```
close all
clearvars
%Initial conditions for the equation
a = 0.43; %Transmission rate for variant a
b = 0.39; %Transmission rate for variant b
c = 0.2; %Recovery rate for variant a
d = 0.93; %Recovery rate for variant b
e = 0.80; %Rate at which exposed individuals become infectious for variant a
g = 0.92; %Rate at which exposed individuals become infectious for variant b
P0 = 500000; %Total Population
I01 = 20; %Number of infected people initially by variant a
I02 = 0; %Number of infected people initially by variant b
I0 = I01 + I02; %Total number of infected people initially
E01 = 0; %Number of people exposed to variant a initially
E02 = 0; %Number of people exposed to variant b initially
R01 = a/c; %Reproduction number for variant a
R02 = b/d; %Reproduction number for variant b
R0 = R01 + R02; %Reproduction number
S0 = P0; %Number of susceptible people initially
%System of equations
tstart = 0; %Initial time
tstart2 = 60; %Start of variant b
tfinal = 365; %Final Time
nsteps = 10000;
y0 = [S0 ; E01 ; E02 ; I01 ; I02 ; R01 ; R02];
f = @(ybar,t) [ -a*ybar(4)*ybar(1)/P0 - b*ybar(5)*ybar(1)/P0 ;
a*ybar(4)*ybar(1)/P0 - e*ybar(2) ; b*ybar(5)*ybar(6)/P0 - g*ybar(3) ; e*ybar(2)
- c*ybar(4) ; (g*ybar(3) - d*ybar(5))*(1/2 + 1/2*tanh((t-200)*100)) ; c*ybar(4)
; d*ybar(5)];
[ysol,t] = vector_FE(tstart,tfinal,f,y0,nsteps);
S = ysol(1,:);
E_a = ysol(2,:);
E_b = ysol(3,:);
E = E_a + E_b;
I_a = ysol(4,:);
I_b = ysol(5,:);
I = I_a + I_b;
R_a = ysol(6,:);
R_b = ysol(7,:);
R = R_a + R_b;
figure
plot(t,S)
hold on
plot(t,E)
plot(t,I)
plot(t,R)
title('Spread of disease with different variants')
ylabel('Number of People')
xlabel('Time (days)')
```

```
legend('Susceptible', 'Exposed but not infected', 'Infected', 'Recovered')
function [ybar,t] = vector_FE(tstart,tfinal,f,y0,nsteps)
 dt = (tfinal - tstart)/nsteps;
 t = (tstart:dt:tfinal);
 ybar = zeros(length(y0),length(t));
 ybar(:,1) = y0;
 for i = 2: length(t)
     ybar(:,i) = ybar(:,i-1) + dt*f(ybar(:,i-1), t(i-1));
 end
end
```