Classify the origin and assess its stability of the solutions of $\mathbf{z}' = \mathbf{A}\mathbf{z}$ given the eigenvalues and eigenvectors of $\mathbf{A}$. (And sketch trajectories if you are interested.)

1. $\lambda_1 = 3,\ \lambda_2 = 2,\ \mathbf{v_1} = \begin{bmatrix} 1 \\ 2 \end{bmatrix},\ \mathbf{v_2} = \begin{bmatrix} -3 \\ 1 \end{bmatrix}$
2. $\lambda_1 = 1,\ \lambda_2 = -1,\ \mathbf{v_1} = \begin{bmatrix} 1 \\ 0 \end{bmatrix},\ \mathbf{v_2} = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$
3. $\lambda_1 = -3,\ \lambda_2 = -1,\ \mathbf{v_1} = \begin{bmatrix} 1 \\ -1 \end{bmatrix},\ \mathbf{v_2} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

For Questions 7 – 10 in Problem Set 11.2, classify the origin and assess its stability. (And sketch trajectories if you are interested.)

7. $x' = 2y, y' = x + 3y$
8. $x' = -5x + 10y, y' = -4x + 7y$
9. $x' = x - 2y, y' = -4x - y$
10. $x' = -10x + 4y, y' = -3x - 2y$