

第一次作业：符号运算

1 化简

$$\sqrt{(a + \sqrt{a^2 - b})/2} + \sqrt{(a - \sqrt{a^2 - b})/2}$$

```
syms a b;  
simplify(sqrt((a+sqrt(a^2 - b))/2) + sqrt((a - sqrt(a^2 - b))/2))
```

ans =

$$\frac{\sqrt{2} (\sqrt{a + \sqrt{a^2 - b}} + \sqrt{a - \sqrt{a^2 - b}})}{2}$$

```
p=(a + (a^2 - b)^(1/2))^(1/2)/2 + (a - (a^2 - b)^(1/2))^(1/2)/2;  
expand(p.*p)
```

ans =

$$\frac{a}{2} + \frac{\sqrt{a + \sqrt{a^2 - b}} \sqrt{a - \sqrt{a^2 - b}}}{2}$$

2 解方程

$$(1) x^2 + 10(x - 1)\sqrt{x} + 14x + 1 = 0$$

```
syms x y z;  
solve(x^2 + 10*(x - 1)*sqrt(x) + 14*x + 1) % 未来版本将不再支持字符串格式的公式
```

ans =

$$\begin{pmatrix} (\sqrt{2} - 1)^2 \\ (\sqrt{17} - 4)^2 \end{pmatrix}$$

$$(2) \begin{cases} 4x^2/(1 + 4x^2) - y = 0, \\ 4y^2/(1 + 4y^2) - z = 0, \\ 4z^2/(1 + 4z^2) - x = 0. \end{cases}$$

```
syms x y z; [x y z] = solve(4*x^2/(1+4*x^2)-y,4*y^2/(1+4*y^2)-z,4*z^2/(1+4*z^2)-x)
```

x =

$$\begin{pmatrix} \frac{327\sigma_1^2}{89} - \frac{110\sigma_1^3}{89} - \frac{1924\sigma_1^4}{89} - 20\sigma_1^5 - \frac{21\sigma_1}{356} - \frac{1}{89} \\ 0 \\ \frac{1}{2} \end{pmatrix}$$

where

$$\sigma_1 = \text{root}\left(z_1^6 + \frac{25z_1^5}{89} + \frac{31z_1^4}{356} + \frac{3z_1^3}{178} + \frac{7z_1^2}{1424} + \frac{z_1}{1424} + \frac{1}{5696}, z_1, 6\right)$$

y =

$$\begin{pmatrix} \frac{451\sigma_1^2}{178} + \frac{926\sigma_1^3}{89} + \frac{9863\sigma_1^4}{89} + 156\sigma_1^5 + \frac{107\sigma_1}{356} + \frac{139}{1424} \\ 0 \\ \frac{1}{2} \end{pmatrix}$$

where

$$\sigma_1 = \text{root}\left(z_1^6 + \frac{25z_1^5}{89} + \frac{31z_1^4}{356} + \frac{3z_1^3}{178} + \frac{7z_1^2}{1424} + \frac{z_1}{1424} + \frac{1}{5696}, z_1, 6\right)$$

z =

$$\begin{pmatrix} \text{root}\left(z_1^6 + \frac{25z_1^5}{89} + \frac{31z_1^4}{356} + \frac{3z_1^3}{178} + \frac{7z_1^2}{1424} + \frac{z_1}{1424} + \frac{1}{5696}, z_1, 6\right) \\ 0 \\ \frac{1}{2} \end{pmatrix}$$

有的版本运行时则没有给出 σ_1 的含义。

```
vpa([x y z]') % 转成浮点数。
```

ans =

$$\begin{pmatrix} -0.055869011194229747835946156711679 - 0.22108561269887145278355886311692i & 0 \\ -0.20638628718333472422786438700878 + 0.14591560496938088264289536925341i & 0 \\ 0.12180586017531728105257458866428 - 0.19496067272379724816977143098553i & 0 \end{pmatrix}$$

或者

```
double([x y z]')
```

ans =

$$\begin{pmatrix} -0.0559 & -0.2211i & 0.0000 + 0.0000i & 0.5000 + 0.0000i \\ -0.2064 & +0.1459i & 0.0000 + 0.0000i & 0.5000 + 0.0000i \\ 0.1218 & -0.1950i & 0.0000 + 0.0000i & 0.5000 + 0.0000i \end{pmatrix}$$

第二次作业：矩阵运算

1.6

$$B = A^{-1}, C = BA, D = B \cdot A, E^2 = C, F = |E| \text{ (absolute value rather than determinant)}$$

```
format short % 或其他格式
```

```
A = random('Normal', 0, 10, 3, 3), B = inv(A), C = B*A, D = B.*A, E = sqrtm(C), F = abs(E) % E
```

```
A =  
    5.3767    8.6217   -4.3359  
   18.3389    3.1877    3.4262  
  -22.5885  -13.0769   35.7840
```

```
B =  
   -0.0335    0.0531   -0.0091  
    0.1547   -0.0199    0.0206  
    0.0354    0.0262    0.0297
```

```
C =  
    1.0000   -0.0000   -0.0000  
    0.0000    1.0000    0.0000  
    0.0000    0.0000    1.0000
```

```
D =  
   -0.1801    0.4577    0.0396  
    2.8364   -0.0635    0.0707  
   -0.7991   -0.3431    1.0635
```

```
E =  
    1.0000   -0.0000   -0.0000  
    0.0000    1.0000    0.0000  
    0.0000   -0.0000    1.0000
```

```
F =  
    1.0000    0.0000    0.0000  
    0.0000    1.0000    0.0000  
    0.0000    0.0000    1.0000
```

1.7 求值

$$y = x^2 + \sin x + \ln x, x = 1, 2, 3, \dots, 100.$$

可以用各种方式定义函数，但直接用矩阵运算最简便：

```
x = 1:100; y = x.^2 + sin(x) + log(x)
```

```
y =  
1.0e+03 * ...  
    0.0018    0.0056    0.0102    0.0166    0.0257    0.0375    0.0516    0.0671
```

1.11 矩阵运算

```
A=magic(3);  
[a,b,c,d,e,f,g,h,i,j,k] = deal(triu(A),tril(A),sum(A),sum(A'),median(A),diag(A),A',fliplr(A),f
```

```

a =
    8    1    6
    0    5    7
    0    0    2

b =
    8    0    0
    3    5    0
    4    9    2

c =
   15   15   15

d =
   15   15   15

e =
    4    5    6

f =
    8
    5
    2

g =
    8    3    4
    1    5    9
    6    7    2

h =
    6    1    8
    7    5    3
    2    9    4

i =
    4    9    2
    3    5    7
    8    1    6

j =
    6    7    2
    1    5    9
    8    3    4

k =
    3    1    2
    4    5    6
    8    9    7

```

1.13 生成矩阵

有同学漏了。

```
diag(1:3), diag((1:3),-1),diag((1:3),1)
```

```

ans =
    1    0    0
    0    2    0
    0    0    3

ans =
    0    0    0    0
    1    0    0    0
    0    2    0    0
    0    0    3    0

```

```
ans =
    0     1     0     0
    0     0     2     0
    0     0     0     3
    0     0     0     0
```

解方程组

这一题是课本的12题加了一个负号，以使结果是整数。注意是左除而非右除。

$$\begin{cases} 2x_1 + x_2 - 5x_3 + x_4 = 8 \\ x_1 - 3x_2 - 6x_4 = 9 \\ + 2x_2 - x_3 + 2x_4 = -5 \\ x_1 + 4x_2 - 7x_3 + 6x_4 = 0 \end{cases}$$

```
A=[2 1 -5 1;1 -3 0 -6;0 2 -1 2;1 4 -7 6];b=[8 9 -5 0]';
x=A\b % 或solve(A*x=b), linsolve(A,b)等
```

```
x =
    3.0000
   -4.0000
   -1.0000
    1.0000
•
```

其它要求

- 课本例题
- 指令总结
- 魔鬼阶梯程序(要求自己编写)
- 树程序PPT(每个人都要做)

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