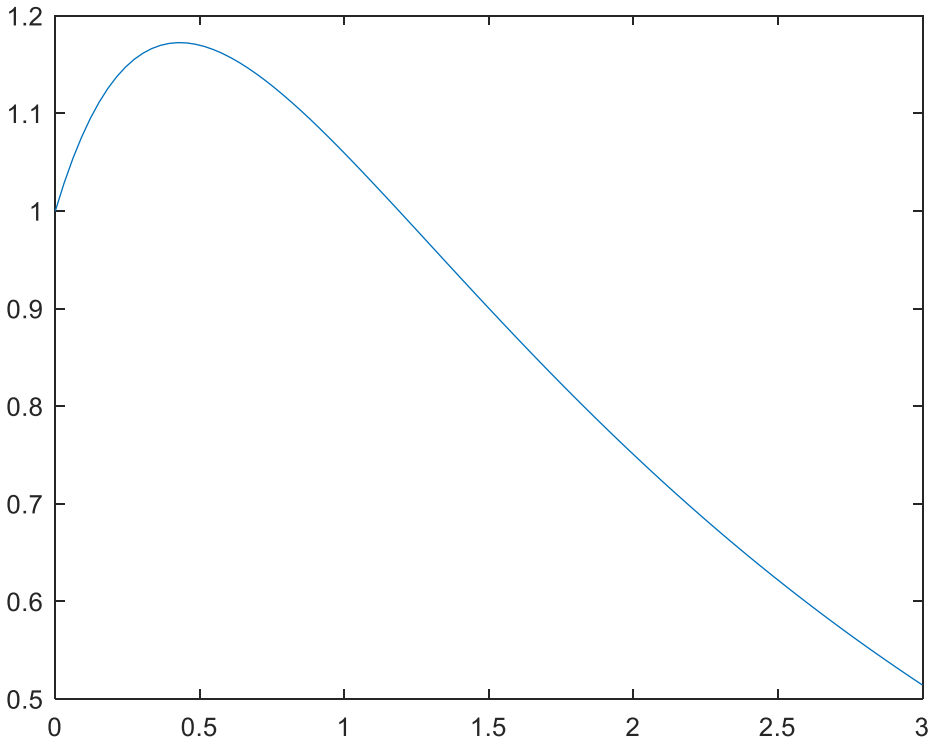
```
function Question1
    x_span=[0,3];
    y0=[1;1];
    options=optimset('Display','off');
    soln=ode45(@odefun,x_span,y0,options);
    y_3=deval(soln,3,1);
    fprintf('y(3) is: %1.4f\n', y_3)
    xx=linspace(0,3,100);
    yy=deval(soln,xx,1);
    plot(xx,yy)
    function dydx=odefun(x,z)
        % z(1) is y, z(2) is y'
        dydx(1,1)=z(2);
        dydx(2,1)=-3*z(2)-z(1);
    end
end
```

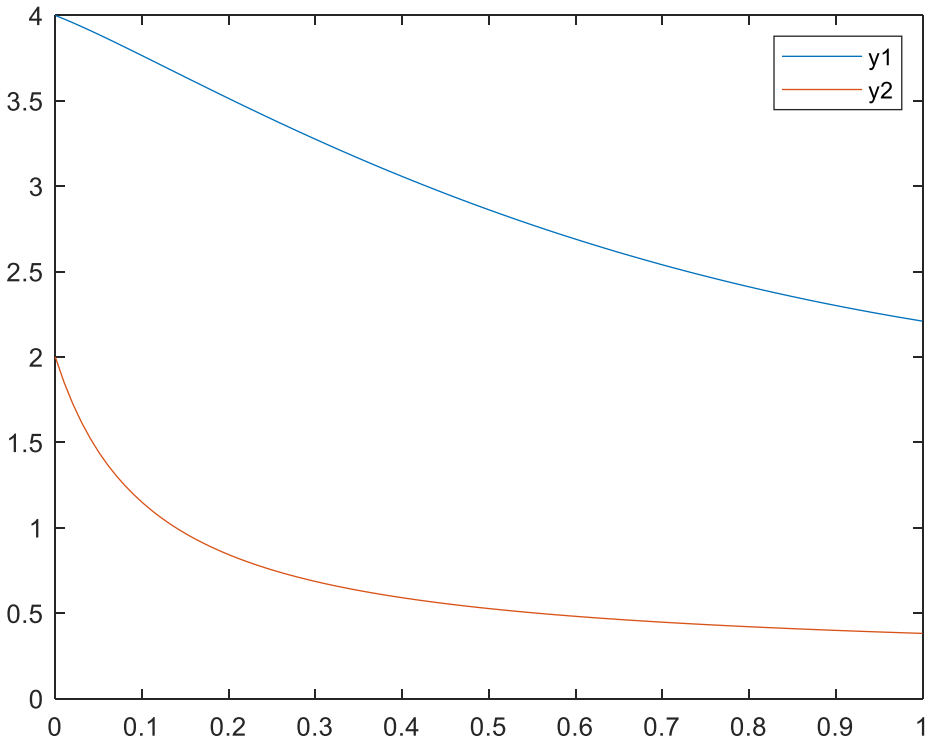
y(3) is: 0.5142



```
function Question2
    x_span=[0,1];
    y0=[4;2];
    options=optimset('Display','off');
    soln=ode45(@odefun,x_span,y0,options);
    y1_1=deval(soln,1,1);
    y2_1=deval(soln,1,2);
    fprintf('y1(1) is: %1.4f\n', y1_1)
    fprintf('y2(1) is: %1.4f\n', y2_1)
    xx=linspace(0,1,100);
    yy=deval(soln,xx);
    plot(xx,yy)
    function dydx=odefun(x,z)
        % z(1) is y1, z(2) is y2
        dydx(1,1)=-z(1)+z(2)+x;
        dydx(2,1)=-z(1)*z(2)^2/(1+x);
    end
end
```

y1(1) is: 2.2102

y2(1) is: 0.3819

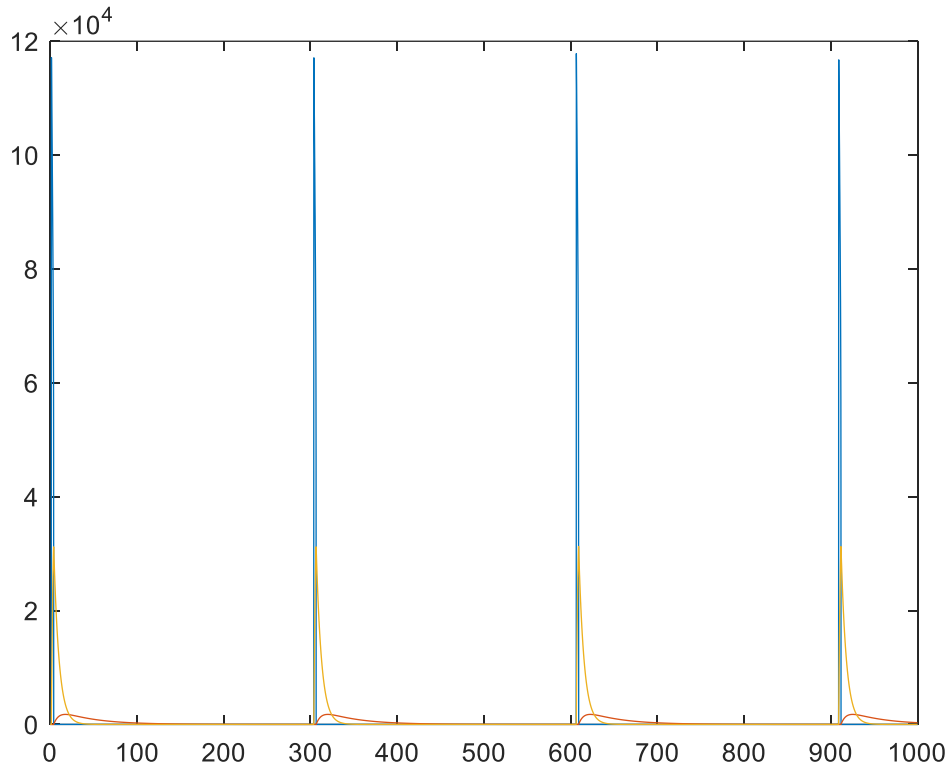


```
function Question3
    x_span=[0,1000];
    y0=[4;1.1;4.0];
    options=optimset('Display','off');
    soln=ode15s(@odefun,x_span,y0,options);
    y1_1000=deval(soln,1000,1);
    y2_1000=deval(soln,1000,2);
    y3_1000=deval(soln,1000,3);
    fprintf('y1(1000) is: %1.2f\n', y1_1000)
    fprintf('y2(1000) is: %3.0f\n', y2_1000)
    fprintf('y3(1000) is: %1.2f\n', y3_1000)
    xx=linspace(0,1000,10000);
    yy=deval(soln,xx);
    plot(xx,yy)
    function dydx=odefun(x,z)
        % z(1) is y1, z(2) is y2, z(3) is y3
        dydx(1,1)=77.27*(z(2)-z(1)*z(2)+z(1)-8.375*10^-6*z(1)^2);
        dydx(2,1)=(z(3)-z(2)-z(1)*z(2))/77.27;
        dydx(3,1)=0.162*(z(1)-z(3));
    end
end
```

y1(1000) is: 1.00

y2(1000) is: 302

y3(1000) is: 1.02




```
function Question4
    t_span=[0,100];
    y0=[1;300];
    options=optimset('Display','off');
    soln=ode45(@odefun,t_span,y0,options);
    CA_100=deval(soln,100,1);
    T_100=deval(soln,100,2);
    fprintf('CA(100) is: %1.4f gmol/L\n', CA_100)
    fprintf('T(100) is: %3.0f K\n', T_100)
    function dydx=odefun(t,z)
        % z(1) is Ca (gmol/L), z(2) is T (K)
        EoverR=300; % K
        K1=-0.1; % 1/s
        K2=1; % K/gmol s
        dydx(1,1)=K1*z(1)*exp(-EoverR/z(2));
        dydx(2,1)=K2*z(1)*exp(-EoverR/z(2));
    end
end
```

CA(100) is: 0.0231 gmol/L

T(100) is: 310. K