

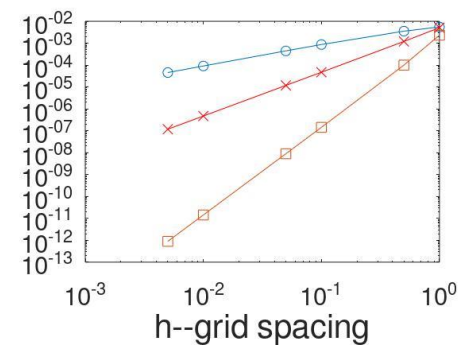
B10505005 蔣依健

A2

```

1  x = 4;
2  h = [1; 0.5; 0.1; 0.05; 0.01; 0.005];
3  n = size(h, 1);
4  yexact = (x*cos(x)-3*sin(x))/(x^3);
5  yforward = zeros(n, 1);
6  yoc = zeros(n, 1);
7  yfoc = zeros(n, 1);
8
9  for i = 1:n
10     yt1(i) = ((sin(x+h(i)))/(x+h(i)).^3) - sin(x)/(x.^3)/h(i); %forward difference
11     yforward(i) = abs(yt1(i)-yexact); %the absolute values of error
12 endfor
13
14 for j = 1:n
15     yt2(j) = ((sin(x+h(j)))/(x+h(j)).^3) - sin(x-h(j))/(x-h(j)).^3)/(2*h(j)); %second-order central difference
16     yoc(j) = abs(yt2(j)-yexact)
17 endfor
18
19 for k = 1:n
20     yt3(k) = (8.*(sin(x+h(k)))/(x+h(k)).^3) - 8.*(sin(x-h(k)))/(x-h(k)).^3) - (sin(x+2.*h(k))/(x+2.*h(k)).^3) + (sin(x-2.*h(k))/(x-2.*h(k)).^3))/(12.*h(k));
21     %fourth-order central difference
22     yfoc(k) = abs(yt3(k)-yexact)
23 endfor
24
25 figure(1), clf;
26 loglog(h, yforward, 'o-');
27 hold on;
28 loglog(h, yoc, 'x-');
29 loglog(h, yfoc, 's-');
30 set(gca, 'FontSize', 15);
31 xlabel("h--grid spacing", 'FontSize', 20);

```

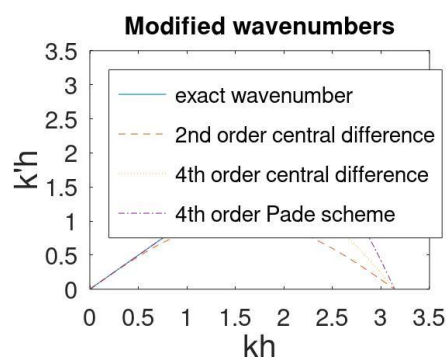


B2

```

1  kh = 0:0.01:pi;
2  khexact = kh;
3  khsoc = sin(kh);
4  khfoc = ((8.*sin(kh)).-sin(2.*kh))./6;
5  khfops = (3.*sin(kh))./(2.+cos(kh));
6
7  plot(kh, khexact);
8  hold on
9
10 plot(kh, khsoc, '--');
11 plot(kh, khfoc, ':');
12 plot(kh, khfops, '-.');
13 %plot the figure with different kinds of line
14
15 set(gca, 'FontSize', 15);
16 xlabel("kh", 'FontSize', 20);
17 ylabel("k'h", 'FontSize', 20);
18 title("Modified wavenumbers", 'FontSize', 15);
19 legend('exact wavenumber', '2nd order central difference', '4th order central difference', '4th order Pade scheme', 'Location', 'NorthWest');

```



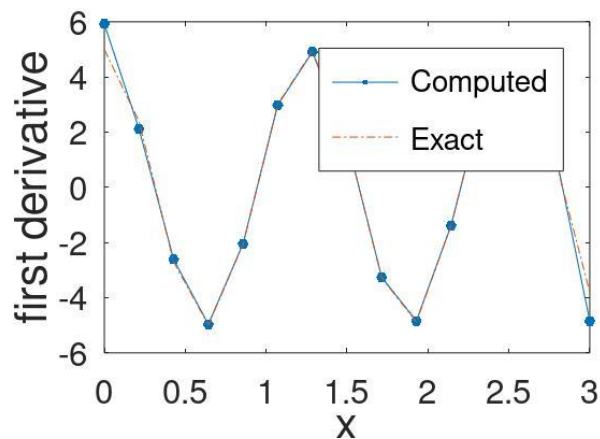
C2

```

1 n = 15;
2 x = zeros(n,1);
3 pade = zeros(n,n);
4 fd=zeros(n,1);
5 f=zeros(n,1);
6 h=3/14;
7
8 for q=2:n;
9     x(q,1)=x((q-1),1)+3/14;
10 endfor;
11
12 #build a pade matrix
13 for i=1:n;
14     for j=1:n;
15         if j==i-1;
16             pade(i,j)=1;
17         endif;
18         if j==i;
19             pade(i,j)=4;
20         endif;
21         if j==i+1;
22             pade(i,j)=1;
23         endif;
24     endfor;
25 endfor;
26
27 pade(1,1)=1;
28 pade(1,2)=2;
29 pade(n,n-1)=2;
30 pade(n,n)=1;
31
32 for k=2:n-1;
33     f(k,1)=3*(sin(5*x(k+1))-sin(5*x(k-1)));
34 endfor;
35
36 #define the boundaries
37 f(1,1)=(-5*sin(5*x(1))/2+2*sin(5*x(2))+sin(5*x(3))/2);
38 f(n,1)=(5*sin(5*x(15))/2-2*sin(5*x(14))-sin(5*x(13))/2);
39
40 f=f/h;
41 fd=pade\f;
42 #fd is found
43 y=5*cos(x*5);
44
45 plot(x,fd,'.-','MarkerSize',15)
46 hold on;
47 plot(x,y,'-');
48 set(gca,'FontSize',15);
49 xlabel("x",'FontSize',20);
50 ylabel("first derivative",'FontSize',20);
51 title("Pade scheme differentiation",'FontSize',20);
52 legend('Computed','Exact');

```

## Pade scheme differentiation



D4

```
1 kh = 0:0.1:pi;  
2 khexact = kh;  
3 khcd = -2.*(cos(kh).-1);  
4 khps = -12.*(cos(kh).-1)./(cos(kh)+5);  
5  
6 plot(kh,khexact.^2,kh,khcd,kh,khps);  
7 set(gca,'FontSize',15);  
8 xlabel("kh",'FontSize',20);  
9 ylabel("k'^2h^2",'FontSize',20);  
10 title("Modified wavenumbers",'FontSize',15);  
11 legend('exact wavenumber','central difference','Pade scheme','Location','NorthWest');
```

