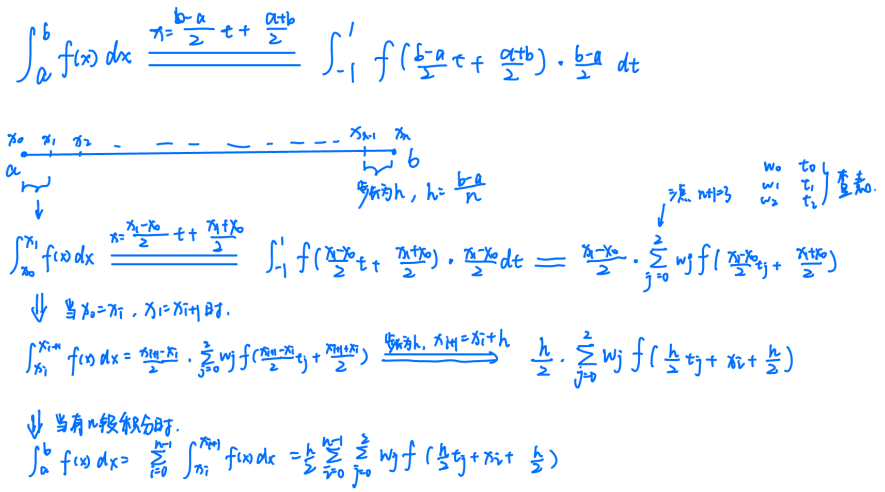
数值实验五——计算机作业

1. 计算圆周率
   a) 复合辛普森公式，当 n=7 时，计算结果为 3.141592648320655
   b) 复合三点高斯-勒让德公式，当 n=2401 时，计算结果为 3.141592663583750
   推导过程如下：



2. 计算年增长率
   a) 两点公式：

rate2 =

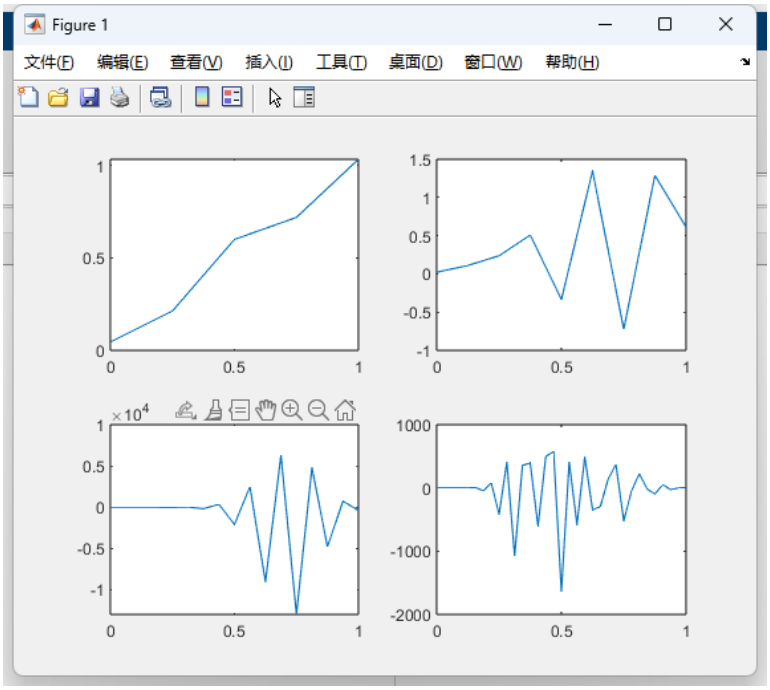
0.021052631578947	0.015760869565217	0.015680751173709
0.006899350649351	0.014426727410782	0.018978102189781
0.013775794757390	0.011029411764706	0.010993377483444

   b) 三点公式：

rate3 =

0.022039473684211	0.016576086956522	0.014647887323944
0.010227272727273	0.010440394836750	0.015792966157930
0.014863357501394	0.011568627450980	0.010463576158940
0.010381861575179		

3. 结算结果：



4	1.506568e+04	0.099311
8	4.521167e+08	1.475252
16	1.181506e+17	12974.164824
32	1.969206e+17	1639.845545

代码块

文件名称：hw5_1_1.m	功能：数值实验 5.1（1）的计算代码

```
clc,clear all
format long;
fun=@(x) 4./(1+x.^2);
f1=integral(fun,0,1);
n=4;
f2=fsimpson(fun,0,1,n);
delta=abs(f2-f1);
while delta>1e-8
    n=n+1;
    f2=fsimpson(fun,0,1,n);
    delta=abs(f2-f1);
end
n,f2 % 7

function I=fsimpson(fun,a,b,n)
    h=(b-a)/n;
    x=linspace(a,b,2*n+1);
    y=feval(fun,x);
    I=h/6*(y(1)+2*sum(y(3:2:2*n-1))+4*sum(y(2:2:2*n))+y(2*n+1));
end
```

文件名称：hw5_1_3.m	功能：数值实验 5.1（3）的计算代码

```
clc,clear all
format long;
w=[5 8 5]/9;
t=[-sqrt(15) 0 sqrt(15)]/9;
fun=@(x) 4./(1+x.^2);
f1=integral(fun,0,1);
n=3;
f2=fglegendre(fun,w,t,0,1,n);
delta=f2-f1;
while delta>1e-8
    n=n+1;
    f2=fglegendre(fun,w,t,0,1,n);
    delta=abs(f2-f1);
end
n,f2 %2401

function f=fglegendre(fun,w,t,a,b,n)
    h=(b-a)/n;
    f=0;
```

```
    for i=0:n-1
        gp=h/2+(a+i*h)+h/2*t;
        f=f+fun(gp)*w'*h/2;
    end
end
```

文件名称：hw5_5.m	功能：数值实验 5.5 的计算代码

```
clc,clear all
format long;
y=1900:10:1990;
p=[76.0 92.0 106.5 123.2 131.7 150.7 179.3 204.0 226.5 251.4];
% 2points
L2=diff(p)./diff(y);
rate2=L2./p(1:end-1)
% 3points
Lleft=(-3*p(1)+4*p(2)-p(3))/20; %  左边界点采用向后  差分
Lright=(p(end-2)-4*p(end-1)+3*p(end))/20; %右边界点采用向前差分
Lmid=(-p(1:end-2)+p(3:end))/20;%  中点采用中心差分格式
L3=[Lleft Lmid Lright];
rate3=L3./p
```

文件名称：hw5_7.m	功能：数值实验 5.7 的计算代码

```
clc,clear all
warning off
n=[4 8 16 32];
hold on;
for i=1:4
    [x,U]=hw7(n(i));
    subplot(2,2,i)
    plot(x,U)
end
hold off;
function [x,U]=hw7(n)
    x=[linspace(0,1,n+1)]';
    y=((x.^2+1).^(3/2)-x.^3)/3;
    h=2/n;
    w=ones(n+1,1)*2/6;w(2:2:n)=4/6;w([1 n+1])=1/6;w=w*h;
    [X,S]=meshgrid(x);
    % This MATLAB function returns 2-D grid coordinates based on the
    % coordinates contained in vectors x and y.
    A=(X.^2+S.^2).^(1/2); % A*diag(d)*x==y
    U=(A\y)./w;
    fprintf('%3d %13.6e %13.6f\n',n,cond(A),norm(U-x,"inf"));
end
```

文件名称：check.m	功能：验证部分手算作业的答案

```
%% homework 5.5
clc,clear all
format long;
fun=@(x) exp(x);
f1=ftrapz(fun,0,1,4);
f2=fsimpson(fun,0,1,4);
f3=exp(1)-1;
deltaf1=f3-f1;
deltaf2=f3-f2;

%% homework 5.8
clc,clear all
format long;
x1=0.5555556*(1/(0.7745967+2)+1/(2-0.7745967))+0.5*0.8888889
x2=0.2369269*(1/(0.9061798+2)+1/(2-0.9061798))+0.4786287*(1/(0.5384693+2)+1/(2-
0.5384693))+0.5*0.5688889

%% homework 5.9
clc,clear all
fun=@(x) 1./sqrt(1+x.^2)
f4=fqbxf(fun,4)
deltaf4=f4-2.62205755429213
%% funtion
function I=ftrapz(fun,a,b,n)
    h=(b-a)/n;
    x=linspace(a,b,n+1);
    y=feval(fun,x);
    I=h/2*(y(1)+2*sum(y(2:n))+y(n+1));
end

function I=fsimpson(fun,a,b,n)
    h=(b-a)/n;
    x=linspace(a,b,2*n+1);
    y=feval(fun,x);
    I=h/6*(y(1)+2*sum(y(3:2:2*n-1))+4*sum(y(2:2:2*n))+y(2*n+1));
end
function I=fqbxf(fun,n)
    t=1:2:2*n+1;
    x=cos(t/(2*(n+1))*pi);
    y=feval(fun,x);
    I=pi/(n+1)*sum(y);
end
```