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

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:

$$x' = y$$
$$y' = -x + \frac{1}{4}x^2$$

3. Sketch solutions to the Hamiltonian system:

$$x' = x^2 + y - x$$
$$y' = y - 2xy$$

4. Sketch solutions to the Hamiltonian system:

$$x' = x^2 + x$$
$$y' = -2xy - y$$