

For each system below, find the critical points, give a classification of their types and stability, and draw a local phase portrait.

$$(1) \frac{dx}{dt} = y(2-x-y), \quad \frac{dy}{dt} = -x-y-2xy$$

$$(2) \frac{dx}{dt} = x-x^2-xy, \quad \frac{dy}{dt} = \frac{1}{2}y - \frac{1}{4}y^2 - \frac{3}{4}xy$$

$$(3) \frac{dx}{dt} = y+x(1-x^2-y^2), \quad \frac{dy}{dt} = -x+y(1-x^2-y^2)$$

$$(4) \frac{dx}{dt} = (1+x)\sin y, \quad \frac{dy}{dt} = 1-x-\cos y$$