AMATH 301
Homework 5: Autumn 2007

DUE: Friday, December 7 at 11 p.m.

I Consider the reaction-diffusion system

$$U_t = (1 - U^2 - V^2)U + \beta(U^2 + V^2)V + D_1\nabla^2 U$$
$$V_t = -\beta(U^2 + V^2)U + (1 - U^2 - V^2)V + D_2\nabla^2 V$$

where $\beta = 1$, $D_1 = D_2 = 0.1$, $\nabla^2 = \partial_x^2 + \partial_y^2$ and $x, y, \in [-10, 10]$. Assume periodic boundary conditions and use $n = 64$ for the number of discrete points.

Initial Conditions Start with spiral initial conditions in U and V.

```
[X,Y]=meshgrid(x,y);  m=1; % number of spirals
u=tanh(sqrt(X.^2+Y.^2)).*cos(m*angle(X+i*Y)-(sqrt(X.^2+Y.^2)));
v=tanh(sqrt(X.^2+Y.^2)).*sin(m*angle(X+i*Y)-(sqrt(X.^2+Y.^2)));
```

Transform the PDE and use **ode45** to advance the solution in time for $tspan = 0 : 0.5 : 10$.

(a) Solve the system using a finite-difference scheme. (See Lecs. 7.1-7.3)

ANSWER: ode45 solution output should be A1.dat

(b) Solve the system using FFTs. Compare with (a). (See Lecs. 7.4-7.5)

ANSWER: ode45 solution output should be A2.dat