Ordinary Differential Equations

In this problem you will use Matlab’s built-in ODE solver, \texttt{ode45}, to solve a system of ordinary differential equations. The goal is to solve the following system of ODEs.

\[
\begin{align*}
y_1' &= y_2 \\
y_2' &= -\frac{1}{5}y_2 - \sin(y_1)
\end{align*}
\]

Before doing anything, you will need to define a function containing the right hand side of the above system with the following header.

\begin{verbatim}
function dydt=yprime(t,y)
\end{verbatim}

Remember that \( y \) is going to be a vector containing the values \( y_1 \) and \( y_2 \). Your Matlab function will take \( t \) and \( y \) and return the derivative \( \text{dydt} \).

Then, write a script \texttt{odesystem.m} which uses \texttt{ode45} to solve your ODE system for \( t \in [0, 40] \), with initial conditions \( y_1(0) = 0 \) and \( y_2(0) = 3 \). Your program should also produce the following plots:

- plot of \( y_1(t) \) and \( y_2(t) \) vs. \( t \)
- plot of \( y_1(t) \) vs \( y_2(t) \) (the phase plane)