We will study the system

\[ x' = x - x^3 - ay \]
\[ y' = x - y \]

in two different regimes. In the first part we will assume \( a > 1 \) and in the second that \( 0 < a < 1 \).

1. Let us assume that \( a > 1 \).
   (i) [10 points] Calculate the \( x \) and \( y \) nullclines and draw the phase plane on large, carefully drawn axes. Evaluate the nullclines at many precise values of \( x \), namely at
   \[ \{-3/2, -5/4, -1, -3/4, -1/2, -1/4, 0, 1/4, 1/2, 3/4, 1, 5/4, 3/2\}, \]
   and, for the purpose of graphing, you may assume the precise value \( a = 2 \). Carefully label the axes and nullclines.
   (ii) [10 points] Calculate the direction of the flow on each nullcline on each side of every steady state assuming only that \( a > 1 \). Draw the associated arrows on the phase plane from part (i). Carefully justify every arrow.
   (iii) [10 points] Compute the Jacobian and evaluate its eigenvalues at each steady state and assess the stability of each steady state assuming only that \( a > 1 \).

2. Let us assume that \( 0 < a < 1 \).
   (i) [10 points] Calculate the \( x \) and \( y \) nullclines and draw the phase plane on large, fresh, carefully drawn axes. Evaluate the nullclines at many precise values of \( x \), namely at
   \[ \{-3/2, -5/4, -1, -3/4, -1/2, -1/4, 0, 1/4, 1/2, 3/4, 1, 5/4, 3/2\}, \]
   and, for the purpose of graphing, you may assume the precise value \( a = 1/2 \). Carefully label the axes and nullclines.
   (ii) [30 points] Calculate the direction of the flow on each nullcline on each side of every steady state assuming only that \( 0 < a < 1 \). Draw the associated arrows on the phase plane from part (2.i). Carefully justify every arrow.
   (iii) [30 points] Compute the Jacobian and evaluate its eigenvalues at each steady state and assess the stability of each steady state assuming only that \( 0 < a < 1 \).