# Problem 1

#### 求函数在指定点的数值导数, x=1,2,3

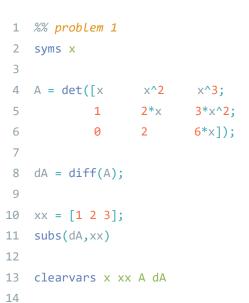
$$f(x) = \begin{vmatrix} x & x^2 & x^3 \\ 1 & 2x & 3x^2 \\ 0 & 2 & 6x \end{vmatrix}$$

#### MATLAB Code









# Output







# [6, 24, 54]

ans =

# 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
    clearvars a b f t
15
    % problem 2-2
16
    f = @(x) \log(1+x)./(1+x.^2);
17
    a = 0;
18
    b = 1;
19
    t = 0.5*(b-a).*x + 0.5*(b+a);
20
    I2 = 0.5*(b-a)*sum(w.*f(t));
21
22
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
      n - number of Gaussian points
7
  %
8 %
      Output
9 %
        w - Gauss-Legendre quadrature coefficients
10 %
        x - Gaussian points
```

```
11 %
12
       polyPrevious = 1;
13
        polyCurrent = [1 0];
       for i = 1:n
14
           polyForward = [polyCurrent*(2*i+1)/(i+1) 0];
15
16
           polyForward = polyForward - [0 0 polyPrevious*i/(i+1)];
17
           polyPrevious = polyCurrent;
           polyCurrent = polyForward;
18
       End
19
20
21
       x = roots(polyPrevious);
        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;
           -1
                  4
                        -1;
     3
                  2
           4
                        -2;
```

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

# Output







× = 4.833333333333333 -1.8333333333333333 -13.0833333333333343 -10.0000000000000004 × = 4.833333333333333 -1.8333333333333333 -13.0833333333333343 -10.0000000000000005 × = 4.83333333333333 -1.8333333333333333 -13.0833333333333343 -10.0000000000000004