Contents

CS375 HW13

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```
clear all;clc;close all;
```

Problem 3

```
f=@(t,y) y^2 - y^3;

[y,t]=RK4(f,0.01,0.1);

[y1,t1]=RK4(f,0.01,10);

figure(1);
plot(t,y)

figure(2)
plot(t1,y1)

fprintf("the plot for h=0.1 works well because h is small enough to not induce any error. \n")
fprintf("the plot for h=10 on the other hand has an oscillatory behavior that eventually overshoots \n")
fprintf("therefore, the solution with h=0.1 describes the behavior of the flame more precisely \n")
```
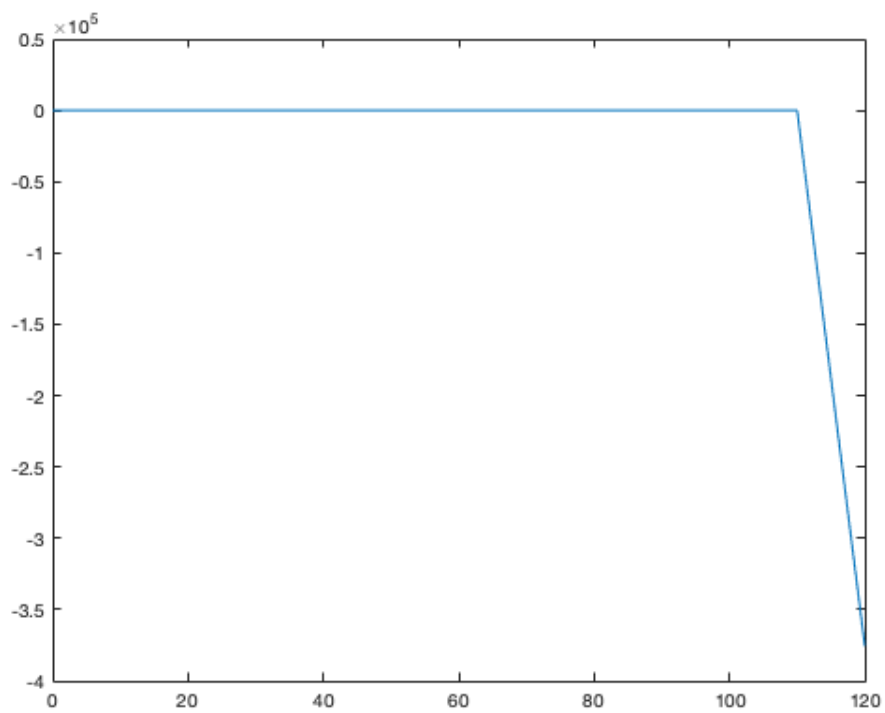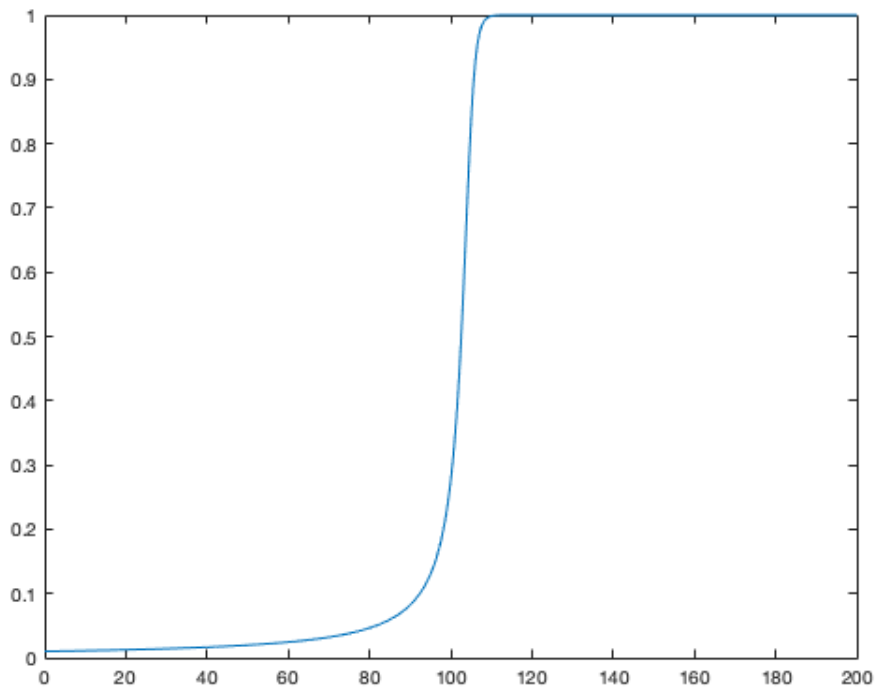
```
the plot for h=0.1 works well because h is small enough to not induce any error.
the plot for h=10 on the other hand has an oscillatory behavior that eventually overshoots
therefore, the solution with h=0.1 describes the behavior of the flame more precisely
```

4.C

```
f_x=@(x) sqrt(4-x.^2);

% checking that the code works
% answer should be close to 1.57 or pi/2

monte_carlo(f_x,0,2,10000)
```

```
ans =

    1.5738
```

4.D

```
N = [10, 100, 1000, 10000, 100000, 1000000];

E=zeros(length(N),10);
V2=zeros(length(N),10);
error=zeros(length(N),10);

for i=1:length(N)
    for j=1:10
        E(i,j)=monte_carlo(f_x,0,2,N(i));
        f_v=@(x) (sqrt(4-x.^2)-E(i,j)).^2;
        V2(i,j)=monte_carlo(f_v,0,2,N(i));
        error(i,j) = sqrt(V2(i,j))/N(i);
    end
end

for i=1:length(N)
loglog(N(i),error(i,:),'o');
hold on
end
title('Number of iterations vs error');
xlabel('N');
ylabel('Error');


fprintf("the error becomes smaller as N increases (as expected.) Moreover, it is possible to see how \n");
fprintf("as N grows, the error starts to converge and cluster.\n")
```

```
the error becomes smaller as N increases (as expected.) Moreover, it is possible to see how
as N grows, the error starts to converge and cluster.
```

Number of iterations vs error