

System of ODEs - Problem IV

Harsh Solanki, Pietro Dalbosco, Rakhsanda Naureen Ansari

February 13, 2025

We solve the following system of ordinary differential equations

$$\begin{aligned}y' &= \sin(y) + \cos(zx) \\z' &= e^{-yx} + \frac{\sin(zx)}{x}\end{aligned}$$

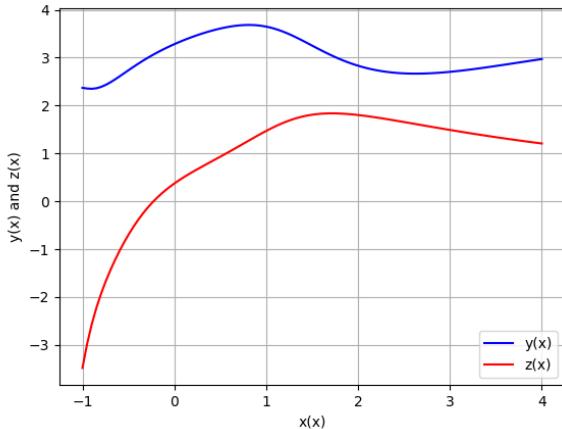
with IC $y(-1) = 2.37$ and $z(-1) = -3.48$.

We decide to use the RK4 method.

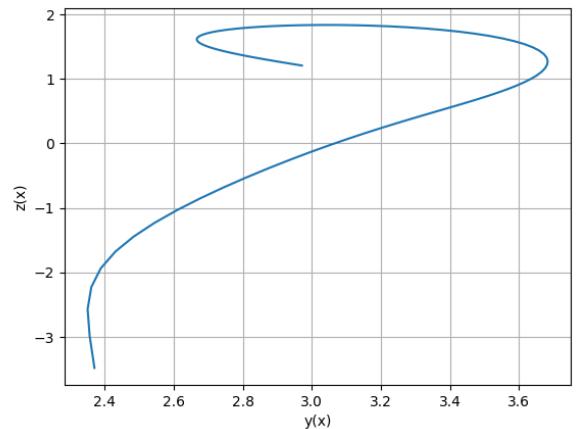
1 Code structure

- Function
 - for the system of ODEs ("ode")
 - performing one "RK4 step" in vectorial form ("rk4_step")
 - performing all the RK4 steps ("solve_ode")
- We set $x_start=-1$, $x_end=4$, and $n_points=100$ so that $\delta x = 0.25$.
- We plot $y(x)$ and $z(x)$, and the parametric curve $y(x)$ vs $z(x)$.

2 Results



(a) Solutions of the system of ODEs.



(b) Parametric curve $y(x)$ vs $z(x)$.