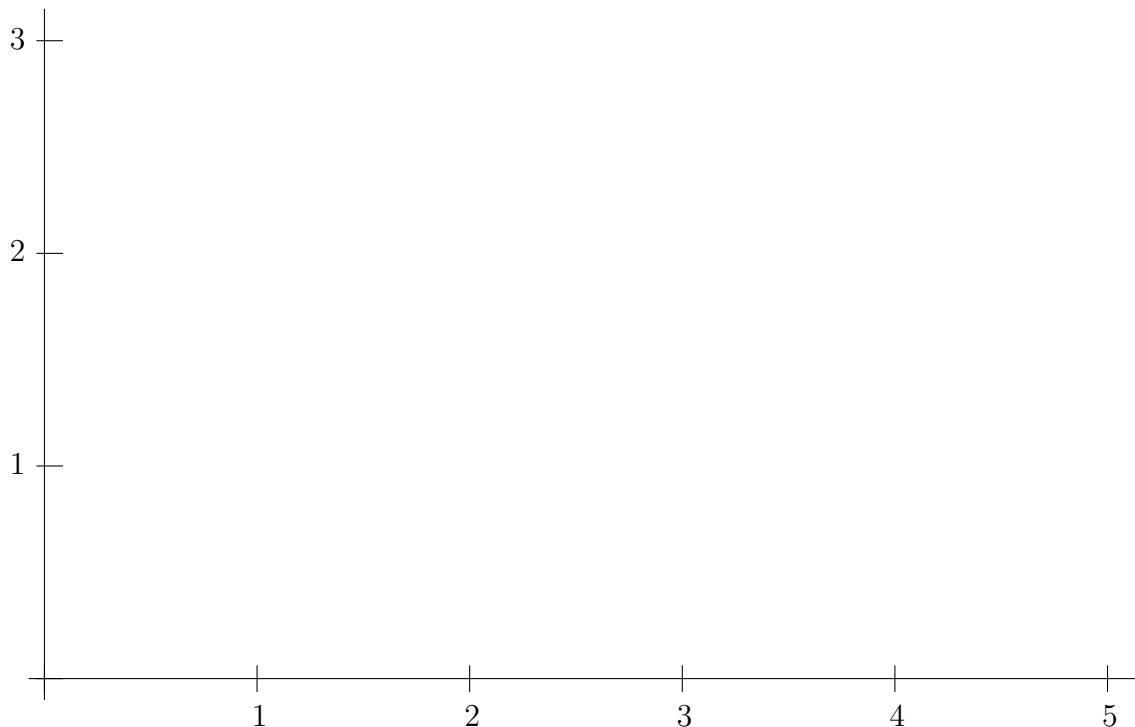


Sample Quiz 3b for M309

- (1) Two non-negative populations $x(t)$, $y(t)$ satisfy $\begin{cases} x' = x(3 - x - y) \\ y' = y(4 - 2y - x) \end{cases}$ for $x \geq 0$, $y \geq 0$.

The lines $x + y = 3$ and $x + 2y = 4$ separate the positive quadrant into four regions. Give the signs of the components of direction field in each of the four regions. Sketch a vector of the direction field in each region.

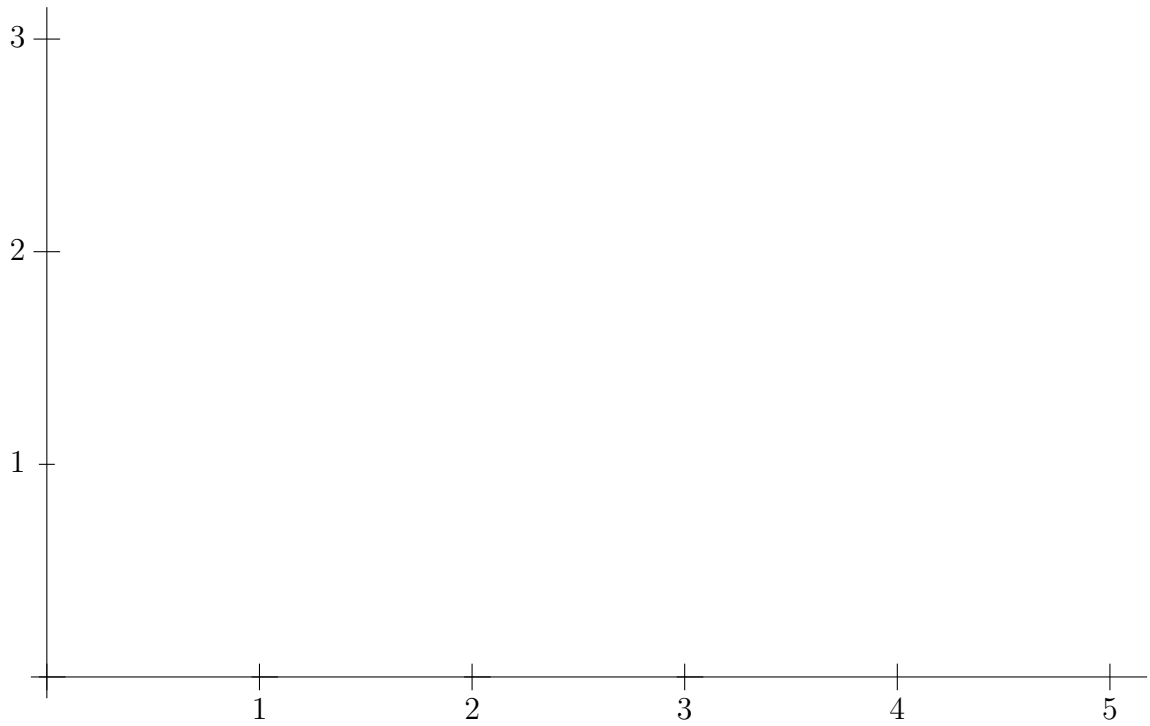


- (1b) The point $(2, 1)$ is a critical point of (1a). What is its type and stability?

- (2) Two non-negative populations $x(t)$ and $y(t)$ satisfy $\begin{cases} x' = x(-2 + y) \\ y' = y(5 - y - x) \end{cases}$,

- (2a) The point $(3, 2)$ is a critical point. What is its type and stability?

- (2b) Plot the direction field at each of the points $(4, 2)$, $(3, 1)$, $(2, 2)$, $(3, 3)$,



(3) Two non-negative populations $x(t)$ and $y(t)$ satisfy
$$\begin{cases} x' = x(1 - 0.5y) \\ y' = y(-.75 + 0.25x) \end{cases}$$

for $x \geq 0$ and $y \geq 0$. Find the critical points of this system, and for each critical point give its type and stability