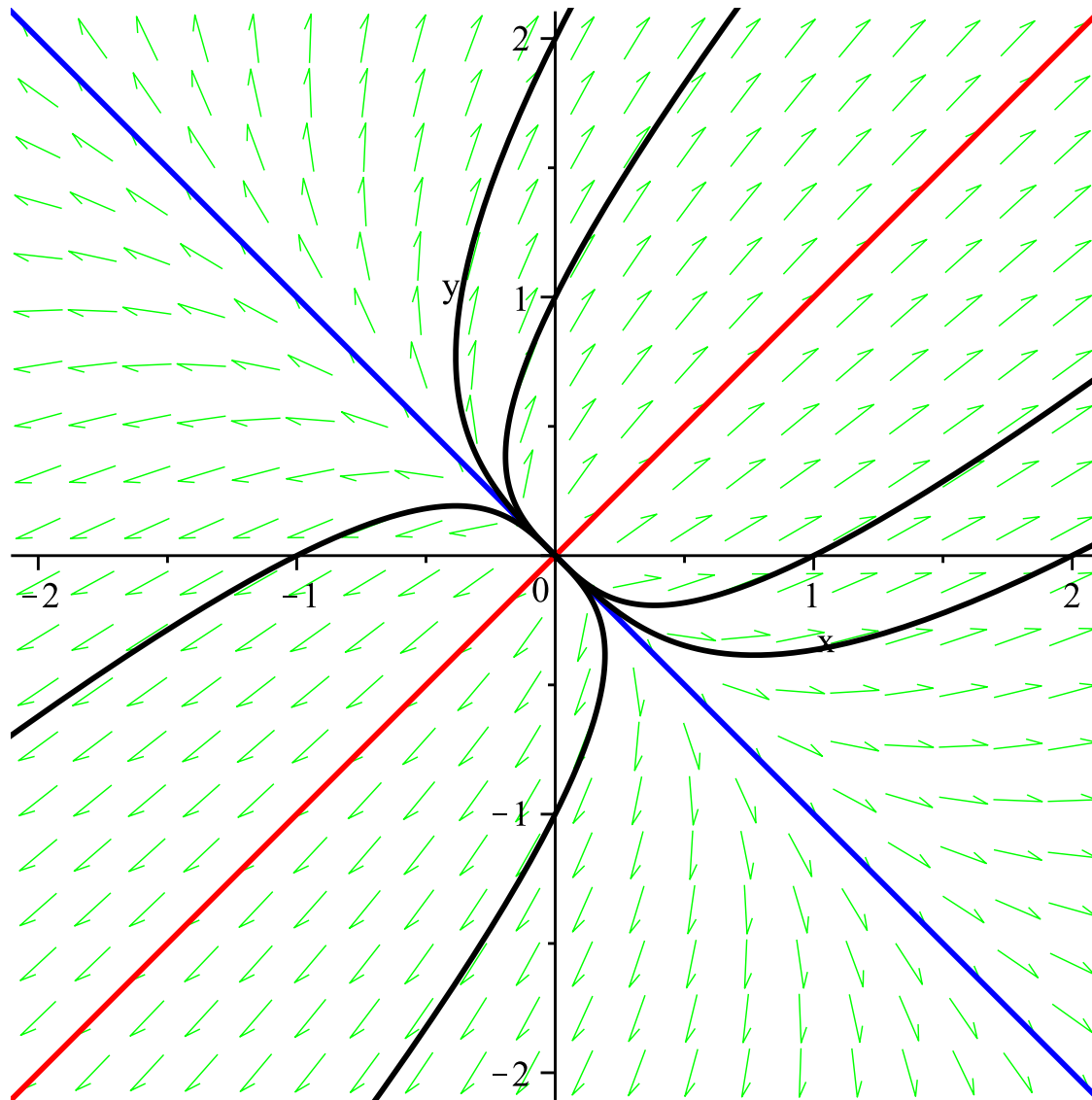
An unstable node: The system $\begin{pmatrix} x \\ y \end{pmatrix}' = \begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$.

An unstable focus (spiral): The system $\begin{pmatrix} x \\ y \end{pmatrix}' = \begin{pmatrix} 3 & -2 \\ 4 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}.$

A center: The system $\begin{pmatrix} x \\ y \end{pmatrix}' = \begin{pmatrix} 1 & 3 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$.