

Phase Portrait Analysis

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May 6, 2024

Phase Portrait Analysis

To determine the nature of the phase portrait for $x, y \geq 0$, we first find the x- and y-nullclines by setting $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} = 0$, respectively.

X-Nullclines

- For the x-nullcline:

$$x' = x(2 - y - 2x) = 0$$

Setting x' equal to zero gives us two possibilities:

1. $x = 0$
2. $2 - y - 2x = 0$

Y-Nullclines

- For the y-nullcline:

$$y' = y(3 - y - 4x) = 0$$

Setting y' equal to zero gives us two possibilities:

1. $y = 0$
2. $3 - y - 4x = 0$

Phase Portrait Analysis

Region	Phase Portrait
1	Both x and y are increasing
2	Only x is decreasing, y is increasing
3	Both x and y are decreasing
4	Only y is decreasing, x is increasing

By analyzing the signs of x' and y' in each region, we can sketch the phase portrait.