

Problem 1

求函数在指定点的数值导数, $x=1,2,3$

$$f(x) = \begin{vmatrix} x & x^2 & x^3 \\ 1 & 2x & 3x^2 \\ 0 & 2 & 6x \end{vmatrix}$$

MATLAB Code

```
1 %% problem 1
2 syms x
3
4 A = det([x      x^2      x^3;
5          1      2*x      3*x^2;
6          0      2      6*x]);
7
8 dA = diff(A);
9
10 xx = [1 2 3];
11 subs(dA,xx)
12
13 clearvars x xx A dA
14
```

Output

ans =

[6, 24, 54]

Problem 2

用数值方法求定积分

$$I_1 = \int_0^{2\pi} \sqrt{\cos t^2 + 4\sin(2t)^2 + 1} dt$$

$$I_2 = \int_0^1 \frac{\ln(1+x)}{1+x^2} dx$$

MATLAB Code

```

1 %% problem 2
2 format long
3 [w,x] = GaussLegendreCoef(8);
4
5 % problem 2-1
6 f = @(t) cos(t.^2) + 4*sin(4*t.^2) + 1;
7 a = 0;
8 b = 2*pi;
9
10 t = 0.5*(b-a).*x + 0.5*(b+a);
11 I1 = 0.5*(b-a)*sum(w.*f(t));
12 I1
13
14
15 clearvars a b f t
16 % problem 2-2
17 f = @(x) log(1+x)./(1+x.^2);
18 a = 0;
19 b = 1;
20 t = 0.5*(b-a).*x + 0.5*(b+a);
21 I2 = 0.5*(b-a)*sum(w.*f(t));
22 I2
23
24 clearvars
25

```

MATLAB function

```

1 function [w,x] = GaussLegendreCoef(n)
2 %GaussLegendreCoef Calculate Gauss-Legendre quadrature coefficients and Gaussian points.
3 %
4 % [w,x] = GaussLegendreCoef(n)
5 %
6 % Input
7 %     n - number of Gaussian points
8 % Output
9 %     w - Gauss-Legendre quadrature coefficients
10 %     x - Gaussian points

```

```

11 %
12     polyPrevious = 1;
13     polyCurrent = [1 0];
14     for i = 1:n
15         polyForward = [polyCurrent*(2*i+1)/(i+1) 0];
16         polyForward = polyForward - [0 0 polyPrevious*i/(i+1)];
17         polyPrevious = polyCurrent;
18         polyCurrent = polyForward;
19     End
20
21     x = roots(polyPrevious);
22     w = 2*(1-x.^2)./((n+1)*polyval(polyCurrent,x)).^2;
23 End
24

```

Output

I1 =

14.255711356520822

I2 =

0.272198261261199

Problem 3

分别用 3 种不同的数值方法解线性方程组。

$$\begin{cases} 6x + 5y - 2z + 5u = -4 \\ 9x - y + 4z - u = 13 \\ 3x + 4y + 2z - 2u = 1 \\ 3x - 9y + 2u = 11 \end{cases}$$

MATLAB Code

```

1 %% problem 3
2 A = [6      5      -2      5;
3      9      -1      4      -1;
4      3      4       2      -2;

```

```

5      3      -9      0      2];
6  b = [-4;
7      3;
8      1;
9      11];
10
11  x = A\b
12
13  x = inv(A)*b
14
15  [L,U,P]=lu(A);
16  x = U\(L\P*b)
17
18  clearvars
19

```

Output

x =

```

4.833333333333337
-1.833333333333333
-13.083333333333343
-10.000000000000004

```

x =

```

4.833333333333337
-1.833333333333333
-13.083333333333343
-10.000000000000005

```

x =

```

4.833333333333337
-1.833333333333333
-13.083333333333343
-10.000000000000004

```