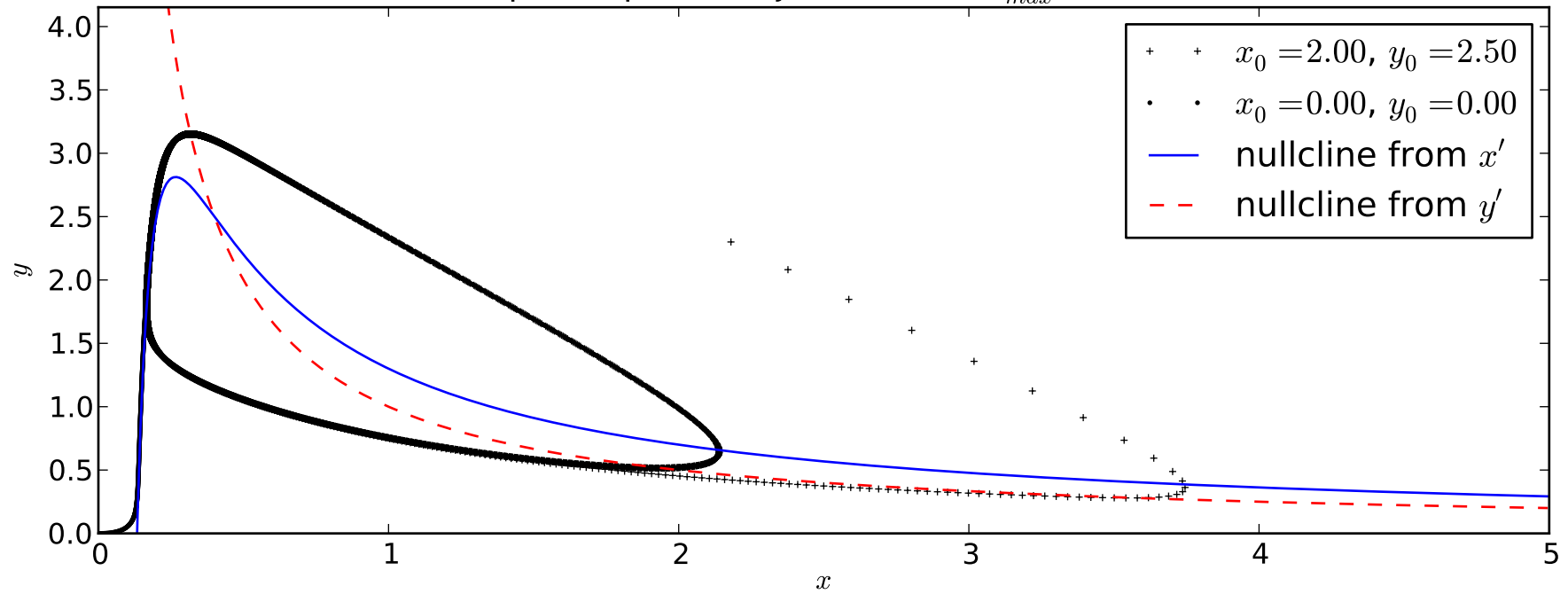Problem 1: Stable Limit Cycle, with the parameters $\mu = 0.20$, $\alpha = 0.50$, and the eigenvalues $0.170 + 0.226\,j$; $0.170 - 0.226\,j$

phase-plane trajectories for $\tau_{max} = 200$

$x_0 = 2.00$, $y_0 = 2.50$
$x_0 = 0.00$, $y_0 = 0.00$
nullcline from x'
nullcline from y'

y

x

Conversion over time starting from $x_0 = 0.0$, $y_0 = 0.0$

x
y

x or y

τ (tick marks are separated by periods $T = 2\pi/\omega = 27.8$, as predicted by the linearization)