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)

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)

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)

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=[1,100];

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: 0.0240 gmol/L

T(100) is: 310 K