7. [14 points] The van der Pohl oscillator is a circuit that may be modeled with the system of differential equations

\[ \begin{align*}
    x' &= -y, \\
    y' &= x + (a - y^2) \cdot y,
\end{align*} \]

where \( x \) is the charge on a capacitor in the circuit and \( y \) is current in the circuit, scaled appropriately. The constant \( a \) is a parameter in the system.

a. [3 points] Find all critical points for this system.

b. [6 points] The two phase portraits (I and II) shown below are generated for the system two of the three cases \( a = -1 \), \( a = 0 \) or \( a = 1 \). By doing a linear analysis of the system at your critical points, determine which cases these match and explain why.

![Phase Portraits](image_url)

I. ![Phase Portrait I](image_url)  
II. ![Phase Portrait II](image_url)

c. [5 points] Based on your linear analysis, sketch a phase portrait for the last of the three cases \( a = -1 \), \( a = 0 \), or \( a = 1 \).