Differential Equations Seminar: Week 3 Exercises

For each of the following matrices A, classify the equilibrium point of the system $\mathbf{x}' = A\mathbf{x}$ (i.e. state whether the origin is asymptotically stable, stable, or unstable, and label the origin as a nodal source, saddle, center, spiral sink, etc). Feel free to use *Mathematica* to help with eigenvalues/eigenvectors or phase plane portraits.

1.
$$A = \begin{pmatrix} 8 & 20 \\ -4 & -8 \end{pmatrix}$$
.
2. $A = \begin{pmatrix} 2 & -4 \\ 8 & -6 \end{pmatrix}$.
3. $A = \begin{pmatrix} -11 & -5 \\ 10 & 4 \end{pmatrix}$.
4. $A = \begin{pmatrix} -7 & 10 \\ -5 & 8 \end{pmatrix}$.
5. $A = \begin{pmatrix} 3 & 2 \\ -4 & -1 \end{pmatrix}$.
6. $A = \begin{pmatrix} -4 & 10 \\ -2 & 4 \end{pmatrix}$.