Reading Assignment: Keep browsing through Chapter 7 (7.1, 7.2, & 7.4) of Moler on ordinary differential equations. Keep reading the “UNIX Tutorial for Beginners” (Intro–Tutorial 4) & the “C Programming Notes” (Chapters 1–10).

Homework 5
Due: Mon Mar 1

(1) Explain in a short paragraph what the following code fragment from van.c does & why:

```c
u0 = u[step-1];
v0 = v[step-1];
/* u2, v2 step (2 * dt/2) */
RK(dt/2., u0, v0, &u1, &v1, epsilon);
RK(dt/2., u1, v1, &u2, &v2, epsilon);
/* u1, v1 step (dt) */
RK(dt, u0, v0, &u1, &v1, epsilon);
compute_dt(timestep, u0, v0, u1, v1, u2, v2);
if (!timestep->REDO_STEP) {
    u[step] = u2;
    v[step] = v2;
}
```

(2) Fill in the functions f1, f2, f3 in shaw.c to solve the Shaw oscillator IVP

\[
\begin{align*}
    u' &= 0.7v + 10u(0.1 - v^2) \\
    v' &= -u + 0.25\sin(1.57w) \\
    w' &= 1
\end{align*}
\]

\[
\begin{align*}
    u(0) &= -0.73, \quad v(0) = 0, \quad w(0) = 0
\end{align*}
\]

(w is time t). Turn in just a copy of your functions f1, f2, & f3.

(3) Run the program shaw.c to t = 100. Using Plot3.m (be sure to change the legend on the phase diagram),

(a) plot \( u(t) \) & \( v(t) \);
(b) plot the phase diagram \( v(t) \) vs. \( u(t) \).