MATH 246 Homework 3.7
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Directions:

- Work should be done neatly and on separate paper.
- Enough work must be shown so that the steps you are taking is clear.

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1. For each of the following systems first find the eigenvalues and eigenvectors, then sketch a reasonable family of solutions and finally trace and label the specific solutions with initial values $\bar{x}(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\bar{x}(0) = \begin{bmatrix} -2 \\ 0 \end{bmatrix}$.

   (a) $\bar{x}' = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix} \bar{x}$

   (b) $\bar{x}' = \begin{bmatrix} 0 & 2 \\ 0 & 0 \end{bmatrix} \bar{x}$

2. Sketch solutions to the Hamiltonian system:

$$\begin{aligned} x' &= y \\ y' &= -x + \frac{1}{4}x^2 \end{aligned}$$

3. Sketch solutions to the Hamiltonian system:

$$\begin{aligned} x' &= x^2 + y - x \\ y' &= y - 2xy \end{aligned}$$

4. Sketch solutions to the Hamiltonian system:

$$\begin{aligned} x' &= x^2 + x \\ y' &= -2xy - y \end{aligned}$$