A classical model used to study interacting populations is the Volterra-Lotka or predator-prey model. Let $y_1(t)$ be the population size of the prey (e.g. rabbits) and $y_2(t)$ be number of predators (e.g. foxes). The dynamics of the populations are described by the system of differential equations:

\[
\begin{align*}
    y_1' &= ay_1 - by_1y_2, \quad y_1(0) = 80 \\
    y_2' &= -cy_2 + dy_1y_2, \quad y_2(0) = 30
\end{align*}
\]

where $a = 0.25$, $b = 0.01$, $c = 1.0$ and $d = 0.01$.

1. Write a Matlab program to implement Euler’s method to approximate the solution of the system from $t = 0$ to $t = 80$. You should use both $h = 0.4$ ($n = 200$) and $h = 0.1$ ($n = 800$). Graphically display each result in the phase plane $(y_1, y_2)$. Your program should be a script with all the necessary steps included. Generate two plots.

2. Use the Matlab command ode45 to construct a numerical solution to the system for $t$ in $[0,80]$ and graphically display the results. Below is some sample code describing the implementation of ode45.

```matlab
% sample driver program
options = odeset('RelTol',1e-4,'AbsTol',[1e-4 1e-4]);
tinterval = [0 80];
ic1 = [80 30];
[ta,ya] = ode45(@prey,tinterval,ic1,options);
plot(ya(:,1),ya(:,2))

Below is a separate function file

function yprime = prey(t,y)
yprime = [a*y(1) - b*y(1)*y(2),-c*y(2) + d*y(1)*y(2)];
```

3. Explain the differences in the your Euler’s method solution and the solution found using ode45.